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REGION 10

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OFFICE OF
ENVIRONMENTAL CLEANUP

FEB 07 2011

Mr. Mark R. Arenaz
FFA/CO Manager
Idaho Cleanup Project
U.S. Department of Energy
Idaho Operations Office
1955 Fremont Avenue
Idaho Falls, Idaho 83415

Re: U.S. Environmental Protection Agency (EPA) Concurrence on the Five-Year Review for
Idaho National Laboratory Fiscal Years 2005-2009.

Dear Mr. Arenaz:

The EPA has reviewed the January 2011 *Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory Site Fiscal Years 2005 – 2009* and notes that all of our comments have been satisfactorily addressed. We appreciate the effort that your project team demonstrated in finalizing the document.

The document provides a clear summary of the status and protectiveness of the individual Waste Area Groups (WAGs) as well as Recommendations and Follow-up Actions (Table 11-4). Based on the information provided in the report, EPA concurs with the U.S. Department of Energy's determinations and recommendations.

If you have any questions or concerns, please contact me at (206) 553-1855, or the INL Program Manager, Dennis Faulk, at (509) 376-8631.

Sincerely,

A handwritten signature in black ink, appearing to read "Daniel D. Opalski".

Daniel D. Opalski
Director

cc: Daryl Koch, FFA/CO Manager
Idaho Department of Environmental Quality



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Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory Site— Fiscal Years 2005–2009

January 2011

**Five-Year Review of CERCLA Response Actions
at the Idaho National Laboratory Site—
Fiscal Years 2005–2009**

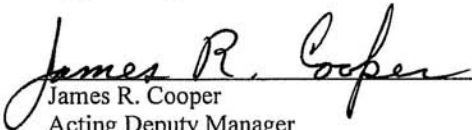
January 2011

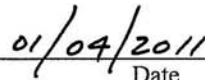
**Prepared for the
U.S. Department of Energy
DOE Idaho Operations Office**

**Five-Year Review of CERCLA Response Actions
at the Idaho National Laboratory Site—
Fiscal Years 2005–2009**

DOE/ID-11429

Approved by


James R. Cooper
Acting Deputy Manager
Idaho Cleanup Project
U.S. Department of Energy Idaho Operations Office


Date

ABSTRACT

This statutory 5-year review evaluates response actions under the Comprehensive Environmental Response, Compensation, and Liability Act at the Idaho National Laboratory Site. Nine of ten waste area groups are managed by the U.S. Department of Energy Idaho Operations Office and are analyzed in this report. The U.S. Department of Energy's Pittsburgh Naval Reactors Office Idaho Branch Office submits a separate 5-year review for the remaining waste area group. Remedial actions for contamination identified in previous Records of Decision are complete at Waste Area Groups 2, 4, 5, 6, and 9, with continued monitoring, maintenance, and institutional controls as required. Remediation is ongoing at Waste Area Groups 1, 3, 7, and 10. This review identifies several issues and recommendations relating to information needs. In general, this review concludes that remedies at the Idaho National Laboratory Site comply with decision documents and are functioning as intended. Remedial responses are protective of human health and the environment or are expected to be protective upon completion. In the interim, exposure pathways that could result in unacceptable risk are being controlled. The next Site-wide 5-year review will cover Fiscal Years 2010–2014 and is scheduled for completion by 2015.

EXECUTIVE SUMMARY

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name (from CERCLIS): Idaho National Laboratory Site		
EPA ID (from CERCLIS): ID4890008952		
Region: 10	State: Idaho	City/County:
SITE STATUS		
NPL status: ☒ Final ☐ Deleted Other (specify) _____		
Remediation status (choose all that apply): ☒ Under construction ☒ Operating ☒ Complete		
Multiple OUs?* ☒ YES ☐ NO Construction completion date: ____ / ____ / ____		
Has site been put into reuse? ☐ YES ☐ NO		
REVIEW STATUS		
Lead agency: ☐ EPA ☐ State ☐ Tribe ☒ Other Federal Agency <u>U.S. Department of Energy</u>		
Author name:		
Author title:		Author affiliation:
Review period:** <u>10/01/04</u> to <u>09/30/09</u>		
Date(s) of site inspection: ____ / ____ / ____		
Type of review: ☒ Post-SARA ☐ Non-NPL Remedial Action Site ☐ Regional Discretion ☐ Pre-SARA ☐ NPL State/Tribe-lead ☐ NPL-Removal only		
Review number: ☐ 1 (first) ☐ 2 (second) <u>Second INL Site-wide review; several OUs were previously reviewed separately</u> ☐ 3 (third) ☒ Other (specify)		
Triggering action: ☐ Actual RA Onsite Construction at OU # _____ ☐ Construction Completion ☒ Other (specify) <u>EPA concurrence on previous INL Site-wide 5-year review</u> ☐ Actual RA Start at OU # _____ ☐ Previous Five-Year Review Report		
Triggering action date (from CERCLIS): <u>12/04/06</u>		
Due date (five years after triggering action date): <u>12/04/11</u>		

* ["OU" refers to operable unit.]

** [Review period should correspond to the actual start and end dates of the Five-Year Review in CERCLIS.]

Five-Year Review Summary Form (continued)

Issues:

Table S-1 lists issues identified in this review.

Table S-1. Issues identified in this 5-year review for the Idaho National Laboratory Site.

Issues	Affects Current Protectiveness (Yes/No)	Affects Future Protectiveness (Yes/No)
WAG 1—Test Area North		
TCE concentrations have not decreased as expected at aquifer monitoring well TAN-28 downgradient of the hot spot.	No	Yes
Cs-137 concentrations have been increasing at the hot spot, and Sr-90 concentrations remain high in the hot spot and several locations in the medial zone.	No	Yes
The monitoring strategy may not be adequate for evaluating plume expansion.	No	Yes
Available information is not sufficient to estimate an end date for ICs at Site TSF-28.	No	Yes
Available information is not sufficient to estimate an end date for ICs at Site TSF-43.	No	Yes
WAG 4—Central Facilities Area		
Nitrate concentrations in the aquifer continue to exceed the maximum contaminant level at two downgradient monitoring wells.	No	Yes
WAG 9—Materials and Fuels Complex		
The new site identification process for two sites, ANL-64 and ANL-65, was initiated and left incomplete. Therefore, these sites were not added to the IC database or addressed in the IC/O&M Plan or annual reports.	No	Yes
WAG 10—Site-wide		
Multiple inconsistencies among the IC database, IC/O&M Plan, and annual IC reports were noted and appear to be caused by a systematic deficiency in the tracking mechanism. Language concerning ICs differs in each of the individual WAG RODs, as shown in the IC/O&M Plan, further complicating evaluation in the 5-year review.	No	Yes
IC institutional control O&M operation and maintenance ROD Record of Decision	TCE trichloroethene WAG waste area group	

Recommendations and Follow-up Actions:

Table S-2 provides recommendations and suggested implementation schedules.

Five-Year Review Summary Form (continued)

Table S-2. Recommendations and follow-up actions for issues identified in this 5-year review for the Idaho National Laboratory Site.

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Yes/No)	
					Current	Future
WAG 1—Test Area North						
TCE concentrations have not decreased as expected at aquifer monitoring well TAN-28 downgradient of the hot spot.	Prepare a test plan to address the TCE concentration issue at Well TAN-28 via a rebound test and vadose zone vapor monitoring.	DOE	EPA and DEQ	Submit a draft test plan in FY 2011	No	Yes
Cs-137 concentrations have been increasing at the hot spot, and Sr-90 concentrations remain high in the hot spot and several locations in the medial zone.	Prepare a test plan to address radionuclide concentrations in the hot spot via a rebound test.	DOE	EPA and DEQ	Submit a draft test plan in FY 2011	No	Yes
The monitoring strategy may not be adequate for evaluating plume expansion.	Prepare a test plan to increase monitoring frequency to yearly rather than once every 3 years at Wells TAN-57 and GIN-4. If TCE concentrations at either well or TAN-56 exceed 10 µg/L, install a downgradient monitoring well.	DOE	EPA and DEQ	Submit a draft test plan in FY 2011	No	Yes
Available information is not sufficient to estimate an end date for ICs at Site TSF-28.	Sample TSF-28 to obtain data for estimating an end date for ICs.	DOE	EPA and DEQ	Before the next 5-year review	No	Yes
Available information is not sufficient to estimate an end date for ICs at Site TSF-43.	Sample TSF-43 to obtain data for estimating an end date for ICs.	DOE	EPA and DEQ	Before the next 5-year review	No	Yes
WAG 4—Central Facilities Area						
Nitrate concentrations in the aquifer continue to exceed the maximum contaminant level at two downgradient monitoring wells.	Continue to monitor and assess nitrate trends annually. If concentration trends do not begin to decline over the next 5-year review period, the Agencies will consider additional steps to re-evaluate the persistence of nitrate in the aquifer. The additional steps may include evaluation of	DOE	EPA and DEQ	Annually until the next 5-year review	No	Yes

Five-Year Review Summary Form (continued)

Table S-2. (continued).

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Yes/No)	
					Current	Future
	additional nitrate sources and evaluation of the release mechanism of the original source(s) in order to implement an applicable remedy to meet the remedial action objective.					
WAG 9—Materials and Fuels Complex						
The new site identification process for two sites, ANL-64 and ANL-65, was initiated and left incomplete. Therefore, these sites were not added to the IC database or addressed in the IC/O&M Plan or annual reports.	Finish processing the new site identification form and identify responses in accordance with the process established in the OU 10-08 ROD.	DOE	EPA and DEQ	September 2011	No	Yes
WAG 10—Site-wide						
Multiple inconsistencies among the IC database, IC/O&M Plan, and annual IC reports were noted and appear to be caused by a systematic deficiency in the tracking mechanism. Language concerning ICs differs in each of the individual WAG RODs, as shown in the IC/O&M Plan, further complicating evaluation in the 5-year review.	Thoroughly validate the IC database to ensure that it is an accurate tracking mechanism for all sites requiring ICs and revise the IC/O&M Plan accordingly. Establish requirements to annotate annual IC reports and revisions to the IC/O&M Plan sufficient to track a site as its status changes. With Agency concurrence, modify the IC/O&M Plan to standardize wording on ICs for consistency across the INL Site.	DOE	EPA and DEQ	September 2011	No	Yes
DEQ	Department of Environmental Quality (Idaho)	O&M	operation and maintenance			
DOE	Department of Energy	OU	operable unit			
EPA	Environmental Protection Agency	ROD	Record of Decision			
FY	fiscal year	TCE	trichloroethene			
IC	institutional control	WAG	waste area group			
INL	Idaho National Laboratory					

Five-Year Review Summary Form (continued)

Protectiveness Statement(s):

Completed remedies at the Idaho National Laboratory (INL) Site are protective of human health and the environment. Ongoing remedies are expected to be protective of human health and the environment upon completion, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled. Remedies comply with decision documents and are functioning as intended. Operations and maintenance (O&M) occur in accordance with requirements, and institutional controls (ICs) are in place and effective. The following subsections repeat the individual protectiveness statements for each major component of the remedial response at the INL Site.

Waste Area Group 1 Protectiveness Statements

The remedy at Operable Unit (OU) 1-07B is currently protective of human health and the environment. Follow-up actions documented in this review to address Waste Area Group (WAG) 1 issues will ensure the remedy remains protective for the long term. An in situ bioremediation rebound test, vadose zone vapor monitoring at the hot spot, and increased monitoring at distal zone wells will provide additional information on whether the in situ bioremediation remedy is functioning as intended and whether the monitored natural attenuation remedy will be protective in 2095. These additional activities will occur before the next 5-year review. In the meantime, groundwater remediation will continue and ICs are in place to control exposure pathways that could result in unacceptable risks. The three components of the remedy have been implemented in accordance with the schedules stated in the appropriate remedial action work plans and are making progress toward achieving remedial action objectives.

The remedy at OU 1-10 is protective of human health and the environment. Responses are complete in accordance with the OU 1-10 Record of Decision (ROD) and action memoranda. Those sites that do not qualify for unrestricted land use are managed appropriately under the INL Site-wide IC/O&M Plan.

Waste Area Group 2 Protectiveness Statement

Because the remedial actions at all OUs in WAG 2 are protective, the site is protective of human health and the environment. Ongoing inspections and perched water and groundwater monitoring indicate that the OU 2-13 remedies are functioning as intended in the decision documents, and the overall remedy remains protective of human health and the environment.

Waste Area Group 3 Protectiveness Statements

The remedy at OU 3-13, Group 1, is expected to be protective of human health and the environment upon completion of the OU 3-14 response. All of the OU 3-13, Group 1 interim remedial actions have been completed.

The remedy at OU 3-13, Group 2, is expected to be protective of human health and the environment upon completion, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled. Group 2 sites compose a deferred action that consists of implementing ICs and soil excavation and capping. The remedy associated with these sites is functioning as intended in the decision document.

The remedy at OU 3-13 Group 3 Phase I (Sets 1, 2, and 3) is protective of human health and the environment. These remedial actions have been completed. The Group 3 Phase I Remedial Action Report has been approved. No changes in the physical conditions of these sites have occurred that would affect the protectiveness of the remedy. The remedy at OU 3-13 Group 3 (Phases I and II) is protective of

Five-Year Review Summary Form (continued)

human health and the environment. The remedial actions for Group 3 have been completed. The Group 3 Phase I and Phase II Remedial Action Reports have been approved. No changes in the physical conditions of these sites have occurred that would affect the protectiveness of the remedy. OU 3-13, Group 4, was closed out by the Group 4 Remedial Action Report. See the Protectiveness Statement in Section 4.8.8 of this report.

OU 3-13, Group 5, was closed out by the Group 5 Remedial Action Report. See the Protectiveness Statement in Section 4.9.8 of this report.

The remedy at OU 3-13, Group 6, is protective of human health and the environment. The remedial actions for Group 6 have been completed. No changes in the physical conditions of these two sites have occurred that would affect the protectiveness of the remedy.

The remedy at OU 3-13, Group 7, is protective of human health and the environment. The remedial actions for Group 7 have been completed. No changes in the physical conditions of these sites have occurred that would affect the protectiveness of the remedy.

The remedy at OU 3-14 is expected to be protective of human health and the environment upon completion, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled. OU 3-14 remedial actions are being implemented according to the established schedule. Although OU 3-14 remedial actions are only partially complete at this time, the actions to date are functioning as intended in the decision document, and monitoring results indicate that the OU 3-14 remedy will be protective.

The remedy at the Idaho CERCLA Disposal Facility (ICDF) is expected to be protective of human health and the environment upon completion, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled. ICDF has been in operation since September 16, 2003, providing a cost-effective treatment and disposal unit for CERCLA cleanup at the INL Site in accordance with the requirements set forth in the OU 3-13 ROD. Compliance with the requirements set forth in the ICDF Complex Remedial Design/Remedial Action Work Plan and various ICDF waste acceptance criteria ensure protection of human health and the environment, including the Snake River Plain Aquifer.

Based on the removal of contaminated buildings and structures as non-time-critical removal actions and implementation of ICs, as necessary, in accordance with the selected remedy for WAG 3 sites in CPP-88 for the OU 3-13 ROD or industrial use area and recharge control zone for the OU 3-14 ROD, the selected remedy with respect to the non-time-critical removal action sites remains protective of human health and the environment.

Waste Area Group 4 Protectiveness Statement

The remedy at OU 4-13 is expected to be protective of human health and the environment, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled. Based on the review of monitoring data and site inspection reports, the remedies are functioning as intended by the OU 4-13 ROD. Previously declining groundwater levels are noted; however, the monitoring network continues to be adequate for assessing the protectiveness of remedies at WAG 4. Nitrate in two downgradient wells continue to exceed the maximum contaminant level, but the surface soil at the source of contamination was removed in 2003, and groundwater concentrations are expected to respond favorably.

Five-Year Review Summary Form (continued)

Waste Area Group 5 Protectiveness Statement

The remedy at OU 5-12 is protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled. Remediation has been completed at all WAG 5 sites, and remedies are functioning as intended.

Waste Area Group 6 Protectiveness Statement

Because the remedial actions at all OUs in WAG 6 are protective, the site is protective of human health and the environment. Those sites with containment remedies or that require ICs are maintained and managed in accordance with the INL Site-wide IC/O&M Plan.

Waste Area Group 7 Protectiveness Statement

The remedy at OU 7-13/14 is expected to be protective of human health and the environment upon completion, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled.

The comprehensive selected remedy is ongoing at the Radioactive Waste Management Complex. Individually and collectively, all elements of the remedial action (e.g., targeted waste retrieval, organic contamination in the vadose zone, and land-use controls) currently protect human health and the environment and are functioning as intended in the OU 7-13/14 ROD. Ongoing maintenance and ICs preclude prolonged direct contact with contamination. Current operational and monitoring data indicate that the remedy is functioning as required to achieve cleanup goals. Upon completion, the OU 7-13/14 remedy is expected to be protective of human health and the environment. In the interim, exposure pathways that could result in unacceptable risk are being controlled, and monitoring of the vadose zone and aquifer will continue for the foreseeable future.

Following completion of Phases 1 and 2, an evapotranspiration surface barrier will be designed and constructed over the entire Subsurface Disposal Area under Phase 3. Phase 3 also will include tasks that prepare for transitioning the site to long-term management and control after the cap is constructed and the remedy is declared operational and functional. The long-term effectiveness of the remedy will be verified by monitoring and will be assessed in future 5-year reviews.

Waste Area Group 9 Protectiveness Statement

The remedy at OU 9-04 is protective of human health and the environment. Remediation goals were achieved and ICs are in place as necessary. Remedies are functioning as intended by decision documents.

Waste Area Group 10 Protectiveness Statements

The remedy at OU 10-04 is expected to be protective of human health and the environment upon completion, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled.

The INL Site-wide IC remedy under OU 10-04 currently protects human health and the environment because INL Site-wide access restrictions are enforced that protect human health and the environment in the short-term. However, for the remedy to be protective in the long-term, the IC database, annual IC reports, and IC/O&M plan should be modified to achieve and maintain consistency.

Five-Year Review Summary Form (continued)

The remedy at TSF-07 is protective of human health and the environment. The TSF-07 disposal pond removal action is complete and ICs are not required.

Other Comments:

The INL Site remains subject to statutory 5-year reviews to ensure that containment remedies remain effective and that ongoing remedies are completed in accordance with requirements. The next INL Site-wide 5-year review will cover FYs 2010 through 2014 and is scheduled for completion by 2015.

ACKNOWLEDGMENTS

The following Idaho Cleanup Project personnel contributed directly to this 5-year review:

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ACRONYMS

ARAR	applicable or relevant and appropriate requirement
ATR Complex	Advanced Test Reactor Complex
bgs	below ground surface
BORAX	Boiling Water Reactor Experiment
CERCLA	Comprehensive Environmental, Response, Compensation, and Liability Act
CFA	Central Facilities Area
CITRC	Critical Infrastructure Test Range Complex
COC	contaminant of concern
DEQ	Idaho Department of Environmental Quality
DOE	U.S. Department of Energy
DOE-ID	U.S. Department of Energy Idaho Operations Office
EBR	Experimental Breeder Reactor
EPA	U.S. Environmental Protection Agency
FFA/CO	Federal Facility Agreement and Consent Order
FY	fiscal year
IC	institutional control
IC/O&M	<i>INL Site-Wide Institutional Controls, and Operations and Maintenance Plan for CERCLA Response Actions</i> (short title)
ICDF	Idaho CERCLA Disposal Facility
ICP	Idaho Cleanup Project
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
MCL	maximum contaminant level
MFC	Materials and Fuels Complex
NTCRA	non-time-critical removal action
O&M	operation and maintenance
OU	operable unit
RAO	remedial action objective

RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RD/RA	remedial design/remedial action
RDX	cyclotrimethylene trinitroamine
ROD	Record of Decision
RWMC	Radioactive Waste Management Facility
SDA	Subsurface Disposal Area
SRPA	Snake River Plain Aquifer
TAN	Test Area North
TCE	trichloroethene
TFIA	Tank Farm Interim Action
TNT	trinitrotoluene
TSCA	Toxic Substances Control Act
VOC	volatile organic compound
WAG	waste area group

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Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory Site— Fiscal Years 2005–2009

1. INTRODUCTION

This report presents the 5-year review of response actions at the Idaho National Laboratory (INL) Site implemented under the Comprehensive Environmental, Response, Compensation, and Liability Act (CERCLA) (42 USC § 9601 et seq.) and the Federal Facility Agreement and Consent Order (FFA/CO) (DOE-ID 1991). The purpose of this review is to evaluate implementation and performance of remedies at the INL Site to determine whether they are—or will be—protective of human health and the environment. This review covers Fiscal Years (FYs) 2005 through 2009, the 5-year period from October 1, 2004, through September 30, 2009. The next 5-year review is planned to evaluate FYs 2010 through 2014.

Publication of the Operable Unit (OU) 10-08 Record of Decision (ROD) (DOE-ID 2009a) at the end of FY 2009 marks a particularly significant milestone under the FFA/CO—it is the last planned ROD for the INL Site. All existing CERCLA sites have been evaluated, and a process is in place in case new sites are discovered in the future. Comprehensive remedial investigations, feasibility studies, and RODs are complete for every portion of the INL Site, and response actions are either complete or ongoing. Thus, this is the first 5-year review to evaluate cleanup actions at the INL Site that, collectively, represent a complete response.

This document describes methods, findings, and recommendations for addressing issues identified in this 5-year review. Subsections that follow summarize general elements that are germane to the entire analysis. Subsequent chapters evaluate response actions at each of eight major facilities and the remainder of the INL Site. The final chapter summarizes this review and concludes that remedies at the INL Site are—or are expected to be—protective of human health and the environment.

1.1 Authority

The INL Site is a federal facility managed by the U.S. Department of Energy (DOE); hence DOE is the lead agency for this review (Executive Order 12580; EPA 2001). The U.S. Environmental Protection Agency (EPA) and Idaho Department of Environmental Quality (DEQ) participate as support agencies using the process defined for primary documents in the INL Site's FFA/CO (DOE-ID 1991). EPA retains final authority on protectiveness determinations, and either will concur with DOE's protectiveness determinations or will provide independent findings.

1.2 Community Notification and Involvement

DOE notified INL Site stakeholders and the public of this 5-year review in accordance with CERCLA requirements (42 USC § 9601 et seq.) and EPA guidance (EPA 2001). In April 2010, area newspapers announced that the 5-year review was being conducted and that results of the review were being compiled into this report. The following newspapers published press releases:

- *Arco Advertiser* (Arco, Idaho)
- *Idaho State Journal* (Pocatello, Idaho)
- *The Idaho Statesman* (Boise, Idaho)
- *Idaho Unido* (Pocatello, Idaho)
- *Moscow-Pullman Daily News* (Moscow, Idaho, and Pullman, Washington)

- *The Post Register* (Idaho Falls, Idaho)
- *Sho-Ban News* (Fort Hall Reservation, Idaho)
- *The Times News* (Twin Falls, Idaho)
- *The Jackson Hole News & Guide* (Jackson, Wyoming).

News releases encouraged public comments or questions and identified a DOE point of contact and a Web address for further information. In addition to newspaper notifications, DOE briefed the Sho-Ban Tribes in April 2010, identifying the purpose of the 5-year review, requirements of the review, and status of past reviews. DOE also briefed the Idaho National Laboratory Site Environmental Management Citizens Advisory Board on May 12, 2010, regarding this 5-year review.

1.3 Background and Chronology

Originally established in 1949, the INL Site is a DOE-managed reservation that historically has been devoted to energy research and related activities. The INL Site also has borne the names National Reactor Testing Station (1949 to 1974), Idaho National Engineering Laboratory (1974 to 1997), and Idaho National Engineering and Environmental Laboratory (1997 to 2003). In mid-2003, DOE defined two business units, one for laboratory research and development missions (Idaho National Laboratory) and one for remediation (Idaho Cleanup Project), and renamed the 2,305 km² (890-mi²) facility the INL Site. Subsections that follow briefly describe the INL Site and factors leading to this 5-year review. Cited references provide details and are available either in the Administrative Record (<http://ar.inl.gov>) or the public domain.

1.3.1 Physical Characteristics

The INL Site occupies 2,305 km² (890 mi²) of the eastern portion of the Snake River Plain in a relatively remote, lightly populated portion of southeast Idaho (see Figure 1-1). The region is classified as arid to semiarid with an average annual precipitation of approximately 8.5 in./year (Clawson, Hukari, and Ricks 2005). The surface is a relatively flat sagebrush desert characterized by thin surficial sediments and basalt outcrops. The average surface elevation is 1,524 m (5,000 ft) above sea level. The Big Lost River is an intermittent stream; when it flows, water enters the INL Site from the west and flows to the north. Compared to the rest of the INL Site, surficial sediments are thicker beneath the river channel. Elsewhere, the subsurface is composed of thick sequences of basalt flows separated by relatively thin layers of interbedded sediments. The Snake River Plain Aquifer (SRPA) underlies most of the facility, ranging in depth from approximately 68.6 m (225 ft) below land surface in the northern portion to more than 190.5 m (625 ft) in the south (DOE-ID 2009a). Like the vadose zone above, the SRPA comprises thick sequences of basalt separated by thin, intermittent layers of sedimentary interbeds. Groundwater direction beneath the INL Site is generally from the northeast to the southwest.

1.3.2 Land and Resource Use

Land within the INL Site is classified as industrial and mixed use (Litus and Shea 2005). The current primary use of the INL Site is to support facility and program operations. Portions within the central area are reserved for Idaho Cleanup Project (ICP) and INL operations. Remaining land within the core, which is largely undeveloped, is used for environmental research, ecological preservation, and sociocultural preservation. Public highways and the Experimental Breeder Reactor I (EBR-I) National Historic Landmark are the only portions of the INL Site with unrestricted access. The Bureau of Land Management (U.S. Department of Interior) manages livestock grazing leases within undeveloped portions of the INL Site perimeter (see Figure 1-2). DOE also collaborates with the Idaho Department of Fish and Game to permit controlled hunting within half a mile of the boundary.

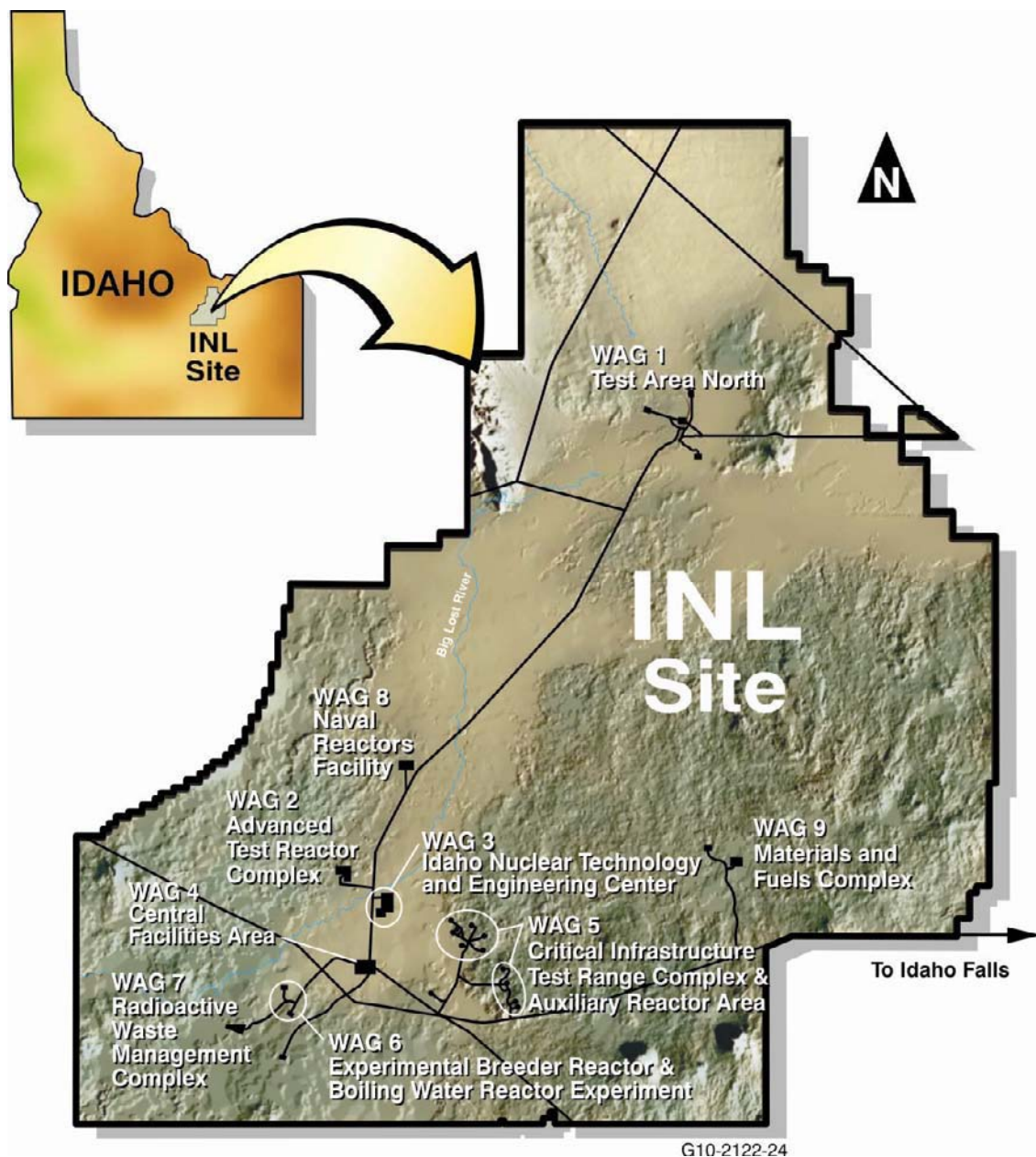


Figure 1-1. The Idaho National Laboratory Site in southeast Idaho with major facilities and their respective waste area groups.

In the five counties surrounding the INL Site, most of the land is rangeland, forest, or barren, and roughly 21% is used for farming (Litus and Shea 2005). Most of the land surrounding the INL Site is owned by the federal government. Private lands near the INL Site are used primarily for grazing and farming.

To facilitate decisions about environmental restoration, DOE projected reasonable INL Site land-use scenarios for the next 100 years (DOE-ID 1995). Though uncertain, future land use most likely will remain essentially unchanged, with research facilities within INL Site boundaries and agricultural and open land surrounding the INL Site. DOE expects to retain ownership and control of the INL Site until at least 2095, and will continue to manage portions that cannot be released for unrestricted land use beyond 2095.

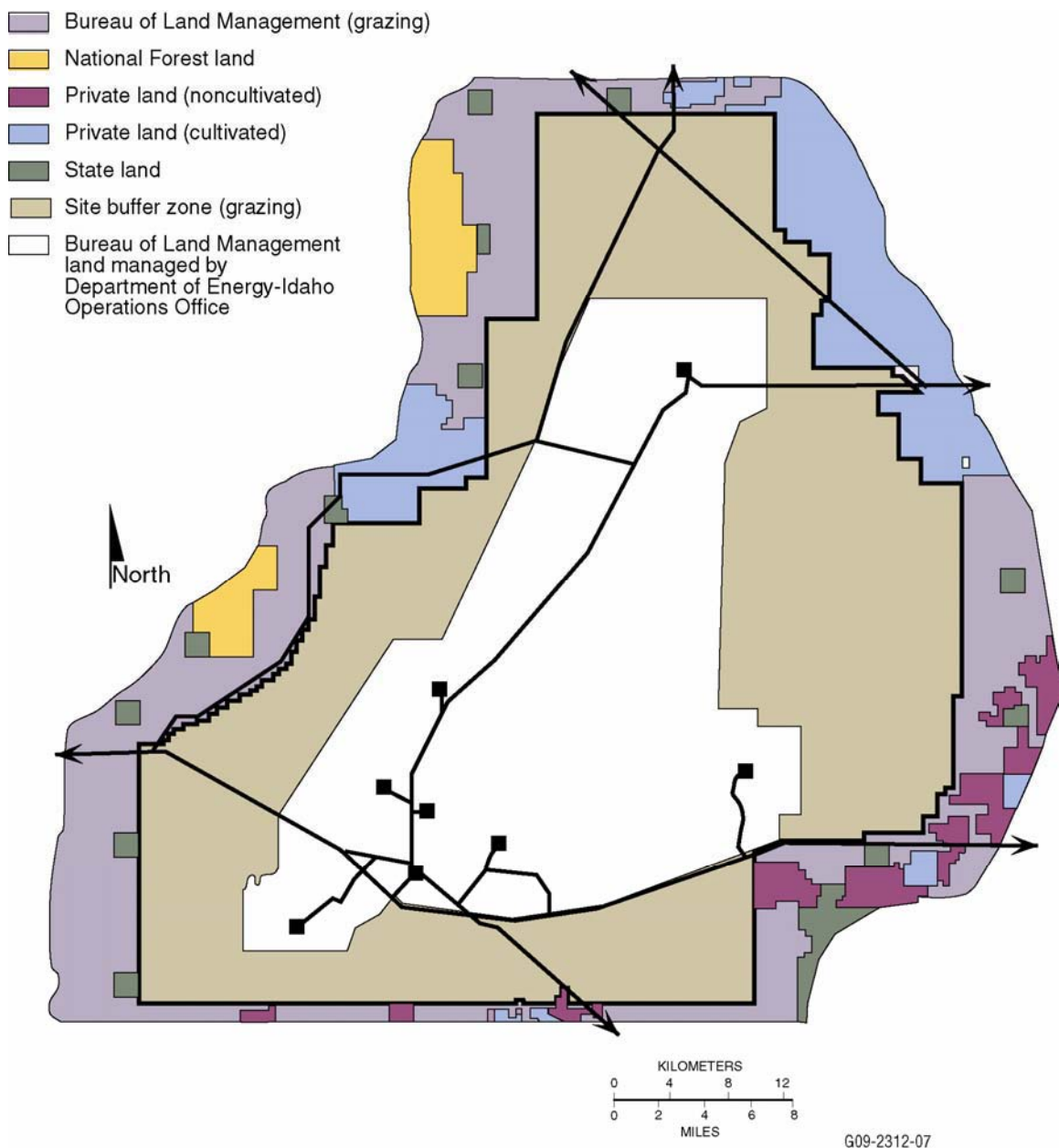


Figure 1-2. Land use in the vicinity of the Idaho National Laboratory Site.

The *INL Site-Wide Institutional Controls, and Operations and Maintenance Plan for CERCLA Response Actions (IC/O&M Plan)* (DOE-ID 2010) summarizes laws and regulations that govern transfer of federal land. Because of the significant hurdles associated with transfer of contaminated federal land, nonfederal entities are not likely to obtain contaminated INL Site land for residential or commercial purposes.

Similarly, DOE restricts use of the SRPA within the boundaries of the INL Site. The SRPA is the source of all water used at the INL Site. Facilities withdraw water for industrial uses (e.g., potable water, process water, and fire water). Water is treated if necessary (e.g., at the Radioactive Waste Management Complex [RWMC]). Residential groundwater use is not allowed on the INL Site, cannot occur before 2095, and is only a remote possibility after that time.

1.3.3 History of Contamination, Initial Responses, and Basis for Taking Action

In January 1986, motivated by detections of radionuclides (e.g., tritium) and volatile organic compounds (VOCs) in the aquifer, DOE identified hazardous waste disposal sites at the INL Site that could pose unacceptable risks to health, safety, or the environment (EG&G 1986). Sites were ranked using either the EPA hazard ranking system for sites with chemical contamination or the DOE-modified hazard ranking system for radioactively contaminated sites. A score of 28.5 or higher in either category qualified a site for the National Priorities List (54 FR 48184). Because several sites within the INL Site received scores greater than 28.5, the entire reservation became a candidate for the National Priorities List.

On July 10, 1987, DOE, EPA, and the U.S. Geological Survey entered into a Consent Order and Compliance Agreement (DOE-ID 1987). The agreement called for implementing an action plan to remediate active and inactive waste disposal sites at the INL Site under authority of the Resource Conservation and Recovery Act (RCRA) (42 USC § 6901 et seq.). RCRA regulates generation, transportation, treatment, storage, and disposal of hazardous waste. The 1987 agreement covered sites identified for further evaluation during the 1986 installation assessment (EG&G 1986).

On November 15, 1989, EPA added the INL Site to the National Priorities List under CERCLA, also known as the Superfund. The National Priorities List identifies high-priority sites for investigation and remediation of hazardous materials. The decision to add the INL Site to the National Priorities List was based on detection of contaminants in the environment at the INL Site.

The FFA/CO, signed by the Agencies (i.e., DOE, EPA, and DEQ), superseded the 1987 Consent Order and Compliance Agreement and established a procedural framework and schedule to develop, prioritize, implement, and monitor appropriate response actions at the INL Site in accordance with CERCLA, RCRA, and the Hazardous Waste Management Act (Idaho Code § 39-4401 et seq.). The FFA/CO subdivided the INL Site into 10 waste area groups (WAGs) to facilitate remediation (Figure 1-1). WAGs contain individual sites that are grouped into OUs based on proximity or similar characteristics. WAGs 1 through 9 comprise primary facility areas at the INL Site, while WAG 10 encompasses the remainder. Each WAG addresses its surface area and affected regions of the vadose zone and underlying SRPA.

1.3.4 Trigger for 5-Year Review

EPA requires 5-year statutory reviews if (1) remedial action was selected under CERCLA after October 17, 1986, and (2) hazardous substances, pollutants, or contaminants remain at levels that preclude unlimited use and unrestricted exposure (EPA 2001). The earliest remedial action that leaves hazardous substances, pollutants, or contaminants at a site triggers the first statutory 5-year review. EPA's concurrence signature date triggers subsequent 5-year reviews.

EPA completed the earliest 5-year review at the INL Site in 1998 (Poeton 1998). Both DOE and EPA prepared subsequent reviews for several individual OUs. As of FY 2004, DOE consolidated the multiple 5-year reviews (excluding WAG 8, Naval Reactors Facility, which is managed and reviewed separately^a) into one INL Site-wide report (DOE-ID 2007). EPA's concurrence signature date for that review, December 4, 2006 (Opalski 2006), is the formal trigger date for this current review. However, DOE elected to conduct this review early to maintain a schedule based on 5-year increments. Table 1-1 summarizes the chronology of significant documents and events preceding this 5-year review.

a. DOE's Pittsburgh Naval Reactors Office Idaho Branch Office manages WAG 8, and the Idaho Operations Office manages everything else at the INL Site. DOE-IBO (2006) presents the most recent 5-year review for WAG 8.

Table 1-1. Chronology of significant documents and events preceding this 5-year review.

Date	Document or Event
1980	Comprehensive Environmental Response, Compensation, and Liability Act
1986	Superfund Amendments and Reauthorization Act
January 1986	<i>Installation Assessment Report for EG&G Idaho, Inc., Operations at the Idaho National Engineering Laboratory</i> (EG&G 1986)
1987	<i>Consent Order and Compliance Agreement</i> (DOE-ID 1987)
November 15, 1989	EPA added the INL Site to the National Priorities List (54 FR 48184)
December 4, 1991	<i>Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory</i> (DOE-ID 1991)
1992–present	Many response actions across the INL Site triggered individual 5-year reviews (see chronologies in chapters for individual WAGs)
2005	DOE-ID published its first INL Site-wide 5-year review, ^a covering FYs 2000 through 2004 (DOE-ID 2007; the 2005 document subsequently was revised)
December 4, 2006	EPA concurrence with the previous 5-year review (Opalski 2006) triggered this current 5-year review
a. Previously, EPA produced an INL Site-wide 5-year review of sites where construction was not yet complete (Gearheard 2000). DOE-ID Department of Energy Idaho Operations Office EPA Environmental Protection Agency FY fiscal year INL Idaho National Laboratory WAG waste area group	

1.4 Five-Year Review Methodology

EPA guidance (EPA 2001) provides general methodology for 5-year reviews. Adaptations specific to this review of the INL Site relate to risk input factors, assessing progress since the last review, and INL Site-wide institutional controls (ICs) and operations and maintenance (O&M).

1.4.1 Assessing Risk Input Factors

Part of the technical assessment within the 5-year review is to ask if exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection remain valid. The purpose of this question is to determine if the basis for a remedial decision may have changed such that the protectiveness of the remedy could be in question. This review focused on toxicity and other risk input factors for contaminants of concern (COCs) at IC sites. IC sites include sites that have been remediated but do not qualify for unrestricted land use and sites that are currently being remediated.

1.4.2 Removal Actions

CERCLA responses can be implemented under the authority of an action memorandum for a time-critical or non-time-critical removal action (NTCRA). DOE and EPA established the CERCLA NTCRA process as an approach for decommissioning (DOE and EPA 1995). In 2006, the CERCLA Agencies selected the NTCRA approach for general decommissioning of facilities at the INL Site (DOE-ID 2006). Before 2006, a separate action memorandum was prepared for each facility. Currently, decommissioning of minor facilities is completed under a General Decommissioning Action Memorandum (DOE-ID 2006). For major facilities, decommissioning can begin under the General Decommissioning Action Memorandum, but a separate action memorandum is typically prepared to

select the final end state. The General Decommissioning Action Memorandum was revised in January 2009 (DOE-ID 2009b), and other addenda have occurred through Agency correspondence to add buildings and structures to the scope of the NTCRA (e.g., buildings scheduled for decommissioning, pursuant to the American Recovery and Reinvestment Act of 2009 [Public Law 111-5]).

Though general decommissioning of buildings and structures as removal actions is not specifically addressed in previous INL Site RODs, removal actions are consistent with RAOs of previous RODs and support the overall cleanup objectives established through the FFA/CO. Therefore, removal actions are addressed in this 5-year review. In accordance with EPA guidance (EPA 2001), pre-ROD removal actions are addressed as initial responses; post-ROD removal actions are addressed as part of the implemented remedy.

1.4.3 Assessing Progress Since the Last Review

Assessing progress since the last review involves examining issues and recommendations identified in the preceding 5-year review to ensure that previously identified vulnerabilities are appropriately tracked. Appendix C of the last INL Site-wide 5-year review identified 11 issues and recommendations (Appendix C of DOE-ID [2007]). In their letter of concurrence, EPA attached an addendum to Appendix C, identifying four additional issues (Opalski 2006). Recommendations and follow-up actions accompanied each issue. This 5-year review assesses progress for the combined set of 15 issues.

Text in the body of the previous 5-year review presented additional issues and recommendations that were not listed for tracking either in the appendix or by EPA. Typically, the extra recommendations reiterated existing strategies taken from RODs, work plans, or other sources. Though this 5-year review does not specifically assess progress for these considerations, they generally are addressed within the body of this report (e.g., data evaluations).

The last 5-year review (DOE-ID 2007) identified a Site-wide issue relating to the previously applied risk-based remediation goal for Cs-137 in soil, naming three sites in particular. EPA modified the goal to a higher concentration (see Section 10.5.4); thus, Cs-137-contaminated sites would qualify for release from IC sooner than previously estimated. Because this change would not call into question the effectiveness of remedies that were based on a lower remediation goal, the last review deferred reanalysis and recommended that DOE, with concurrence from EPA and DEQ, should determine how to best determine the impact on IC sites. In preparing for this 5-year review, DOE recalculated approximate IC termination dates based on Cs-137 decay and then expanded the analysis to the broader issue of estimating IC termination dates for all sites that are expected to eventually qualify for unrestricted land use. Appendixes A through H present recalculated IC terminations dates for WAGs 1, 2, 3, 4, 5, 6, 9, and 10, respectively. An explanation of significant difference will document the revised Cs-137 remediation goal.

1.4.4 Institutional Controls and Operations and Maintenance

The IC/O&M Plan (DOE-ID 2010)^b defines (1) IC requirements and how ICs are implemented for all response actions under the FFA/CO and (2) O&M requirements and how O&M are implemented for those sites that are operated and managed under the IC/O&M Plan.

b. Originally published in 2003, the IC/O&M Plan has been revised several times to incorporate requirements of new RODs. Revisions 0 through 4 addressed ICs. Revision 5, published in 2009, combined ICs and O&M under a single plan. The most recent version, Revision 6, incorporates requirements of the OU 10-08 ROD (DOE-ID 2009), the last planned ROD for the INL Site.

ICs at the INL Site are physical and administrative controls that ensure protectiveness by limiting or prohibiting activities at sites that do not meet requirements for unrestricted use. Physical controls provide material means for controlling access to a site (e.g., warning signs, fences, and permanent markers). Administrative controls restrict land or resource use and include property lease or transfer requirements, government permitting, soil disturbance restrictions, and groundwater use restrictions. Typically, ICs are identified either as the selected remedy in a ROD (i.e., a no further action decision) or as a component of a selected remedy (e.g., capping followed by ICs). ICs also are applied as an initial response to potential new sites and can be the recommended remedy (i.e., no further action) through the new site identification process.

ICs can be terminated by one of three mechanisms:

1. As part of a CERCLA decision through a ROD, explanation of significant difference, or ROD amendment
2. By completing a remedial action and documenting a site's suitability for unrestricted land use in a remedial action report
3. Through a memorandum of nonsignificant change to a ROD processed in accordance with the INL Site-wide IC/O&M Plan (DOE-ID 2010).

Annual IC inspections and 5-year reviews evaluate the adequacy and continued use of ICs for each site. Though this 5-year review document is not a controlling document for ICs, it can suggest that ICs at a site be terminated. In accordance with the IC/O&M Plan, a memorandum is the terminating mechanism, and changes to ICs will be reflected in the IC database.

Each site is an IC site until its ICs are terminated, as described above. Historically, ICs were implemented by individual WAGs. Beginning in 2004, in accordance with the OU 10-04 ROD (DOE-ID 2002), one organization assumed responsibility for implementing and maintaining ICs and consolidated annual IC inspections into a single annual report.

O&M requirements under the INL Site-wide IC/O&M Plan typically arise from reports produced after a response is complete (e.g., removal action and remedial action reports), while OU-specific O&M plans establish requirements for operating remedies (e.g., in situ bioremediation at WAG 1 and vapor vacuum extraction and treatment at WAG 7). In general, the INL Site-wide IC/O&M Plan governs O&M at sites where remediation is complete and maintenance (with or without monitoring) is required to ensure protectiveness (e.g., subsidence repairs in landfill covers).

Under current accounting practices, actual costs are not collected for individual sites that are addressed under the INL Site-wide IC/O&M Plan. EPA's 5-year review guidance (EPA 2001) suggests analysis of O&M costs to identify potential problems with a remedy. Because other means (e.g., inspections and annual IC/O&M reports) are available to identify potential problems with implemented remedial actions, DOE did not include actual costs in this 5-year review. DOE evaluates remedies in annual reports; potential problems with the remedies would be identified during annual reviews. DOE will evaluate the cost accounting practices and make necessary changes so that documentation of O&M costs can be captured in future 5-year reviews.

With ICs governed under one INL Site-wide document and O&M under several, this 5-year review adopts the following approach for evaluating the protectiveness of ICs and O&M:

1. If the only ongoing response at a site comprises ICs, then that site is evaluated under WAG 10, the administrative umbrella for INL Site-wide ICs and the IC database.

2. If response involves ongoing construction or O&M, particularly if monitoring data also are collected that support data review, then that site or OU—including its IC and O&M—is addressed under its respective WAG (e.g., WAG 4 landfills).

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2. WASTE AREA GROUP 1—TEST AREA NORTH

To facilitate cleanup of contamination, Test Area North (TAN) was designated as WAG 1 under the FFA/CO (DOE-ID 1991). To better manage the cleanup, WAG 1 was divided into 10 OUs. Two OUs remain subject to 5-year review—OU 1-07B (which consists of TAN groundwater contamination) and OU 1-10 (which consists of the remainder of TAN).

2.1 Background

The U.S. Air Force and the U.S. Atomic Energy Commission (now DOE) established TAN in the early 1950s to support research into nuclear-powered aircraft. Upon termination of that research in 1961, TAN facilities were converted to support a variety of other DOE research projects. From 1962 through the 1970s, TAN supported reactor safety testing and behavior studies at the Loss-of-Fluid Test facility, the Initial Engine Test Facility, and the Water Reactor Research Test Facility. Beginning in 1980, TAN was used to conduct work with material from the 1979 Three-Mile Island reactor accident. The Technical Support Facility at TAN supported energy research and defense programs.

2.1.1 Physical Characteristics

The TAN area is located on the Eastern Snake River Plain physiographic province and has semidesert characteristics with hot summers and cold winters. The Snake River Plain is a broad low-relief sagebrush-covered basin floored with basalt lava flows and terrestrial sediments. Average annual precipitation is approximately 23 cm (9 in.) per year. The geology and hydrology are discussed in the follow subsections.

2.1.1.1 Geology. The subsurface geology of TAN is characterized by basalt flows with sedimentary interbeds, overlain by fine-grained sediments. Geologic descriptions from wells drilled in the TAN area indicate that the basalt is highly variable, from dense to highly vesicular basalt and from massive to highly fractured basalt. Individual flow units have a median thickness of approximately 4.5 m (15 ft).

The two main interbeds in the TAN area are the P-Q and Q-R interbeds. Both interbeds consist of clay or silt. Because interbed sediments at TAN comprise mostly fine-grained materials with low permeabilities and high absorption capacities, their presence within the basalt section is important with respect to retarding contaminant migration.

The P-Q interbed, located approximately 61 m (200 ft) below ground surface (bgs) near the TSF-05 injection well, appears to be laterally discontinuous because it has been encountered in only about 50% of the wells drilled deep enough at TAN to show the interbed. The range of thickness of the P-Q interbed (when present) appears to be approximately 0.9 to 4.3 m (3 to 14 ft).

The Q-R interbed is located at a depth of approximately 134 m (440 ft) bgs near the TSF-05 injection well and is considered laterally continuous throughout the TAN region. The available geological and hydrological data suggest that the Q-R interbed is continuous and impedes the vertical movement of water and contaminants in the aquifer.

2.1.1.2 Hydrology. The hydraulic gradient for the regional aquifer in the vicinity of TAN is about 0.2 m/km (1 ft/mile). The average depth to the SRPA at TAN is currently approximately 68 m (223 ft).

The Big Lost River and Birch Creek are the only natural surface water features present near TAN. TAN is located between the terminus of the Big Lost River and the terminus of Birch Creek. Because of irrigation and hydropower diversions and infiltration losses, stream flows in the Big Lost River and Birch

Creek are typically depleted before reaching the INL Site. Surface water can occur at TAN during and following periods of heavy rainfall and snowmelt, which generally take place between January and April. However, the presence of diversion systems, and playas—located at the terminal points of the Big Lost River and Birch Creek—typically prevent surface water from reaching TAN.

2.1.2 Land and Resource Use

The land and facilities at WAG 1 are expected to remain under government management and control until at least 2095. Most facilities at TAN, Initial Engine Test Facility, and Water Reactor Research Test Facility have been decommissioned and removed. The only active use in the area of these three former facilities is related to the OU 1-07B TAN groundwater remediation. Drinking water is no longer supplied at these three former facilities, and bottled water is provided for OU 1-07B workers. The WRRTF-01 burn pit will require ICs indefinitely due to asbestos that remains at the site (DOE-ID 2003a, 2008a) and, therefore, cannot be released for unrestricted land use. The Specific Manufacturing Capability facility is the only active facility in the TAN area (the adjacent Loss-of-Fluid Test facility has been decommissioned).

2.2 Operable Unit 1-07B—Test Area North Groundwater Contamination

OU 1-07B comprises the Technical Support Facility injection well (TSF-05) and surrounding groundwater contamination.

2.2.1 Site Chronology

Table 2-1 provides a chronology of significant documents and events for OU 1-07B.

Table 2-1. Chronology of significant documents and events for Operable Unit 1-07B.

Date	Document or Event
January 1992	<i>Community Relations Plan: DOE Studies Groundwater Contamination at the Test Area North</i> (INEL 1992a)
1992	<i>Record of Decision Technical Support Facility (TSF) Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23)</i> (INEL 1992b)
February 1994	Groundwater Treatment Facility began extracting and treating contaminated groundwater near the TSF-05 injection well
January 1994	<i>Remedial Investigation Final Report with Addenda for the Test Area North Groundwater Operable Unit 1-07B of the Idaho National Engineering Laboratory, Volume 1</i> (EG&G 1994)
January 1994	<i>Feasibility Study Report for Test Area North Groundwater Operable Unit 107B at the Idaho National Engineering Laboratory</i> (Dunnivant et al. 1994)
May 1994	<i>Proposed Plan for Groundwater Contamination (Operable Unit 1-07B) and No Action Sites (Operable Units 1-01, -02, -06, -09), Test Area North, Idaho National Engineering Laboratory</i> (DOE-ID 1994)
August 1995	<i>Record of Decision Declaration for the Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites Final Remedial Action</i> (DOE-ID 1995)
November 1997	<i>Explanation of Significant Differences from the Record of Decision for the Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites, Final Remedial Action, Operable Unit 1-07B, Waste Area Group 1</i> (INEEL 1997)

Table 2-1. (continued).

Date	Document or Event
1999	<i>Field Demonstration Report, Test Area North Final Groundwater Remediation, Operable Unit 1-07B (DOE-ID 2000a)</i>
March 2000	<i>New Pump and Treat Facility Remedial Design Test Area North Operable Unit 1-07B (DOE-ID 2000b)</i>
2000	<i>Proposed Plan for Operable Unit 1-07B, Final Remedial Action at the TSF Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) (DOE-ID 2000c)</i>
January 2001	Completed NPTF construction in the medial zone
September 2001	<i>Record of Decision Amendment for the Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites Final Remedial Action (DOE-ID 2001a)</i>
October 2001	Began routine NPTF operations
December 2001	<i>Remedial Design/Remedial Action Scope of Work Test Area North Final Groundwater Remediation Operable Unit 1-07B (DOE-ID 2001b)</i>
December 2002	<i>In Situ Bioremediation Remedial Action Work Plan for Test Area North Final Groundwater Remediation, Operable Unit 1-07B (DOE-ID 2002a)</i>
June 2003	<i>Monitored Natural Attenuation Remedial Action Work Plan for Test Area North Final Groundwater Remediation, Operable Unit 1-07B (DOE-ID 2003b)</i>
October 2003	Began ISB operations
October 2003	Began MNA operations
March 2004	Began alternate electron donor optimization
March 2005	Began medial zone rebound test
June 2005	<i>In Situ Bioremediation Interim Remedial Action Report, Test Area North, Operable Unit 1-07B (DOE-ID 2005a)</i>
August 2005	<i>Monitored Natural Attenuation Interim Remedial Action Report, Test Area North, Operable Unit 1-07B (DOE-ID 2005b)</i>
March 2007	Completed medial zone rebound test
July 2009	<i>New Pump and Treat Facility Operations and Maintenance Plan for Test Area North Final Groundwater Remediation, Operable Unit 1-07B (DOE-ID 2009a)</i>
July 2009	<i>Remedial Design/Remedial Action Scope of Work Test Area North Final Groundwater Remediation Operable Unit 1-07B (DOE-ID 2009b)</i>
July 2009	<i>In Situ Bioremediation Remedial Action Work Plan for Test Area North Final Groundwater Remediation, Operable Unit 1-07B (DOE-ID 2009c)</i>
July 2009	<i>Monitored Natural Attenuation Remedial Action Work Plan for Test Area North Final Groundwater Remediation, Operable Unit 1-07B (DOE-ID 2009d)</i>
July 2009	<i>Monitored Natural Attenuation Interim Remedial Action Report, Test Area North, Operable Unit 1-07B (DOE-ID 2009e)</i>
July 2009	<i>New Pump and Treat Facility Remedial Action Work Plan for Test Area North Final Groundwater Remediation, Operable Unit 1-07B (DOE-ID 2009f)</i>
August 2009	<i>Monitored Natural Attenuation Operations, Monitoring, and Maintenance Plan for Test Area North, Operable Unit 1-07B (DOE-ID 2009g)</i>
August 2009	<i>In Situ Bioremediation Interim Remedial Action Report, Test Area North, Operable Unit 1-07B (DOE-ID 2009h)</i>

Table 2-1. (continued).

Date	Document or Event
August 2009	<i>In Situ Bioremediation Operations and Maintenance Plan for Test Area North, Operable Unit 1-07B</i> (DOE-ID 2009i)
August 2009	<i>In Situ Bioremediation Interim Remedial Action Report, Test Area North, Operable Unit 1-07B</i> (DOE-ID 2009j)
ISB	in situ bioremediation
MNA	monitored natural attenuation
NPTF	New Pump and Treat Facility

2.2.2 Background

2.2.2.1 History of Contamination. Releases to TAN groundwater were first identified in 1987 when low levels of the organic compounds trichloroethene (TCE) and tetrachloroethene were detected in the production wells that supply drinking water to the Technical Support Facility. The TSF-05 injection well was identified as the source of the groundwater contamination.

From about 1953 to 1972, liquid waste generated at TAN was disposed of in the Technical Support Facility injection well (i.e., TSF-05 site), resulting in dispersion of contaminants into the SRPA beneath TAN. The waste consisted mainly of industrial and sanitary wastewater but also included organic, inorganic, and low-level radioactive wastewater. As a result of the waste disposed of at the TSF-05 site, contaminated sludge material containing entrapped contaminants, primarily TCE, is present in the nonaqueous-phase liquid or sorbed phase. As groundwater flows through the contaminated sludge material, entrapped contaminants dissolve into the aqueous phase; this has resulted in a contaminated groundwater plume emanating from the TSF-05 injection well. The TSF-05 injection well is 93 m (310 ft) deep and is perforated from 55 to 74 m (180 to 244 ft) and 82 to 93 m (269 to 305 ft) bgs. The depth to groundwater is about 63 m (206 ft). Historical records provide little definitive information on the types and volumes of organic wastes disposed of into the groundwater via the injection well. It is estimated that as little as 1,325 L (350 gal) or as much as 132,489 L (35,000 gal) of TCE may have been disposed of in the well during its period of operation.

The OU 1-07B ROD defined the boundary of the contaminant plume based on TCE concentrations, because TCE has the largest distribution of COCs at OU 1-07B. The 1997 Explanation of Significant Differences (INEEL 1997) divided the TCE plume into three zones according to TCE concentrations (see Figure 2-1):

- Hot spot—the area immediately around the injection well where concentrations of TCE exceed 20,000 µg/L
- Medial zone—the portion of the plume where concentrations of TCE are between 1,000 and 20,000 µg/L
- Distal zone—the remainder of the plume where TCE concentrations were between 5 and 1,000 µg/L.

Groundwater that is in the area of the TSF-05 site and that contains TCE at concentrations greater than 5 µg/L has been designated as OU 1-07B. Final remedial actions for TSF-05 and the surrounding groundwater contamination (i.e., TSF-23 site) are implemented under OU 1-07B. A complete list of the OU 1-07B COCs in the ROD Amendment (DOE-ID 2001a) is provided in Table 2-2.

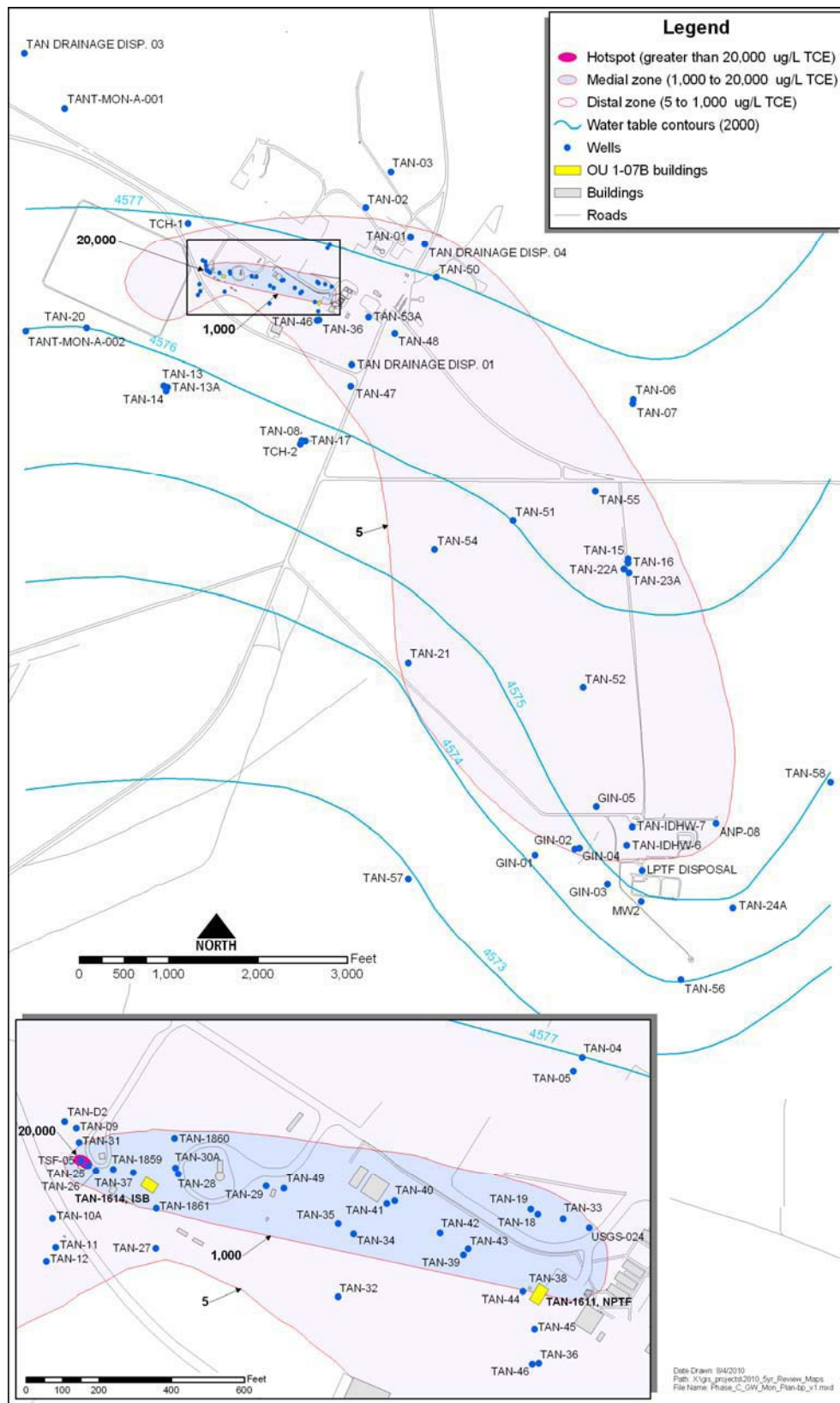


Figure 2-1. Operable Unit 1-07B facilities, well locations, and geographical locations of hot spot, medial zone, and distal zone, based on 1997 trichlorethene concentrations.

Table 2-2. Contaminants of concern and cleanup goals in the decision documents (derived from DOE-ID [2001a]).

Contaminant of Concern	Maximum Historical Concentrations ^a	Cleanup Goal ^b
Volatile Organic Compounds	(µg/L)	(µg/L)
TCE	12,000–32,000	5
PCE	110	5
<i>cis</i> -1,2-DCE	3,200–7,500	70
<i>trans</i> -1,2-DCE	1,300–3,900	100
Radionuclides	(pCi/L)	(pCi/L)
Tritium	14,900–15,300 ^c	20,000
Sr-90	530–1,880	8
Cs-137 (TSF-05 injection well only)	1,600–2,150	119 ^d
U-234 (TSF-05 injection well only)	5.2–7.7 ^c	27 ^e

- Concentration range is taken from measured concentrations at the TSF-05 injection well. Source: *Fiscal Year 1999 Groundwater Monitoring Annual Report Test Area North, Operable Unit 1-07B* (INEL 2000).
- Cleanup goals are based on the federal drinking water standards. The cumulative risk of contaminants must be less than 10^{-4} , and the hazard index must be less than 1.
- Maximum concentrations of tritium and U-234 are below federal drinking water standards, and baseline risk calculations indicate a cancer risk of 3×10^{-6} . While this risk is smaller than 10^{-4} , both tritium and U-234 are included as COCs as a comprehensive plume management strategy.
- The cleanup goal for Cs-137 was the proposed MCL at the time of the 1995 ROD signature. Although the final MCL for Cs-137 is 200 pCi/L, this corresponds to a risk greater than 10^{-4} . Therefore, no change to the cleanup goal has been made at this time.
- The cleanup goal for U-234 is from the 2001 ROD Amendment (DOE-ID 2001a).

COC	contaminant of concern
DCE	dichloroethene
MCL	maximum contaminant level
PCE	tetrachloroethene
ROD	Record of Decision
TCE	trichloroethene

2.2.2.2 Initial Response. Following the initial discovery of TCE in the TAN drinking water wells, an air sparging system was installed to treat the drinking water supply at TAN to comply with safe drinking water requirements.

In 1990, process sludge from the bottom 17 m (55 ft) of the TSF-05 injection well was removed. Analytical results showed the sludge contained a high level of organic contaminants (2% TCE) and radionuclides.

In September 1992, the Agencies (i.e., DOE-ID, EPA, and DEQ) began an interim action for OU 1-07A as documented in the Technical Support Facility ROD (INEL 1992b). Activities included constructing and operating the Groundwater Treatment Facility to extract and treat contaminated groundwater near the TSF-05 injection well.

2.2.2.3 Basis for Taking Action. In 1994, the Remedial Investigation Final Report for OU 1-07B (EG&G 1994) determined what cleanup was required. The primary risk driver was determined to be the ingestion of groundwater contaminated with TCE, but TCE also can be harmful to human health through dermal contact, inhalation of vapors, or ingestion of crops irrigated with TCE-contaminated water. A

Proposed Plan (DOE-ID 1994), based on the Remedial Investigation Final Report, was published in May 1994 and presented the Agencies' recommendations for cleanup of the groundwater contamination. The Agencies' agreement to clean up the site was documented in a ROD signed in August 1995 (DOE-ID 1995). The 1995 ROD directed that pump-and-treat technology be used to restore the hot spot and that treatability studies be conducted concurrently to evaluate alternative technologies to clean up the hot spot portion of the contaminant plume.

One of the treatability studies conducted was for in situ bioremediation. The Agencies recognize that, during in situ bioremediation at the hot spot, VOC daughter products (e.g., vinyl chloride) may be produced as interim, ephemeral breakdown products; however, bioremediation will result in complete dechlorination of VOCs by 2095. Temporary daughter products produced during remediation activities will be short-lived and will not exist at the end of remediation activities. Through the 2001 ROD Amendment (DOE-ID 2001a), in situ bioremediation was adopted for the hot spot area. This approach is expected to meet RAOs and ensure that drinking water standards will be met throughout the contaminant plume by or before 2095.

2.2.3 Remedial Action

2.2.3.1 Remedy Selection. The final remedy for OU 1-07B integrates separate technologies to address the three zones of the plume:

1. In situ bioremediation for hot spot restoration
2. Pump-and-treat technology for the medial zone
3. Monitored natural attenuation for distal zone restoration.

These technologies comprise a comprehensive approach to restoring the contaminant plume. This remedy includes groundwater monitoring throughout the plume, with analysis of samples to ascertain progress of the remedy and to monitor the plume boundary.

The remedy also prevents current and future exposure of workers, the public, and the environment to contaminated groundwater at TSF-05 because the remedy permanently reduces the toxicity, mobility, and volume of contamination at OU 1-07B. ICs (both engineered and administrative) are in place to protect current and future users from health risks associated with groundwater contamination. These ICs will be modified, as required, to maintain a conservative buffer zone around the contaminant plume. Descriptions of remedial components for restoration of the OU 1-07B hot spot, medial zone, and distal zone of the contaminant plume are discussed in the following paragraphs.

Hot Spot—In situ bioremediation—used to remediate the hot spot—promotes bacterial growth by supplying essential nutrients to indigenous bacteria that break down contaminants within the SRPA. An amendment (e.g., sodium lactate and/or whey) is injected into the source area through the TSF-05 injection well or through other injection wells (e.g., TAN-31 and TAN-1859) in the immediate vicinity. Amendment injections increase the number of bacteria, thereby increasing the rate at which VOCs break down into harmless compounds. The amendment supply is distributed, as needed. The treatment system has operated since 1999.

Medial Zone—Pump-and-treat—used to remediate the medial zone—involves extraction of contaminated groundwater, treatment through air strippers, and injection of treated groundwater back into the SRPA. Air stripping is a process that brings clean air into contact with contaminated liquid, allowing the contaminants to pass from the liquid into the air, where they quickly evaporate. In accordance with the original remedy selected in the OU 1-07B ROD, construction of the New Pump and Treat Facility in the medial zone was completed in January 2001. Routine New Pump and Treat Facility operations began on October 1, 2001.

Distal Zone—Natural attenuation encompasses the physical, chemical, and biological processes that act without human intervention to reduce the mass, toxicity, mobility, volume, and concentration of contaminants in groundwater. Monitored natural attenuation—used to remediate the distal zone—includes groundwater monitoring to compare actual measured natural degradation rates to predicted degradation rates.

Contingencies identified for the medial and distal zones under the remedy include the following:

- For the medial zone, monitoring wells located upgradient of the New Pump and Treat Facility (i.e., TAN-25, -28, -29, -30A, -37, and TSF-05) are monitored on a routine basis to ensure that concentrations of radionuclides in the groundwater remain low. Well locations are shown on Figure 2-1. If monitoring indicates that the concentration of radionuclides in the New Pump and Treat Facility effluent would exceed maximum contaminant levels (MCLs), then the Air Stripper Treatment Unit—located between the hot spot and the New Pump and Treat Facility—will be restarted and operated to prevent radionuclides from traveling downgradient to the New Pump and Treat Facility.
- For the distal zone, if the Agencies determine that monitored natural attenuation will not restore this zone of the plume within the restoration timeframe, pump-and-treat units will be designed, constructed, and operated in this zone to remediate the plume. This contingency remedy also will be invoked if the required monitoring necessary for monitored natural attenuation is not performed.

The Remedial Design/Remedial Action Scope of Work (DOE-ID 2001b) defines the scope, schedule, and budget for implementation of the OU 1-07B final remedial action, as required by CERCLA (42 USC § 9601 et seq.) and the FFA/CO and in accordance with the ROD Amendment (DOE-ID 2001a).

2.2.3.1.1 Remedial Action Objectives—Changes and results documented in the Explanation of Significant Differences for OU 1-07B (INEEL 1997) and the TAN Field Demonstration Report (DOE-ID 2000a) prompted a refinement of the RAOs identified in the OU 1-07B ROD (DOE-ID 1995). In the 2001 ROD Amendment (DOE-ID 2001a), the Agencies agreed to apply final RAOs to the entire contaminant plume. The RAOs are as follows:

- Restore contaminated aquifer groundwater by 2095 (100 years from the signature of the OU 1-07B ROD) by reducing all COCs (Table 2-2) to below MCLs and a 1E-04 total cumulative carcinogenic risk-based level for future residential groundwater use and, for noncarcinogens, until the cumulative hazard index is less than 1.
- Reduce the concentrations of VOCs to below MCLs and a 1E-05 total risk-based level for aboveground treatment processes in which treated effluent will be reinjected into the aquifer.
- Implement ICs to protect current and future users from health risks associated with (1) ingestion or inhalation of, or dermal contact with, contaminants in concentrations greater than the MCLs; (2) contaminants with greater than a 1E-04 cumulative carcinogenic risk-based concentration; or (3) a cumulative hazard index of greater than 1, whichever is more restrictive. ICs shall be maintained until concentrations of all COCs are below the MCLs and until the cumulative carcinogenic risk-based level is less than 1E-04 and, for noncarcinogens, until the cumulative hazard index is less than 1. ICs shall include access restrictions and warning signs.

2.2.3.1.2 Cleanup Levels—Cleanup levels for the COCs are listed in Table 2-2.

2.2.3.2 Remedy Implementation. Implementation of the final remedy started in October 2001, when the New Pump and Treat Facility began routine operations in the medial zone. In October 2003, the hot spot remedy (i.e., in situ bioremediation) and the distal zone remedy (i.e., monitored natural

attenuation) became operational; however, actions supporting these remedies have been implemented since 1999 through treatability studies and post-treatability study activities.

Success of the overall remedial action depends on all remedial components performing, as planned, to achieve remediation goals. The monitoring program for each remedial component provides data to evaluate the performance of each component as well as the overall remedial action. As remedial components are completed, a comprehensive monitoring program (see Table 2-3) will continue to provide data necessary to evaluate attainment of all RAOs. Figure 2-2 illustrates the expected interaction of various remedy components' monitoring programs over the life of the remedy.

The ICs for OU 1-07B are administrative controls to protect current and future users from health risks associated with groundwater contamination. The ICs will prevent ingestion of contaminated groundwater. ICs for WAG 1, including OU 1-07B, are addressed in the OU 1-10 ROD (DOE-ID 1999) and Section 10.5 of this 5-year review.

2.2.3.3 Operations and Maintenance. Routine operations for the in situ bioremediation system include amendment injection, sampling, field laboratory analysis, and waste handling. The maintenance strategy for the in situ bioremediation system will consist of periodic preventative maintenance and corrective maintenance, as needed.

The New Pump and Treat Facility was operated as described in the New Pump and Treat Facility O&M Plan (DOE-ID 2009a) and associated procedures. Routine maintenance activities included filter change-outs, lubrication, instrument calibration, and freeze protection. When the New Pump and Treat Facility was running, inspections were performed as required in the O&M Plan. Daily observations and inspections were performed as specified in facility-specific procedures. Facility-component-specific inspections (i.e., tank inspections, fence and posting observations, and site physical conditions) were performed. Monthly inspections were performed for support systems (e.g., decontamination equipment, spill kits, eye washes, safety showers, and fire extinguishers).

To demonstrate compliance with applicable or relevant and appropriate requirements (ARARs), effluent—both air and water—were sampled for comparison with emission control requirements. For the New Pump and Treat Facility, the air stripper water effluent must maintain VOC concentrations below the established MCLs, and the air effluent must be maintained below the allowable discharge limits set in the ROD (DOE-ID 1995). All air and groundwater effluent samples met the allowable discharge limits.

Table 2-3. Monitoring for the Operable Unit 1-07B remedial action.

Monitoring Type	Sample Parameter	Decision/Evaluation Objective	Goal	Sample Program	Basis Document
Hot Spot					
ISB performance	ISB performance parameters: • VOCs • Tritium • Ethene, ethane, methane, redox, electron donor, bioactivity, and nutrient	Trending: • Donor distribution • Source degradation • Flux • New donor	Optimize operation to meet compliance objectives/requirements.	ISB	ISB work plan
ISB compliance	VOCs (TAN-28 and TAN-30A)	VOCs below MCLs for 1 year	Achieve reduction of downgradient flux to below MCLs.	ISB	ISB work plan
	VOCs (TAN-1860 and TAN-1861)	VOCs below MCLs for 1 year	Achieve reduction of cross-gradient flux to below MCLs.		
ISB completion compliance	All VOCs (wells to be determined)	Hot spot completion	Determine whether ISB RAOs have been met in the hot spot.	ISB	ISB remedial action report (TBD)
NPTF performance	VOCs plus radionuclides (strontium and cesium) (TAN-28, TAN-29, and TAN-30A)	Upgradient source	Conduct NPTF contingency evaluation monitoring.	NPTF	NPTF work plan
MNA performance	Radionuclides (strontium and cesium) (TAN-25, TAN-28, TAN-29, TAN-30A, TAN-37, and TSF-05)	Radionuclide monitoring (hot spot)	Monitor/evaluate hot spot radionuclide degradation and migration.	MNA	MNA work plan
Medial Zone					
NPTF performance	Drawdown	Facility operations	Capture the plume.	NPTF	NPTF work plan
NPTF compliance	Facility influent/effluent VOCs and strontium	Facility operations	Stay within influent and effluent specifications.	NPTF	NPTF work plan
	Air emissions	Facility operations	Stay within effluent specifications.		
	Operations uptime	Facility operations	Maintain 90% uptime.		
	Extraction flow rate	Facility operations	Operate within specified flow rate.		

Table 2-3. (continued).

Table 2-3 (Continued)							
Monitoring Type		Sample Parameter	Decision/Evaluation Objective		Goal	Sample Program	Basis Document
NPTF completion compliance		All COCs (wells to be determined)	Medial zone completion		Determine that NPTF RAOs have been or can be met in the medial zone.	NPTF	NPTF work plan
Distal Zone							
MNA performance		MNA performance parameters: • VOCs • Tritium	Breakthrough curves Plume expansion Degradation rate		Trends are toward achievement of RAOs.	MNA	MNA work plan
MNA compliance		MNA performance parameters for 5 years	MNA performance parameters		Annual sampling is a requirement for at least the first 5 years.	MNA	MNA work plan
MNA completion compliance		All COCs	Remedial action completion		Determine that RAOs have been met throughout the plume.	MNA	MNA remedial action report
COC	contaminant of concern		MNA	monitored natural attenuation	TBD	to be determined volatile organic compound	
ISB	in situ bioremediation		NPTF	New Pump and Treat Facility	VOC		
MCL	maximum contaminant level		RAO	remedial action objective			

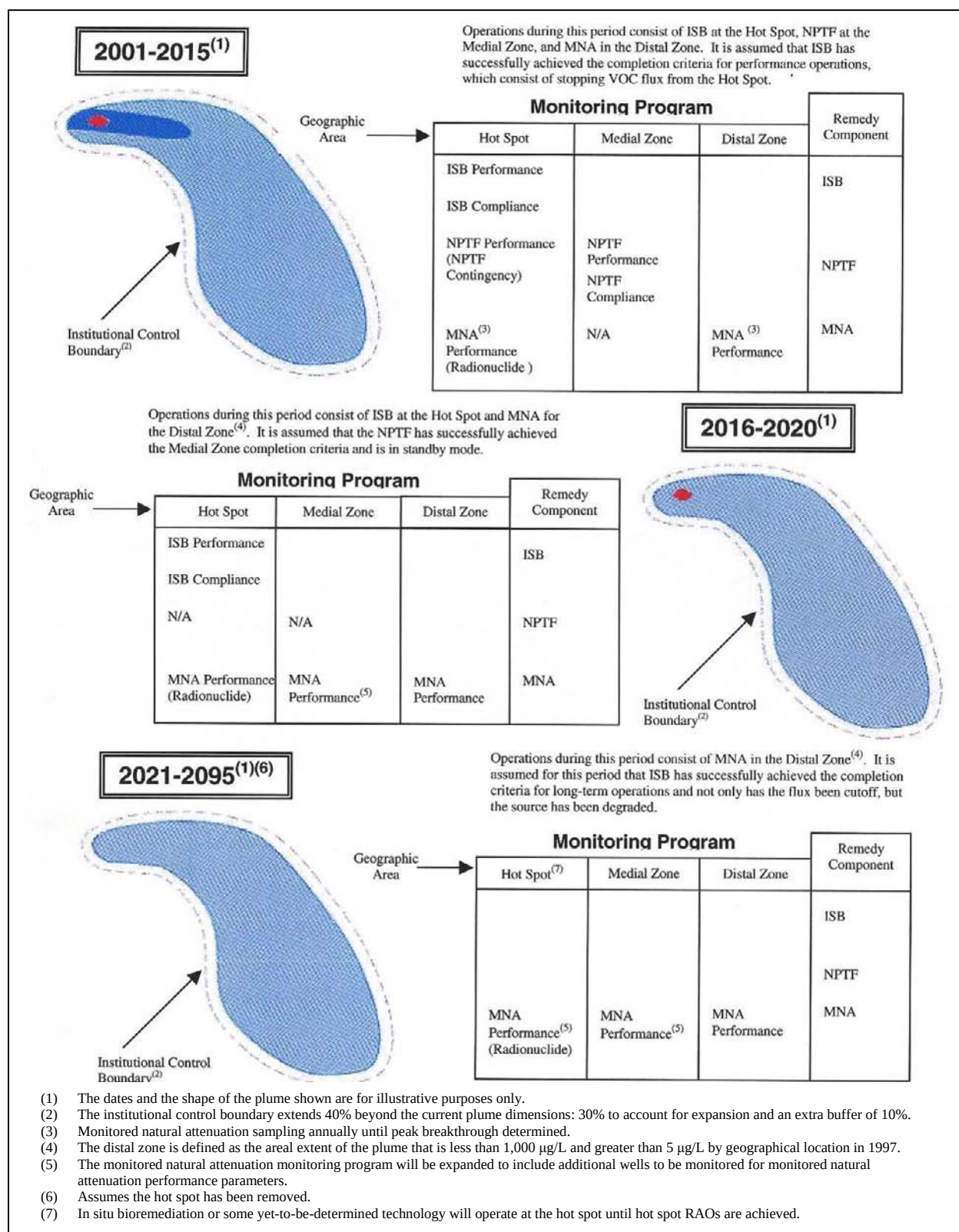


Figure 2-2. Generalized monitoring program operations throughout the remedial action timeframe.

2.2.4 Progress Since the Last Review

No issues were identified in the previous 5-year review for OU 1-07B (DOE-ID 2007a).

2.2.5 Operable Unit 1-07B Data Review and Evaluation

The following subsections summarize data collected to evaluate the performance of the three remedial components. Data summarized in this section were collected from FY 2005 through 2009 in the reports listed below:

- FY 2005 and 2006 monitoring data are summarized in the following individual reports:
 - In situ bioremediation—RPT-192 and RPT-372
 - New Pump and Treat Facility—ICP (2005) and RPT-311
 - Monitored natural attenuation—RPT-199 and RPT-383.
- FY 2005 and 2006 summary reports—RPT-233 and RPT-430.
- FY 2007, 2008, and 2009 comprehensive reports covering all three remedy components—RPT-488, DOE-ID (2009k), and DOE-ID (2010a).

2.2.5.1 Hot Spot Monitoring. Currently, in situ bioremediation is being implemented in the hot spot. The goal of in situ bioremediation operations is to meet in situ bioremediation compliance objectives stated in Table 2-3. Those objectives include reducing the residual source in the hot spot and reducing flux to downgradient wells (i.e., TAN-28 and TAN-30A) and cross-gradient wells (i.e., TAN-1860 and TAN-1861).

In situ bioremediation activities consist of periodic electron donor injections to stimulate increased biological activity, which results in enhanced biodegradation of VOCs through anaerobic reductive dechlorination. Starting with the treatability studies in 1999 through October 2003, sodium lactate was injected into TSF-05 weekly to bimonthly. The injection strategy was modified to optimize in situ bioremediation performance. Beginning in November 2003, sodium lactate was injected into TSF-05 and TAN-1859 (a downgradient well) on alternate months. Following these alternating injections, field optimization testing for whey injection began in March 2004 and continued through June 2005. These tests evaluated in situ bioremediation effectiveness using whey and optimized the injection strategy using various concentrations of whey powder. The FY 2005 In Situ Bioremediation Annual Report (RPT-192) documented results of this field optimization. Except for the July 2006 injection, whey-only injections continued until August 2008 in wells TSF-05, TAN-1859, and TAN-31. Simultaneous two-well injections into TSF-05 and TAN-31 started in June 2006. Simultaneous injections into TSF-05 and TAN-1859 started in September 2007. The goal of the simultaneous injections was to increase the area directly impacted by in situ bioremediation and to treat any residual source impacting TAN-28. Starting in August 2008, sodium lactate was added to the whey injections to reduce the pH drop after injections. In FY 2009, simultaneous injections were made into TAN-31 and TSF-05 and into TSF-05 and TAN-1859. The FY 2009 injections used whey and lactate.

Groundwater monitoring data, including COC concentration trends—along with the other analytical parameters—are used to evaluate the injection strategy and to measure progress of the remedy. Multiple analytical parameters, including target VOCs, redox indicators, and bioactivity indicators, are collected from 17 monitoring locations (i.e., TSF-05A, TSF-05B, TAN-10A, -25, -26, -27, -28, -29, -30A, -31, -37A, -37B, -37C, -D2, -1859, -1860, and -1861) (Figure 2-1) to ascertain the strategy's effectiveness. Operational changes are evaluated, based on the data, to optimize anaerobic reductive dechlorination.

TCE concentration trends demonstrate that the injections are enhancing dissolution from the residual source. Typically, 1 week after an injection, enhanced dissolution—evidenced by an increase in TCE and degradation products concentrations—was observed in the injection wells and was gone by the month after each injection. A plot of TCE concentrations for select source area non-injection wells shows that TCE concentrations have been mostly low, except for a couple of spikes, since October 2006 (Figure 2-3). The low TCE concentrations in wells in the source area (i.e., TAN-25 and TAN-D2) and immediately downgradient of the hot spot (i.e., TAN-37A and TAN-37B) indicate that TCE is being rapidly degraded in the source area. Sulfate, iron, and methane data indicate, in general, maintenance of good conditions for anaerobic reductive dechlorination in the hot spot; and concentrations of biologically mediated breakdown products indicate completion of dechlorination before arriving at the downgradient wells.

The downgradient flux of TCE is still present in TAN-28, -29, and -1860 (Figure 2-4). In spite of adjusting injection strategies to affect a larger source area, TCE concentrations have remained elevated at TAN-28 since starting in situ bioremediation. Determining the cause of the continuing elevated TCE concentrations at TAN-28 is difficult because travel time from the source-area injection wells to TAN-28 ranges from 13 to 25 months. In addition to TAN-28, TCE concentrations in TAN-1860 exhibited a spiking pattern over the last 5 years, with concentrations ranging from as high as 575 µg/L to less than the MCL (5 µg/L) (Figure 2-4). In general, TCE concentrations at TAN-1861 have been lower than at TAN-28 or TAN-1860. At TAN-30A, TCE concentrations have been reduced to a narrow range, extending from just above to below the MCL.

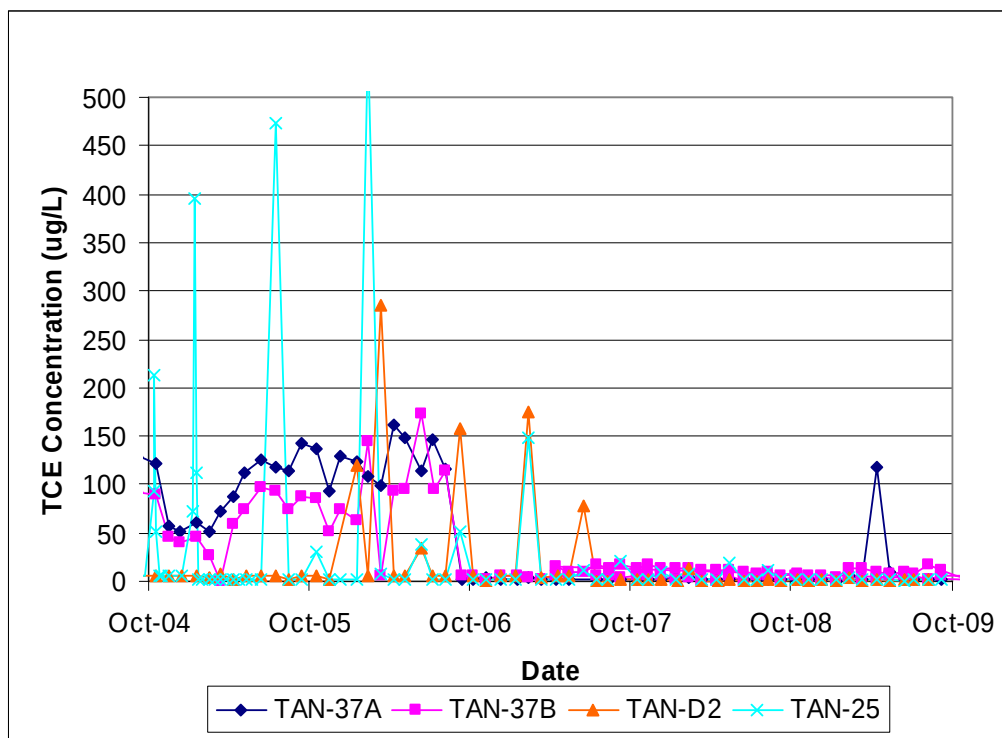


Figure 2-3. Trichloroethene concentration for select source area and immediately downgradient wells.

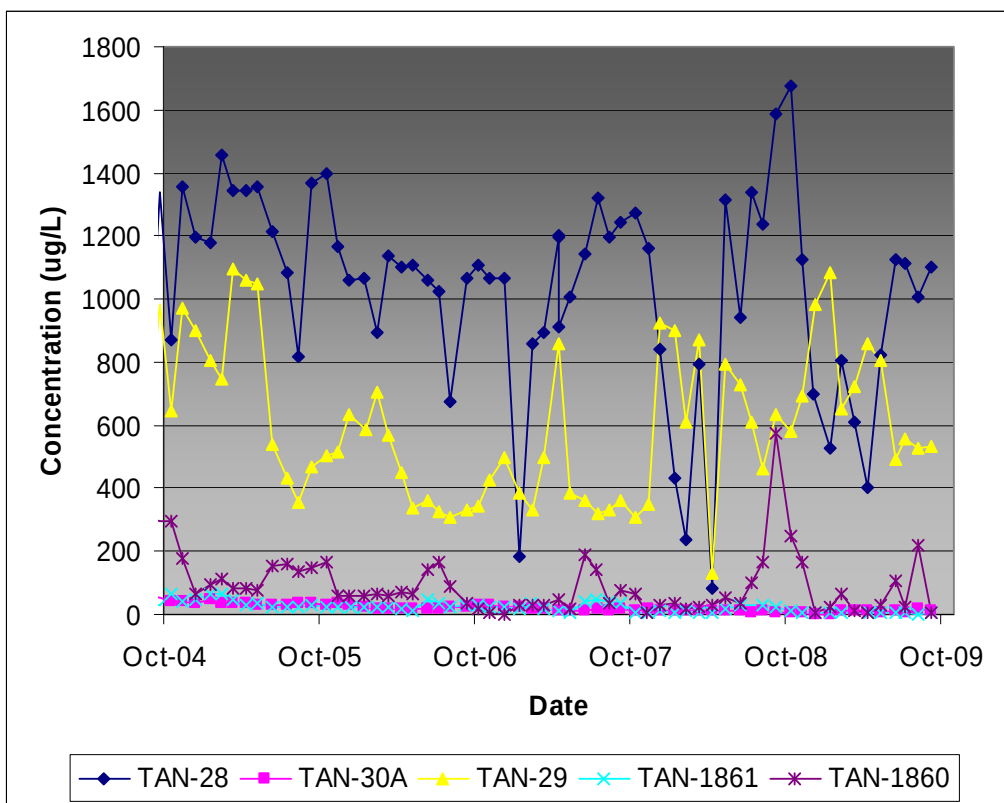


Figure 2-4. Trichloroethene concentrations in wells downgradient of the hot spot.

A goal of in situ bioremediation is to reduce the residual source. Dissolution of TCE from the residual source material to the aqueous phase is one of the rate-limiting steps determining the in situ bioremediation remedial time period because TCE must be dissolved into the aqueous phase to be available for microbial degradation. Residual source material quantities can be examined, in part, by considering the concentrations of trans-dichloroethene observed in source area wells over time. Trans-dichloroethene is thought to be a marker of source strength in that it (1) was co-disposed along with TCE in TSF-05, (2) is not likely produced during in situ bioremediation operations, and (3) is more recalcitrant and is not as susceptible to anaerobic reductive dechlorination as the other contaminants at this site. If an overall decrease in trans-dichloroethene is observed over time and the assumptions presented above hold, then a decrease in trans-dichloroethene concentrations, over time, suggests a decrease in residual source material.

As shown in Figure 2-5, the data collected to date suggest that most of the contactable source material (i.e., higher than 95%) will be removed from TSF-05, TAN-25, and TAN-31 around 2012, based on trans-dichloroethene trends and assuming continued in situ bioremediation operations. The predicted trans-dichloroethene concentrations for TSF-05, TAN-25, and TAN-31 are based on best-fit lines through the observed data using first-order exponential decay equations and 2002 data as the starting point. Overall, the trans-1,2-dichloroethene data suggest that the amount of residual source material continues to decline at TSF-05, TAN-25, and TAN-31.

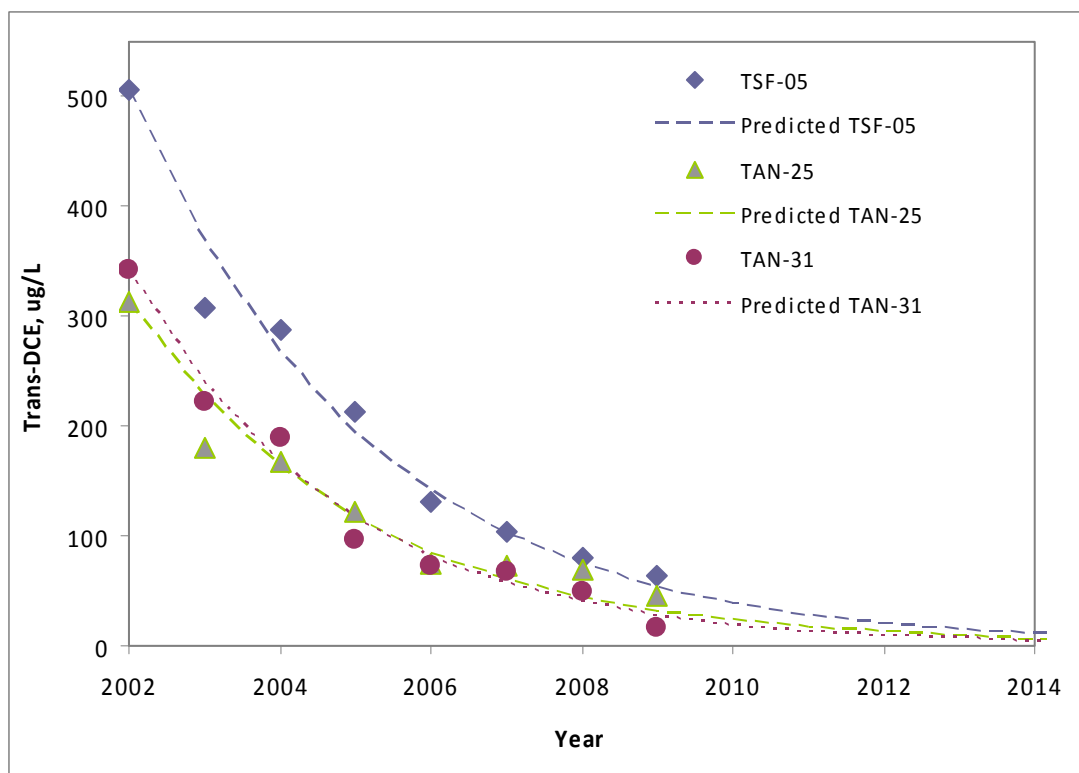


Figure 2-5. Average observed and predicted trans-dichloroethene, by fiscal year, in TSF-05, TAN-25, and TAN-315.

To evaluate the amount of residual source material that in situ bioremediation can treat, a plot shows the total amount of molar ethenes (i.e., TCE, cis-1,2-dichloroethene, vinyl chloride, and ethene) following an injection at TSF-05 (Figure 2-6). The interaction of the injected water and amendment, with residual sludge in the formation, enhances dissolution of TCE from the residual source material. Total molar ethene concentrations are plotted, rather than TCE concentrations, because the total molar ethene value accounts for degradation that occurs between the injection and the sampling event 1 week after the injection. Initially, larger amounts of total ethenes were released during the early stages of in situ bioremediation. After 2002, the quantity of total molar ethenes following an injection has mostly been less than 20 micromoles/L. Over time, total ethenes released following an injection have not declined as systematically as seen in trans-dichloroethene in TSF-05A. However, both parameters suggest a decline in the amount of the residual source that in situ bioremediation reaches. Total molar ethenes have not declined as systematically as trans-dichloroethene probably because the amount of TCE released from the residual source varies, depending on injection size and amendment type and concentration. In situ bioremediation operations varied the injection size and amendment type and concentration to optimize effectiveness.

2.2.5.2 Medial Zone. The New Pump and Treat Facility was constructed to remediate the medial zone of the plume by extracting contaminated groundwater, treating it through air strippers, then reinjecting the treated water. Performance and compliance monitoring demonstrates that the New Pump and Treat Facility operates as intended. Monitoring includes effluent concentrations and the associated calculated carcinogenic risk of (1) water treated through the New Pump and Treat Facility and reinjected into the SRPA, (2) air emissions, and (3) contaminant concentrations in groundwater in the medial zone.

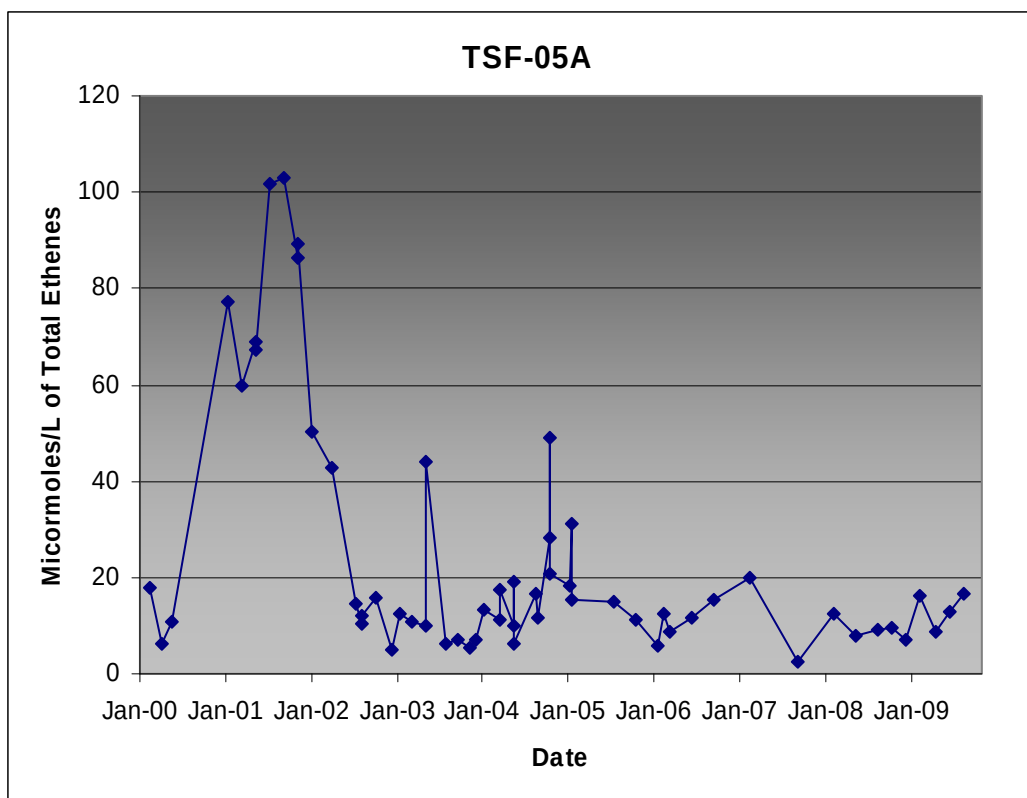


Figure 2-6. Sum of total molar ethenes (trichloroethene, cis-dichloroethene, vinyl chloride, and ethene) in TSF-05A following injections.

Operating the New Pump and Treat Facility during an approximate 3.5-year period (October 2001 to March 2005) demonstrated a decrease in TCE concentrations to approximately 100 µg/L. The New Pump and Treat Facility Medial Zone Rebound Test, conducted in accordance with the New Pump and Treat Facility Test Plan (ICP 2004) from March 1, 2005, to March 5, 2007, assessed the overall impact of New Pump and Treat Facility operations on remediation of the medial zone. Based on results obtained during the rebound test, the long-term operational strategy of the New Pump and Treat Facility was modified to a pulsed-pumping strategy as described in the New Pump and Treat Facility Remedial Action Work Plan (DOE-ID 2007b) and the New Pump and Treat Facility O&M Plan (DOE-ID 2007c). The objective of the pulse-pumping operations was to maintain TCE concentrations in the medial zone below 200 µg/L through a cycle of operation and standby modes. The New Pump and Treat Facility was operated until TCE concentrations at three medial zone monitoring wells (i.e., TAN-33, -36, and -44) were less than 100 µg/L. When this occurred, the New Pump and Treat Facility was placed in standby until TCE concentrations increased to 200 µg/L in any of the three medial zone monitoring wells. From November 16, 2007, to the end of FY 2009, the New Pump and Treat Facility operated in standby. During standby, the facility used extraction water from TAN-39 and TAN-40 to process purge water generated during monthly OU 1-07B groundwater sampling activities.

Two discharge criteria were established for the New Pump and Treat Facility effluent liquid:

1. All COCs must be below MCLs (DOE-ID 2007c).
2. Cumulative carcinogenic risk from VOCs must be less than 1E-05 (DOE-ID 2007c).

Concentrations of VOCs in the New Pump and Treat Facility effluent liquid samples were below detection limits, and therefore, met the water effluent-discharge criteria every year for the last 5 years. Sr-90, gross alpha, and gross beta results for the effluent were below MCLs. Tritium results were less than one-quarter of the MCL of 20,000 pCi/L.

VOC emissions from the New Pump and Treat Facility air strippers to the atmosphere were below the allowable air discharge limits. VOC emissions were calculated in two ways. The first approach calculated the VOC discharge mass flow rate using VOC concentrations measured in air stripper off-gas samples (the air effluent approach). The second approach assumes that all VOCs dissolved in the New Pump and Treat Facility influent are removed from the treated water, transferred to the air effluent, and discharged to the atmosphere (the water influent approach). Comparison of results from two independent calculation methods provides a conservative indication that the concentrations and mass flow rates of VOC COCs in New Pump and Treat Facility air effluent remain below the allowable air discharge limits. The New Pump and Treat Facility Remedial Design for OU 1-07B (DOE-ID 2000b) describes limits for VOCs discharged from the New Pump and Treat Facility to the atmosphere.

Trends and concentrations of TCE in groundwater from three wells (i.e., TAN-33, -36, and -44) near the New Pump and Treat Facility are used to determine the operational status of the New Pump and Treat Facility. Figure 2-7 shows that TCE concentrations rapidly decreased from March to November 2007 after the restart of the New Pump and Treat Facility at the termination of the rebound test. After the New Pump and Treat Facility shutdown in November 2007 and transition to standby mode, TCE concentrations in TAN-33, -36, and -44 rebounded slowly. Some rebound in TCE concentrations in the medial zone wells was expected to occur if TCE migration from the hot spot was not completely cut off. Modeling showed that TCE concentrations of around 200 $\mu\text{g/L}$ at medial zone well TAN-36 and downgradient at distal wells TAN-51 and TAN-54 in 2010 will degrade below the MCL before 2095 (Whitmire 2003). Thus, the remedy is expected to meet the RAOs.

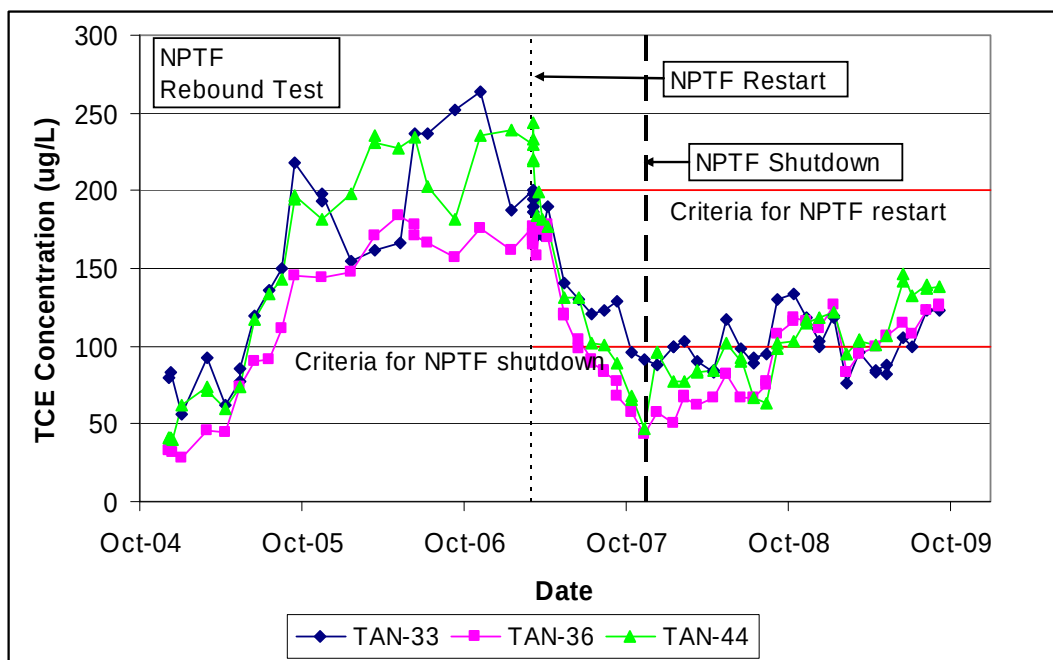


Figure 2-7. Trichloroethene concentration present in groundwater from TAN-33, TAN-36, and TAN-44.

2.2.5.3 Distal Zone. Technical information supporting implementation of monitored natural attenuation includes determining peak TCE concentration breakthrough at select wells in the downgradient portion of the TCE plume, monitoring the expansion of the TCE plume, and evaluating radionuclide concentrations in the hot spot.

2.2.5.3.1 Determining Peak TCE Concentration Breakthrough—Numerical modeling predicted dates of peak TCE concentrations at monitoring locations TAN-16, -21, -51, -52, -54, -55, -56, -57, -58, ANP-8, and GIN-4 in the distal zone (see Figure 2-1 for well locations). Times of TCE peak concentration breakthrough—determined from monitoring data—will be compared to the numerical model (DOE-ID 2003b) predictions to determine whether the monitored natural attenuation remedy is proceeding as expected.

TCE data for TAN-16 do not indicate a conclusive trend, while data for TAN-55 seem to indicate a downward trend; however, more data are needed to confirm the downtrend trend in TAN-55 and to determine the peak in TAN-16 (Figure 2-8). Like TAN-16, the TCE concentration data trends in TAN-51 and TAN-54 do not show a distinct trend, even though these wells should be past their respective model-predicted TCE peak time intervals. Given the distance from the hot spot area, the TCE concentration peaks will probably be gradual rather than a distinct, sharp peak. The gradual nature of the peak means that more time may be needed to decisively determine the peak and subsequent downward trend.

On the edge of the TCE plume, TCE concentrations in ANP-8 exhibited a gradual increase in concentration with an estimated peak breakthrough expected in 9 to 15 years. TCE concentrations in TAN-21 do not show a distinct trend, although peak breakthrough is estimated to occur in 9 to 15 years.

2.2.5.3.2 Evaluating Plume Expansion—The map in Figure 2-9 has overlays for the 5- μ g/L TCE concentration contours for 1997, 2006, and 2009 and shows minimal plume expansion in the downgradient direction of the plume. The position of the 5- μ g/L line from 2006 and 2009 is estimated from available data for wells sampled; consequently, apparent changes in plume length and width are approximate. Plume expansion is measured along the center plume axis as directed in the Monitored Natural Attenuation Remedial Action Work Plan (DOE-ID 2003b). It is assumed that TAN-56 is located on or near the longitudinal axis of the plume, and a TCE plume expansion to TAN-56 would represent an approximately 15% expansion. The estimated plume expansion has been less than 8% (243/3,066 m [798/10,059 ft]), as measured along the center axis of the plume and using the estimated positions of the 5- μ g/L contours in 1997 and 2009. Data suggest that only marginal plume extension has occurred and that it is within the 30% allowed in the 2001 ROD Amendment (DOE-ID 2001a). Evidence for some plume expansion is given by the upward TCE concentration trends in both GIN-4 and TAN-57. The upward TCE trends in GIN-4 and TAN-57 suggest that the plume axis is shifting to the west. This shift will be evaluated by collecting annual data for GIN-4 and TAN-57 over the next few years. TCE detections in TAN-58 and TAN-56 are not sufficient to evaluate TCE trends for these wells. Groundwater modeling indicated that minimal plume expansion may continue to occur near the location of the former Water Reactor Research Test Facility for a few more years (INEEL 2002a). Note that TCE concentrations shown in Figure 2-8 in the hot spot area are believed to be lower than 5 μ g/L because of the influence of continuing in situ bioremediation operations. If electron-donor injections in the hot spot were to cease, the TCE concentrations would probably exceed 5 μ g/L in the source area.

2.2.5.3.3 Evaluating Radionuclide Data—All monitored natural attenuation monitoring locations were sampled for tritium, and wells located in and downgradient of the hot spot (i.e., TAN-25, TAN-28, TAN-29, TAN-30A, TAN-37, and TSF-05) were also sampled for Cs-137, Sr-90, and gross alpha. Gross alpha is measured to address U-234, an analyte of concern.

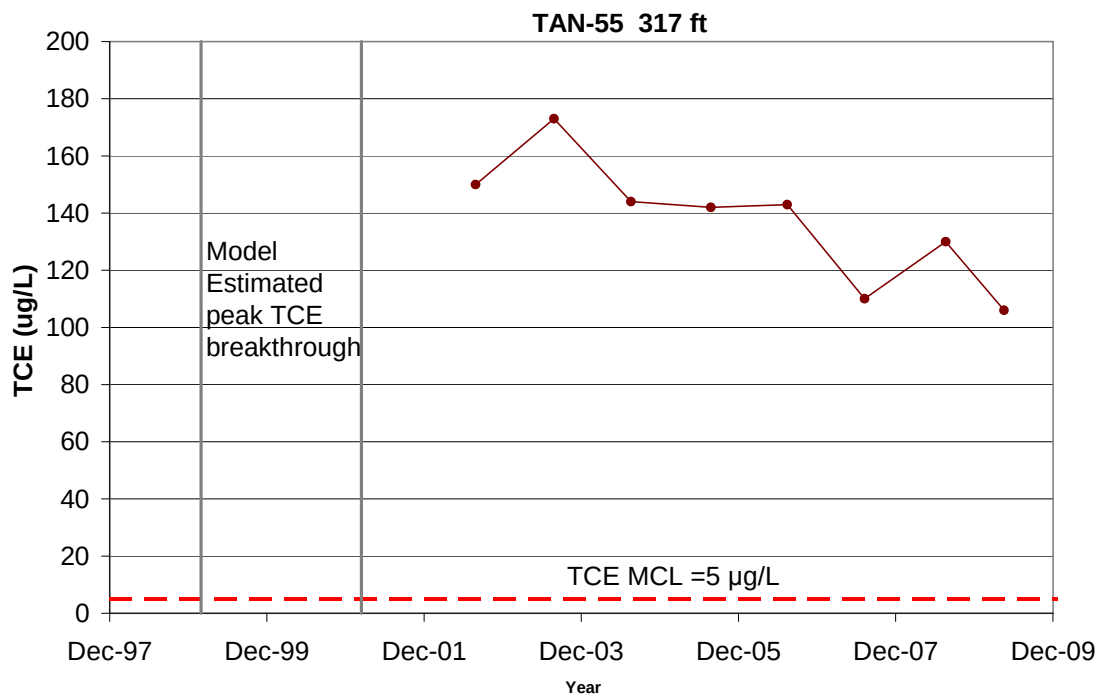
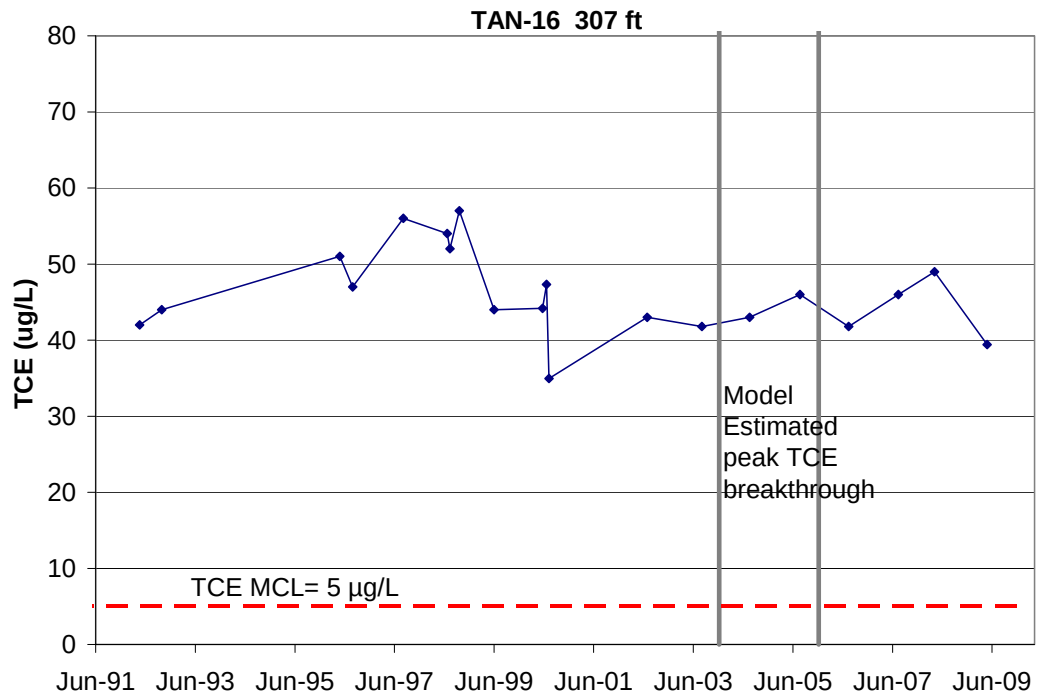


Figure 2-8. Trichloroethene concentration plots for TAN-16 and TAN-55.

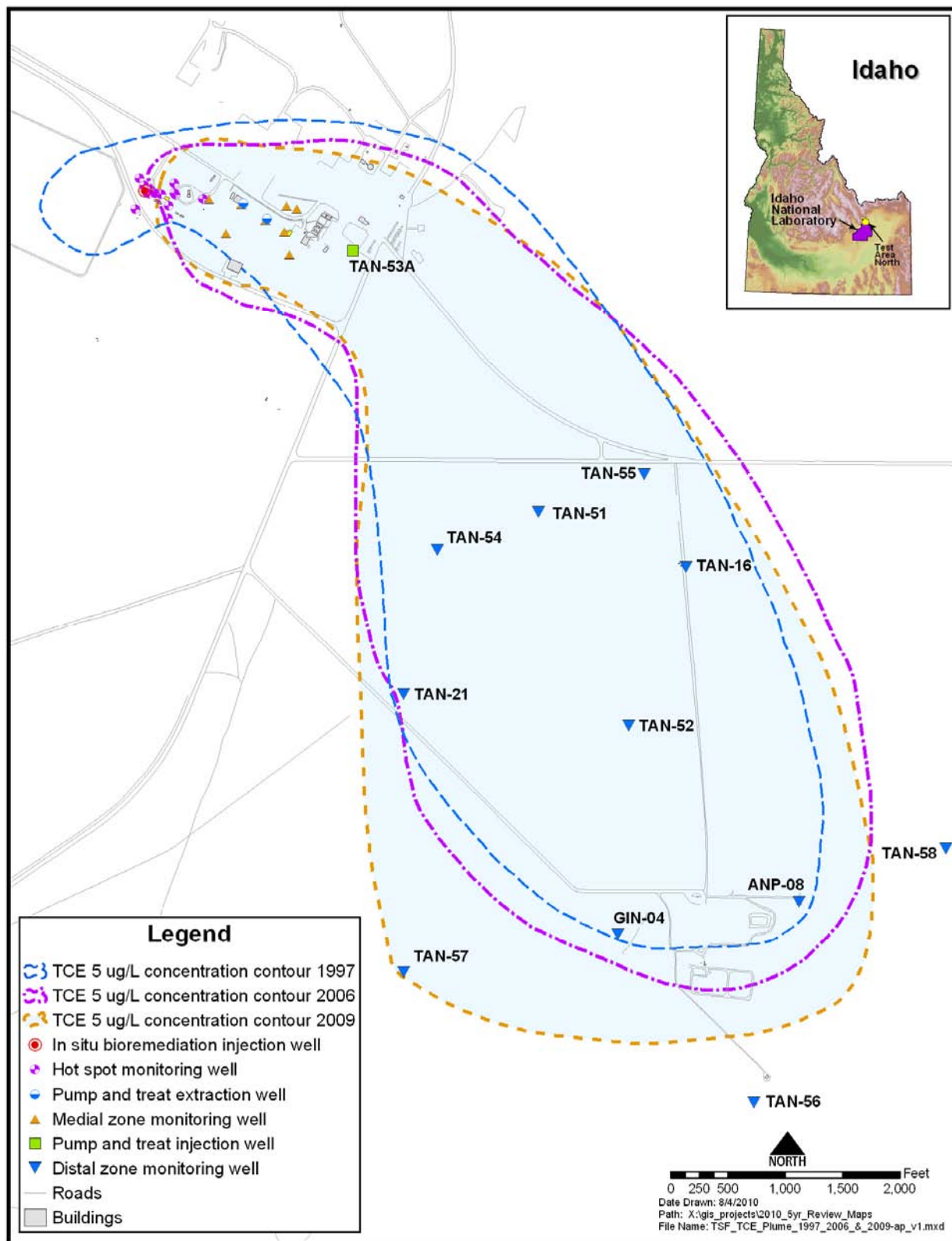


Figure 2-9. Comparison of the May 2009 trichloroethene aquifer plume to the 2006 and 1997 plumes (plume shape based on the 5-µg/L contour line).

Sampling results for tritium show that concentrations remain well below the MCL of 20,000 pCi/L, with tritium concentrations typically less than one-fourth of the MCL.

Cs-137 exceeded the remediation goal of 119 pCi/L in TSF-05A, TSF-05B, and TAN-25 (Figure 2-10). No migration of Cs-137 from the immediate source area (TSF-05 and TAN-25) has been observed. Downgradient of TSF-05 and TAN-25, Cs-137 concentrations decreased rapidly. In general, Cs-137 concentrations in TSF-05 and TAN-25 have increased over the past few years when compared to historical concentrations. These increases in Cs-137 could be from the injection of whey and lactate, which may release Cs-137 along with Sr-90 and TCE from the residual sludge.

Sr-90 was above its MCL of 8 pCi/L in all wells sampled for Sr-90 in the hot spot and medial zone, except TAN-30A (Figure 2-11). The highest Sr-90 concentrations are usually in TSF-05A, TSF-05B, and TAN-25 (see Figure 2-1 for monitoring well locations). Downgradient of the hot spot, Sr-90 concentrations are within their historical trends at TAN-28 and TAN-29 and below the MCL at TAN-30A. Because Sr-90 concentrations have remained within their historical range in downgradient wells TAN-28 and TAN-29, the higher concentrations of Sr-90 present near the hot spot do not appear to be migrating to the downgradient wells. The Sr-90 and Cs-137 trends will be evaluated after in situ bioremediation operations have stopped to determine whether RAOs will be met by 2095. The injection of whey and lactate is probably causing the release of Sr-90 and Cs-137 along with TCE from the residual sludge.

Gross alpha is measured to assess U-234, which is a COC for the TSF-05 injection well only. Because the in situ bioremediation operations create redox conditions that are not favorable for uranium migration, U-234 data will be evaluated after in situ bioremediation operations have stopped to determine whether RAOs are being met.

2.2.6 Technical Assessment

Subsections that follow present a technical assessment for each of the three major elements of the OU 1-07B selected remedy, followed by an overall technical assessment summary. The protectiveness of the remedy is examined below.

2.2.6.1 Technical Assessment—Hot Spot—In Situ Bioremediation. The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes for the short term but potentially no for the long term. Monitoring data show that in situ bioremediation is functioning as intended, in accordance with the decision documents, with a few exceptions. In spite of adjusting injection strategies to affect a larger source area, TCE concentrations have remained elevated at TAN-28 since starting in situ bioremediation. Persistent TCE concentrations at TAN-28 suggest that there could be a vadose zone source that has not been investigated and would not be remediated efficiently by in situ bioremediation. Cs-137 is trending upward in the hot spot. Sr-90 remains elevated in the hot spot and portions of the medial zone. The in situ bioremediation injections could be causing the release of Sr-90 and Cs-137 from the residual source. Once in situ bioremediation stops, radionuclide concentrations are expected to trend downward. Further testing is necessary to determine what effects, if any, radionuclide migration or a vadose zone source may have on remedial action performance over the long term.

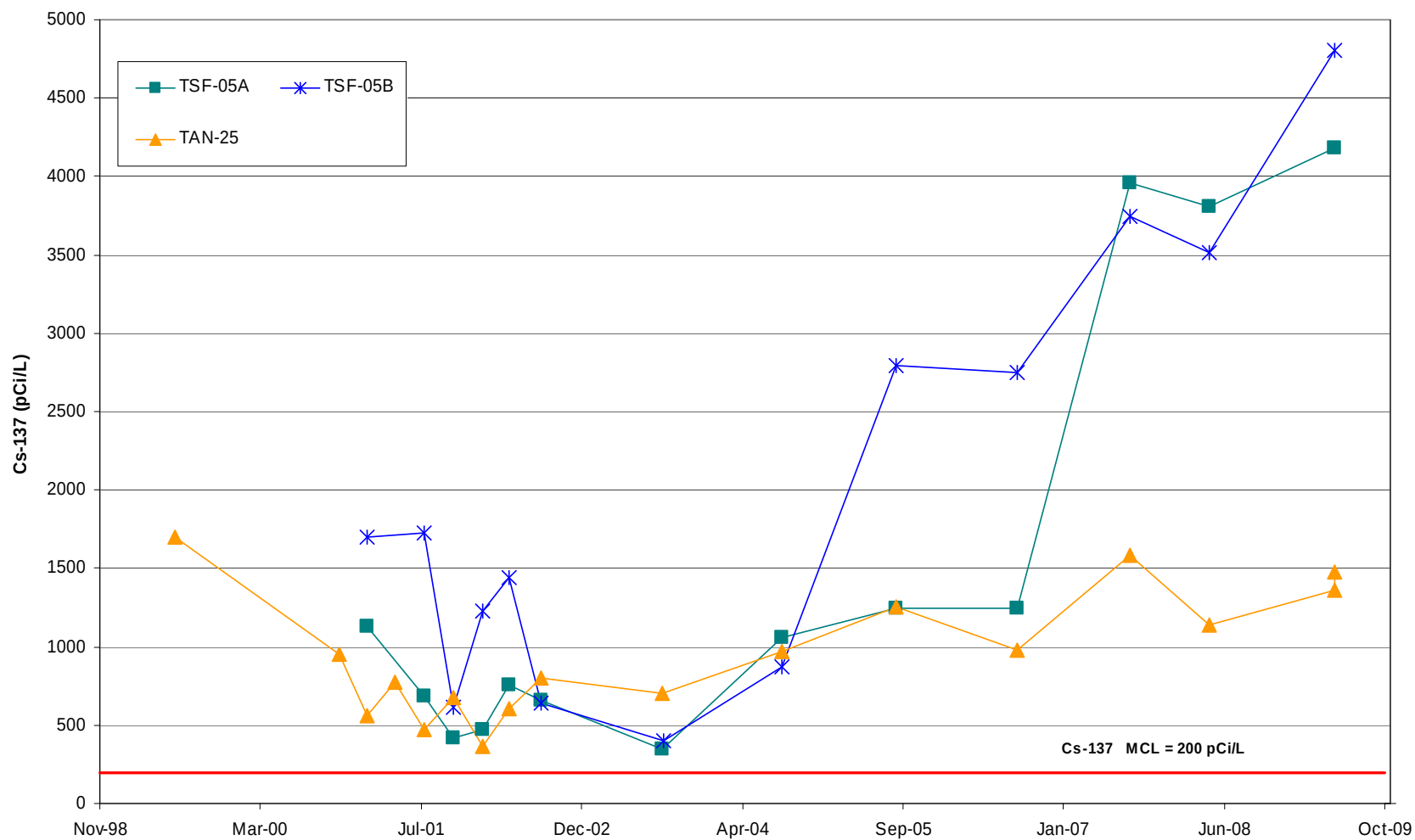


Figure 2-10. Trends for Cs-137 in wells above the maximum contaminant level (note that the maximum contaminant level is currently 200 pCi/L, but an action level of 119 pCi/L was established in the 1995 OU 1-07B Record of Decision).

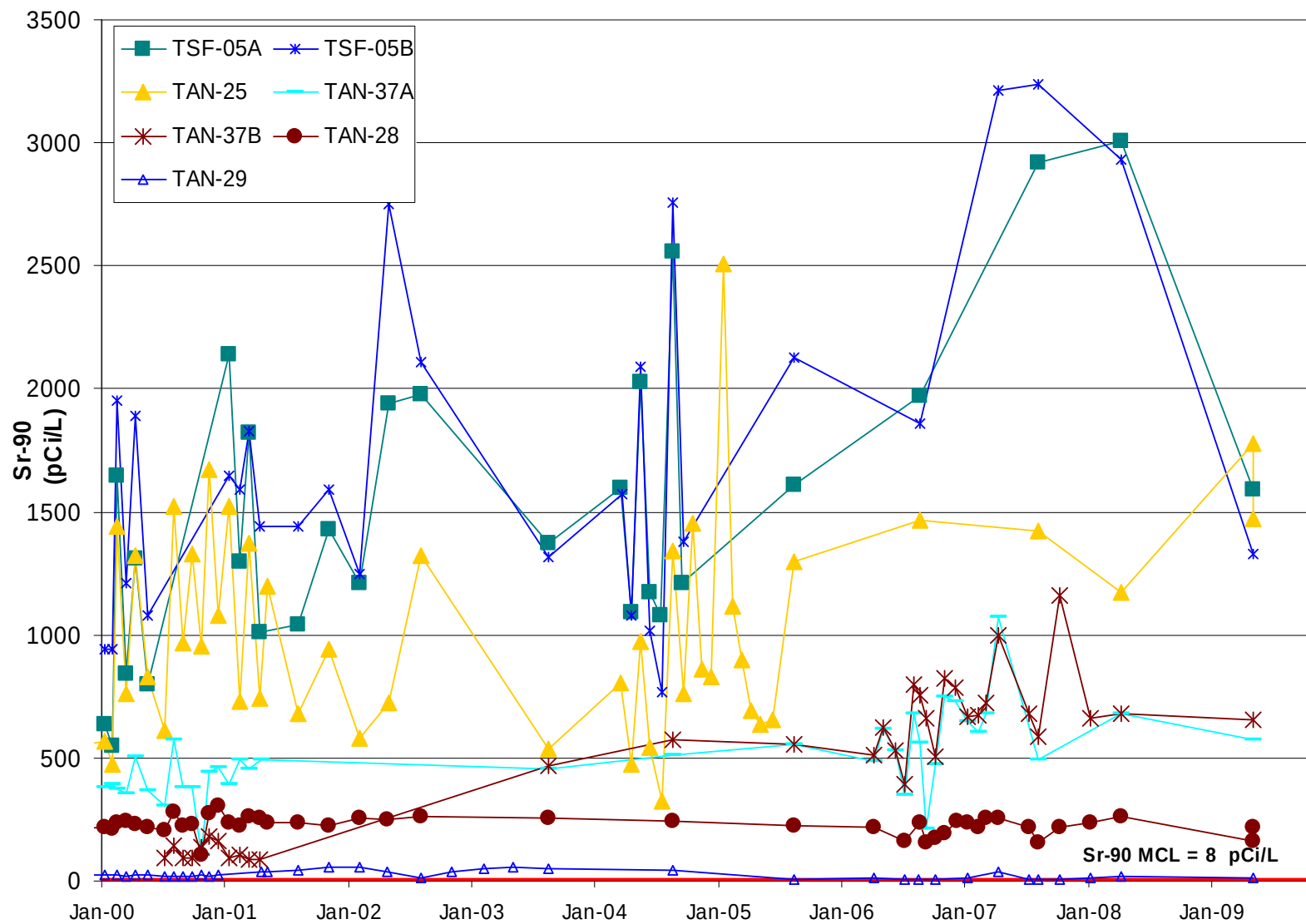


Figure 2-11. Strontium-90 concentration trends for select monitored natural attenuation wells.

O&M of the in situ bioremediation system encompass maintaining all equipment in operational status to perform amendment injections, sampling activities, and field laboratory activities. Routine inspections of safety equipment are completed as specified in project procedures. ICs identified in the 2001 ROD Amendment and the In Situ Bioremediation Remedial Action Work Plan (DOE-ID 2002a) are in place and are maintained under the INL Site-wide IC/O&M Plan (DOE-ID 2010b).

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Yes. Although vinyl chloride is a significant by-product of in situ bioremediation operations, dechlorination appears to be going to completion. The creation of vinyl chloride due to in situ bioremediation activities is transitory, and vinyl chloride was not detected in the medial zone wells near the New Pump and Treat Facility.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

2.2.6.2 Technical Assessment—Medial Zone—New Pump and Treat Facility. The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. Monitoring data collected during the past 5 years of the New Pump and Treat Facility operations indicate that the remedy is functioning as intended, in accordance with the decision documents. O&M of the New Pump and Treat Facility encompass maintaining all equipment in operational status and inspecting the system, as required. ICs identified in the 2001 ROD Amendment (DOE-ID 2001a) and the New Pump and Treat Facility O&M Plan (DOE-ID 2007c) are in place and are maintained under the INL Site-wide IC/O&M Plan (DOE-ID 2010b).

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Yes.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

2.2.6.3 Technical Assessment—Distal Zone—Monitored Natural Attenuation. The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. Monitoring results indicate that monitored natural attenuation is functioning as intended, in accordance with the decision documents. O&M of monitored natural attenuation implementation encompass maintaining all equipment in operational status to conduct monitoring activities. This includes inspecting and maintaining the well infrastructure and all sampling equipment. ICs identified in the 2001 ROD Amendment and the Monitored Natural Attenuation Remedial Action Work Plan for OU 1-07B (DOE-ID 2003b) are in place and maintained under the INL Site-wide IC/O&M Plan.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Yes.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Yes. The remedy allowed for a 30% expansion of the plume and that has not occurred. However, sample data from TAN-57 indicate the plume could be heading in a more south-southwesterly direction than anticipated. This calls into question whether the monitoring strategy is adequate to measure plume expansion.

2.2.6.4 Technical Assessment Summary. The remedy for OU 1-07B consists of three components: (1) in situ bioremediation for the hot spot, (2) pump-and-treat for the medial zone, and (3) monitored natural attenuation for the distal zone. Monitoring data show the three components are functioning as intended by the 2001 ROD Amendment (DOE-ID 2001a) and decision documents. However, though injection strategies have been adjusted to affect a larger source area, TCE concentrations have remained elevated at some medial zone wells (e.g., TAN-28) since starting in situ bioremediation. Elevated TCE concentrations may be from a vadose zone source, which could affect long-term protectiveness of the hot spot remedy. RAOs identified in the 2001 ROD Amendment are still valid, and monitored natural attenuation and pump and treat components of the remedy continue to progress as anticipated. No new information calls into question the current protectiveness of the pump and treat and monitored natural attenuation remedies. Though the remedy is currently protective, elevated radionuclide concentrations in the hot spot and medial zone should be evaluated to ensure RAOs will be obtained in the future. Sample data from distal zone wells indicate that the plume could be heading in a more south-southwesterly direction than anticipated; therefore, the monitoring strategy should be modified to adequately evaluate plume expansion.

2.2.7 Issues

- TCE concentrations have not decreased as expected at aquifer monitoring well TAN-28 downgradient of the hot spot.
- Cs-137 concentrations have been increasing at the hot spot and Sr-90 concentrations remain high in the hot spot and several locations in the medial zone.
- The monitoring strategy may not be adequate for evaluating plume expansion.

2.2.8 Recommendations and Follow-Up Activities

Prepare a test plan as an addendum to the In Situ Bioremediation Work Plan (DOE-ID 2009c) to define and implement an in situ bioremediation rebound test and monitor vadose zone vapor at the hot spot. These actions will help to determine whether (1) a vadose zone source is present, (2) TCE concentrations at TAN-28 downgradient of the hot spot will trend downward, and (3) radionuclide concentrations will trend downward. Because TCE concentrations at the distal edge of the plume in Wells TAN-57 and GIN-4 are above the MCL, monitoring frequency will be increased to yearly rather than once every 3 years for these wells. If TCE concentrations at either well or TAN-56 exceed 10 µg/L TCE, a downgradient monitoring well will be installed.

2.2.9 Protectiveness Statement for Operable Unit 1-07B

The remedy at OU 1-07B is currently protective of human health and the environment. Follow-up action documented in this review to address WAG 1 issues will ensure the remedy remains protective for

the long term. An in situ bioremediation rebound test, vadose zone vapor monitoring at the hot spot, and increased monitoring at distal zone wells will provide additional information on whether the in situ bioremediation remedy is functioning as intended and whether the monitored natural attenuation remedy will be protective in 2095. These additional activities will occur before the next 5-year review. In the meantime, groundwater remediation will continue and ICs are in place to control exposure pathways that could result in unacceptable risks. The three components of the remedy have been implemented in accordance with the schedules stated in the appropriate remedial action work plans and are making progress toward achieving RAOs.

2.3 Operable Unit 1-10—Test Area North Comprehensive Remediation

The Final OU 1-10 ROD (DOE-ID 1999) represents the comprehensive selected remedy for all of WAG 1. It encompasses all WAG 1 sites, including IC sites, except the Technical Support Facility injection well (i.e., TSF-05) and surrounding groundwater contamination (i.e., TSF-23), which remain under the OU 1-07B ROD discussed in Section 2.2 above. Figure 2-12 illustrates the locations of the WAG 1 sites at the Technical Support Facility. Figure 2-13 illustrates the locations of other sites in WAG 1.

2.3.1 Site Chronology

Table 2-4 provides a chronology of significant documents and events for OU 1-10.

2.3.2 Background

The OU 1-10 sites that are subject to this 5-year review are shown in Table 2-5. TSF-07 and TSF-08 Area 13B later became OU 10-08 sites (see Section 10).

2.3.2.1 History of Contamination. Construction, operations, and maintenance activities at TAN generated various types of waste that were, in some cases, disposed of onsite or stored onsite. Underground storage tanks were used to store diesel fuel and process waste and as catch basins for floor-drain waste. In some instances, tanks or piping around the tanks developed leaks, contaminating the surrounding soil. Similarly, transfer operations to remove liquid from the tanks occasionally resulted in spills, which contaminated the surrounding soil. Solids that formed or collected in some tanks were hazardous or, with repeated use, entrained hazardous materials. Construction debris occasionally was disposed of in pits and subsequently burned. Additionally, some types of liquid waste were transferred to evaporation ponds or injected into the ground.

Table 2-4. Chronology of significant documents and events for Operable Unit 1-10.

Document or Event	Date
August 1995	<i>Record of Decision Declaration for the Technical Support Facility injection well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites Final Remedial Action (DOE-ID 1995)</i>
November 1997	<i>Comprehensive Remedial Investigation/Feasibility Study for the Test Area North Operable Unit 1-10 at the Idaho National Engineering and Environmental Laboratory (DOE-ID 1997)</i>
February 1998	<i>Proposed Plan for Waste Area Group 1 - Test Area North Idaho National Engineering and Environmental Laboratory (DOE-ID 1998a) (first proposed plan for OU 1-10 ROD)</i>
November 1998	<i>Proposed Plan for Waste Area Group 1 - Test Area North at the Idaho National Engineering and Environmental Laboratory (DOE-ID 1998b) (second proposed plan for OU 1-10 ROD)</i>

Table 2-4. (continued).

Document or Event	Date
November 1998	<i>Comprehensive Remedial Investigation and Feasibility Study Supplement for the Test Area North Operable Unit 1-10 at the Idaho National Engineering and Environmental Laboratory (DOE-ID 1998c)</i>
October 1999	<i>Final Record of Decision for Test Area North Operable Unit 1-10 (DOE-ID 1999)</i>
February 2000	<i>Test Area North, Waste Area Group 1, Operable Unit 1-10 Remedial Design/Remedial Action Scope of Work (DOE-ID 2000d)</i>
February 2000	<i>Field Sampling Plan for Post-Record of Decision Sampling and Field Screening of Selected Sites at Waste Area Group 1, Operable Unit 1-10 (DOE-ID 2000e)</i>
February 2000	Initiated OU 1-10 remedial action with the start of post-ROD characterization sampling
May 2000	Removed TSF-26 soil pile
July 2000	Removed TSF-06 overburden soil
August 2000 Rev. 0	<i>Comprehensive Remedial Design/Remedial Action Work Plan for the Test Area North, Operable Unit 1-10, Group 1 Sites (DOE-ID 2003c)</i>
January 2001	<i>Test Area North (TAN) -616 Track 1 Decision Documentation Package (DOE-ID 2001c)</i>
November 2001 Rev. 1	<i>Operations and Maintenance Plan for Test Area North, Operable Unit 1-10 (DOE-ID 2001d)</i>
March 2002 Rev. 1	<i>Comprehensive Remedial Design/Remedial Action Work Plan for the Test Area North, Waste Area Group 1, Operable Unit 1-10, Group 2 Sites (DOE-ID 2002b)</i>
July 2002	<i>Technology Evaluation Scope of Work for the V-Tanks, TSF-09/18, at Waste Area Group 1, Operable Unit 1-10 (DOE-ID 2002c)</i>
October 2002	<i>Technical Support Facility-06 and Technical Support Facility-26 Calendar Year 2000 Sampling and Remediation Summary Report for Waste Area Group 1, Operable Unit 1-10 (INEEL 2002b)</i>
January 2003	<i>TSF-03 and WRRTF-01 2000/2001 Sample Data Compilation and Risk Assessment Report for Operable Unit 1-10, Waste Area Group 1, at Test Area North (DOE-ID 2003d)</i>
April 2003	<i>Explanation of Significant Differences for the Record of Decision for the Test Area North Operable Unit 1-10 (DOE-ID 2003a)</i>
April 2003	<i>New Proposed Plan for the V-Tanks Contents (TSF-09 and TSF-18) at Test Area North, Operable Unit 1-10 (DOE-ID 2003e)</i>
May 2003	<i>Comprehensive Remedial Design/Remedial Action Work Plan Addendum for V-Tanks Early Remedial Action for the Test Area North, Waste Area Group 1, Operable Unit 1-10, Group 2 Sites (DOE-ID 2003f)</i>
November 2003 Rev. 2	<i>Comprehensive Remedial Design/Remedial Action Work Plan for the Test Area North, Operable Unit 1-10, Group 1 Sites (DOE-ID 2003c)</i>
December 2003	<i>Remedial Design/Remedial Action Work Plan for Group 3, PM-2A Tanks and Burn Pits for Test Area North, Waste Area Group 1, Operable Unit 1-10 (DOE-ID 2003g)</i>
January 2004	Shipped TSF-26 PM-2A tanks (V-13 and V-14) and contents to ICDF: placed PM-2A Tank V-13 directly in ICDF disposal cell; staged Tank V-14, pending treatment prior to disposal
February 2004	<i>Record of Decision Amendment for the V-Tanks (TSF-09 and TSF-18) and Explanation of Significant Differences for the PM-2A Tanks (TSF-26) and TSF-06, Area 10, at Test Area North, Operable Unit 1-10 (DOE-ID 2004a)</i>
April 2004	TSF-03 burn pit remediated

Table 2-4. (continued).

Document or Event	Date
April 2004	New Site TSF-47 assigned to OU 1-10
April 2004	New Site TSF-48 assigned to OU 1-10
May 2004	TSF-06 Area B remediated
May 2004	<i>Risk-Based Screening and Assessment Approach for Waste Area Group 1 Soils (VanHorn and Stacey 2004)</i>
June 2004	<i>Group 3 Remedial Design/Remedial Action Work Plan Addendum 1 for PM-2A Tank Removal and Site Remediation for the Test Area North, Waste Area Group 1, Operable Unit 1-10 (DOE-ID 2004b)</i>
June 2004	TSF-26 PM-2A Tanks (V-13 and V-14) and contents excavated and stored in TAN-607 high bay pending transport to ICDF for treatment and disposal
August 2004	WRRTF-01 burn pits remediated
August 2004	<i>Group 2 Remedial Design/Remedial Action Work Plan Addendum for the Assessment and Cleanup of V-Tank Area New Sites, for the Test Area North, Waste Area Group 1, Operable Unit 1-10 (DOE-ID 2004c)</i>
September 2004	TSF-26 soil remediated
September 2004 Rev. 0	<i>Group 2 Remedial Design/Remedial Action Work Plan Addendum 2 for the TSF-09/18 V-Tanks and Contents Removal and Site Remediation at Test Area North, Waste Area Group 1, Operable Unit 1-10 (DOE-ID 2004d)</i>
October 2004	WRRTF-01 site revegetated
October 2004	TSF-03 site revegetated
November 2004 Rev. 1	<i>Group 2 Remedial Design/Remedial Action Work Plan Addendum 2 for the TSF-09/18 V-Tanks and Contents Removal, Phase 1 Contents Treatment, and Site Remediation at Test Area North, Waste Area Group 1, Operable Unit 1-10 (DOE-ID 2004e)</i>
January 2005	<i>Explanation of Significant Differences for the Record of Decision for the Test Area North Operable Unit 1-10 (DOE-ID 2005c)</i>
May 2005	<i>Group 3 Remedial Design/Remedial Action Work Plan Addendum 2 for TSF-26, PM 2A Tanks – Phase 2 Tank V-14 Treatment and Disposal for Test Area North, Waste Area Group 1, Operable Unit 1-10 (DOE-ID 2005d)</i>
August 2005 Rev. 2	<i>Group 2 Remedial Design/Remedial Action Work Plan Addendum 2 for the TSF-09/18 V-Tanks and Contents Removal, Phase 1 Contents Treatment, and Site Remediation at Test Area North, Waste Area Group 1, Operable Unit 1-10 (DOE-ID 2005e)</i>
August 2005	V-Tank waste transferred to treatment system
August 2005	Agencies approved in situ sparging remaining Tank V-9 contents (DOE-ID 2005e)
August 2005	Granular activated carbon fire
September 2005	TSF-26 Tank V-14 treated and disposed of at ICDF
October 2005	Removed additional contaminated soil along Snake Avenue as part of TSF-06 Area B
November 2005	Certified TSF-26 PM-2A tanks closure (Monson 2005)
November 2005	<i>Group 2 Remedial Design/Remedial Action Work Plan Addendum 2 for the TSF-09/18 V-Tanks and Contents Removal, Phase 1 Contents Treatment, and Site Remediation at Test Area North, Waste Area Group 1, Operable Unit 1-10, Rev. 3 (DOE-ID 2005f)</i>
November 2005	Removed V-Tanks V-3 and V-2 from soil contamination area
January 2006	<i>Engineering Evaluation/Cost Analysis (EE/CA) for Decommissioning of TAN-630 and TAN-650 at the Loss-of-Fluid Test (LOFT) Area (DOE-ID 2006a)</i>
March 2006	TSF-09 (V-Tank) waste treated

Table 2-4. (continued).

Document or Event	Date
March 2006	<i>Action Memorandum for Decommissioning of TAN-630 and TAN-650 at the Loss-of-Fluid Test (LOFT) Area (DOE-ID 2006b)</i>
June 2006	Agencies concurred an off-INL Site facility (i.e., PEcoS, Richland, Washington) can treat Tank V-9 and ancillary waste
July 2006	<i>Engineering Evaluation/Cost Analysis (EE/CA) for Decommissioning of TAN-607A (RPT-214)</i>
July 2006	V-1, V-2, and V-3 tanks and treated solidified waste transported to ICDF for disposal
August 2006	New Site TSF-53 assigned to OU 1-10
September 2006	<i>Action Memorandum for Decommissioning of TAN-607A (DOE-ID 2006c)</i>
October 2006 Rev. 0	<i>Action Memorandum for General Decommissioning Activities under the Idaho Cleanup Project</i> was signed by the Agencies (DOE-ID 2006d)
December 2006	Shipped inlet and outlet pipe waste to PEcoS (Richland, Washington) for testing and treatment
January 2007	<i>Explanation of Significant Differences for the Record of Decision for the Test Area North Operable Unit 1-10 (DOE-ID 2007d)</i>
January 2007	<i>Engineering Evaluation/Cost Analysis (EE/CA) for Decommissioning of TAN-607 Hot Shop Area (DOE-ID 2007e)</i>
March 2007	Remediated remaining soil at TSF-09/18 south
May 2007	<i>Action Memorandum for Decommissioning of TAN-607 Hot Shop Area (DOE-ID 2007f)</i>
July 2007	TSF-53 site remediated
November 2007	New Site TSF-59 assigned to WAG 10
January 2008	<i>Final Removal Action Report for the LOFT Facility (DOE-ID 2008a)</i>
April 2008	<i>Remedial Action Report for OU 1-10 Sites at Test Area North, WAG 1 (DOE-ID 2008b)</i>
September 2008	<i>Final Removal Action Report for Test Area North 607A and 607 (DOE-ID 2008c)</i>
January 2009 Rev. 1	<i>Action Memorandum for General Decommissioning Activities under the Idaho Cleanup Project</i> was signed by the Agencies (DOE-ID 2009k)
ICDF	Idaho CERCLA Disposal Facility
INL	Idaho National Laboratory
LOFT	Loss-of-Fluid Test (facility)
OU	operable unit
ROD	Record of Decision
WAG	waste area group

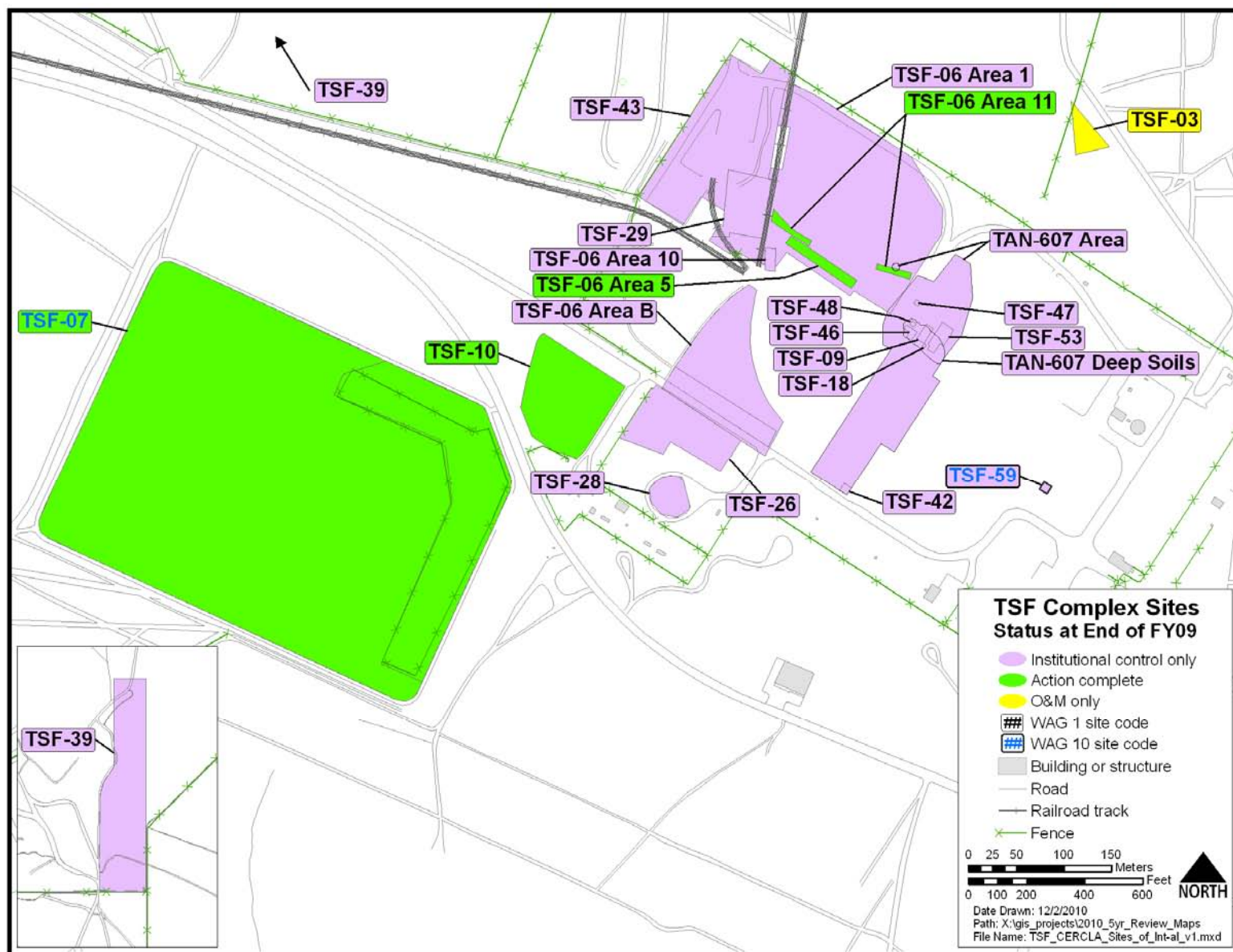


Figure 2-12. Locations of remedial action sites at the Technical Support Facility.

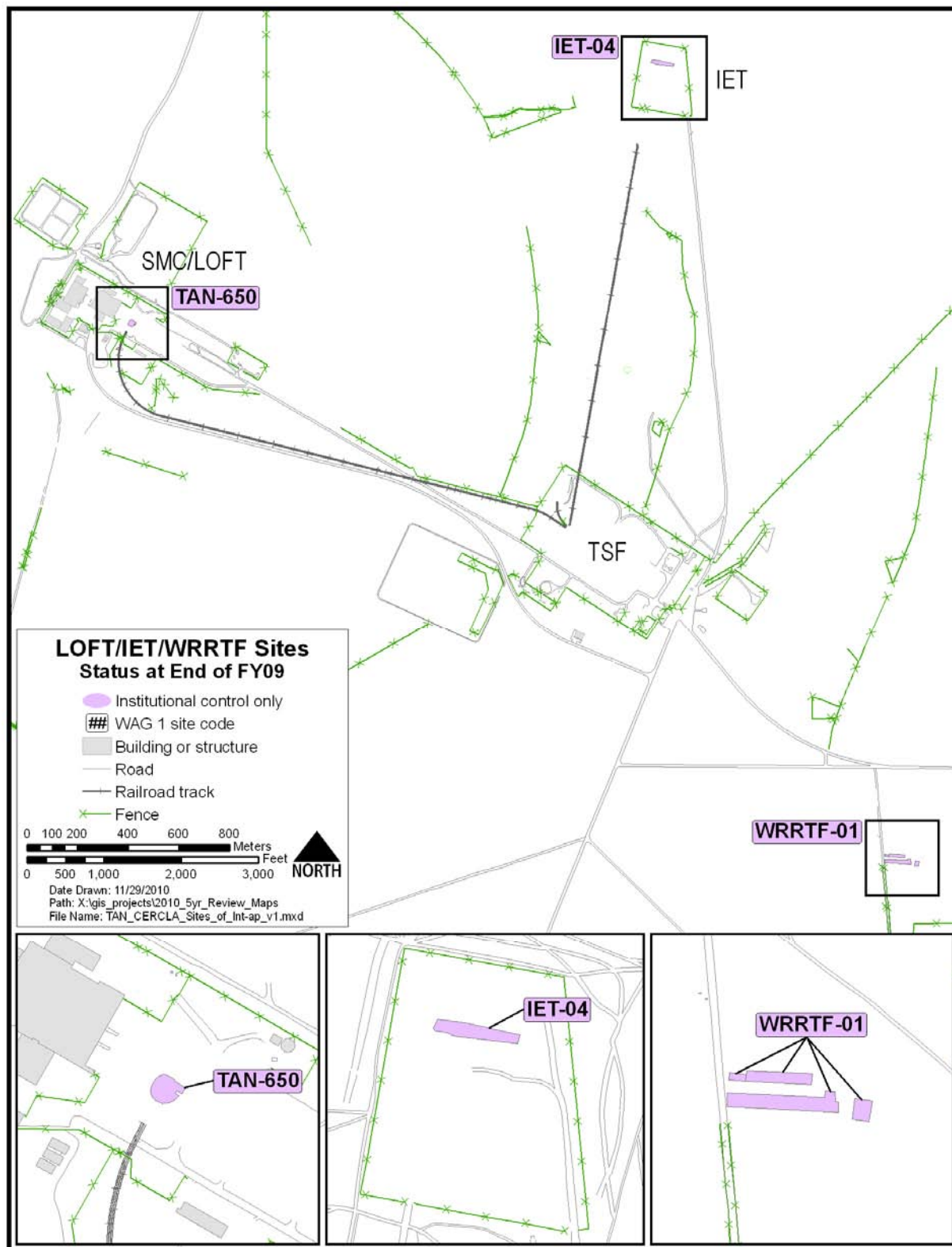


Figure 2-13. Locations of Water Reactor Research Test Facility, Loss-of-Fluid-Test Facility, and Initial Engine Test institutional control sites.

2.3.2.2 Initial Response. Several removal actions were conducted with WAG 1 before the timeframe covered in this review. These actions were discussed in a previous review. No pre-ROD cleanup activities have occurred since the last 5-year review.

2.3.2.3 Basis for Taking Action. The COCs that were the basis for action are identified in Table 2-5. Remedial action was selected because those sites posed an unacceptable risk to human health and/or the environment.

Table 2-5. Operable Unit 1-10 Comprehensive Environmental Response, Compensation, and Liability Act sites.

Site (Site Code)	Site name	Basis for Action	Selected Remedy
Remedial Action Sites			
TSF-03	TSF burn pit	Lead	Soil removal and disposal
TSF-06 Area B	Soil contamination area south of the turntable	Cs-137	Soil removal and disposal
TSF-09	TSF intermediate-level (radioactive) waste disposal system (Tanks V-1, V-2, and V-3) (TSF-09 site), contaminated tank (Tank V-9) southeast of Tank V-3 (TSF-18 site)	Cs-137	Tanks and contents removal, treatment, and disposal
TSF-18			Soil removal and disposal
TSF-19		Cs-137	Tank and contents removal and disposal
TSF-26	V-13 and V-14 tanks and contaminated soils	Cs-137	Tanks and contents removal, treatment, and disposal
			Soil removal and disposal
TSF-46	V-tank area new sites soils	Cs-137	Soil removal and disposal
TSF-47			
TSF-48			
TSF-53	TAN-633 soils	Cs-137	Soil removal and disposal
WRRTF-01	WRRTF Burn Pits II and IV	Asbestos	Native soil cover and permanent monuments
No Further Action Sites			
IET-04	IET Facility stack rubble site	Cs-137	Institutional controls
TSF-06 Area 1	Soil area northeast of turntable	Cs-137	Institutional controls
TSF-06-Area 5	Radioactive soil berm	Cs-137	Institutional controls
TSF-06 Area 10	Reactor vessel burial site	Cs-137	Institutional controls
TSF-06 Area 11	TSF-06 ditch	Cs-137	Institutional controls
TSF-10	TSF drainage pond	Cs-137	Institutional controls
TSF-28	TSF sewage treatment plant (TAN-623 and sludge drying beds)	Cs-137	Institutional controls
TSF-29	TSF acid pond	Cs-137	Institutional controls
TSF-39	TSF transite site (asbestos)	Cs-137	Institutional controls
TSF-42	TAN 607A Room 161 contaminated pipe	Cs-137	Institutional controls

Table 2-5. (continued).

Site (Site Code)		Site name	Basis for Action	Selected Remedy
TSF-43		RPSSA Buildings TAN-647 and TAN-648 and pads	Cs-137	Institutional controls
TAN-650		LOFT basement residual contamination	Cs-137	Institutional controls
IET	Initial Engine Test			
LOFT	Loss-of-Fluid Test (facility)			
RPSSA	Radioactive Parts Service and Storage Area			
TAN	Test Area North			
TSF	Technical Support Facility			
WRRTF	Water Reactor Research Test Facility			

2.3.3 Remedial Actions

OU 1-10 represents the final selected remedy for all of WAG 1 except for OU 1-07B (see Section 2.2); other individual OUs are no longer assessed separately. Subsections that follow describe the comprehensive selected remedy for OU 1-10, implementation of the remedy to date, and current O&M requirements.

2.3.3.1 Remedy Selection. The selected remedies for OU 1-10 sites, as modified by the 2003 Explanation of Significant Differences (DOE-ID 2003a), the 2004 ROD Amendment and Explanation of Significant Differences (DOE-ID 2004a), the 2005 Explanation of Significant Differences (DOE-ID 2005c), and the 2007 Explanation of Significant Differences (DOE-ID 2007d) are:

1. TAN/TSF-1 (soil area) (Site TSF-06 Area B), referred to as the Soil contamination area south of the turntable—excavation and onsite disposal.
2. Technical Support Facility burn pit (Site TSF-03)—containment with a native soil cover in the OU 1-10 ROD was changed to excavation and disposal (DOE-ID 2003a). Water Reactor Research Test Facility burn pit (Site WRRTF-01)—containment with a native soil cover in the OU 1-10 ROD. The remedy for Pit I at the WRRTF-01 burn pits changed from native soil cover to no action, and the COC for Pits II and IV changed from lead to asbestos (DOE-ID 2003a).
3. The remedy for the TSF-26 PM-2A tanks was changed from tank contents removal and treatment, if necessary, to:
 - V-13 tank and tank contents removal and disposal
 - V-14 tank and tank contents removal, treatment of tank contents, and disposal of tank and tank contents (DOE-ID 2005c).
4. TSF-09/18 V-tanks area.
5. Three new sites were presented in the 2005 OU 1-10 Explanation of Significant Differences (DOE-ID 2005c). These were TSF-46, TSF-47, and TSF-48, which were determined to require remedial actions due to the presence of Cs-137 above the remediation goal. The TAN-616 caustic tank (V-4, TSF-19 site) also was identified through that Explanation of Significant Differences as requiring remedial actions in coordination with TSF-46. Post-ROD sampling in accordance with the 2003 OU 1-10 Explanation of Significant Differences (DOE-ID 2003a) identified that the soil contamination around TSF-09/TSF-18 extended to the former location of the Initial Engine Test Facility valve box (TSF-21). That valve box (a no action site, according to the OU 1-10 ROD) was

removed in 1993. The soils surrounding this area were addressed as part of TSF-09/TSF-18 soil remediation. Therefore, TSF-21 is not discussed further in this document as a separate site. Figure 2-14 shows the locations of the new sites. In addition, the new site process determined that the soils under the TAN-633 building (also shown in Figure 2-14) would be remediated under OU 1-10.

The remedy for the TSF-09/TSF-18 V-Tanks was changed from contents removal and off-INL Site treatment to:

- Contents removal, with on-INL Site treatment (sparging and solidification)
- V-Tanks (i.e., V-1, V-2, V-3, and V-9) removal and disposal
- Soil excavation and disposal at the Idaho CERCLA Disposal Facility (ICDF) (DOE-ID 2004a).
- The remedy for Tank V-9 was subsequently modified to require treatment to site-specific treatment standards with disposal at ICDF (DOE-ID 2007d).

In addition, nine new sites were identified in the Technical Support Facility area. One of these sites (TSF-53 soils beneath TAN-633) was assigned to OU 1-10 for remediation. The other eight sites were assigned to OU 10-08 for evaluation. Seven of these eight sites became no action sites. The other site assigned to OU 10-08, TSF-59 (soil beneath TAN-603 northwest sump), became a no further action site with ICs due to Cs-137 contamination and is discussed in Section 10.

2.3.3.2 Operable Unit 1-10 Remedial Action Objectives and Cleanup Levels. RAOs from the OU 1-10 ROD for the soil pathway include:

- Reduce risk from external radiation exposure from Cs-137 to a total excess cancer risk of less than 1 in 10,000 for the hypothetical resident 100 years in the future and the current and future worker
- Prevent direct exposure to lead at concentrations over 400 mg/kg, the EPA residential screening level for lead.

The RAOs from the OU 1-10 ROD for the V-Tank and PM-2A tank contents include preventing release to the environment of V-Tank and PM-2A tank contents.

The final RAOs for the OU 1-10 remedial action sites were the result of slight modifications during the subsequent ROD Amendment and Explanation of Significant Differences. Table 2-6 summarizes the modified RAOs.

Remediation goals were developed to meet the RAOs. The objective of the remediation goals was to ensure a risk-based protectiveness of human health and the environment by providing unrestricted land use in 100 years. A complete list of OU 1-10 remedial action sites, their respective COCs, and remediation goals is presented in Table 2-7.

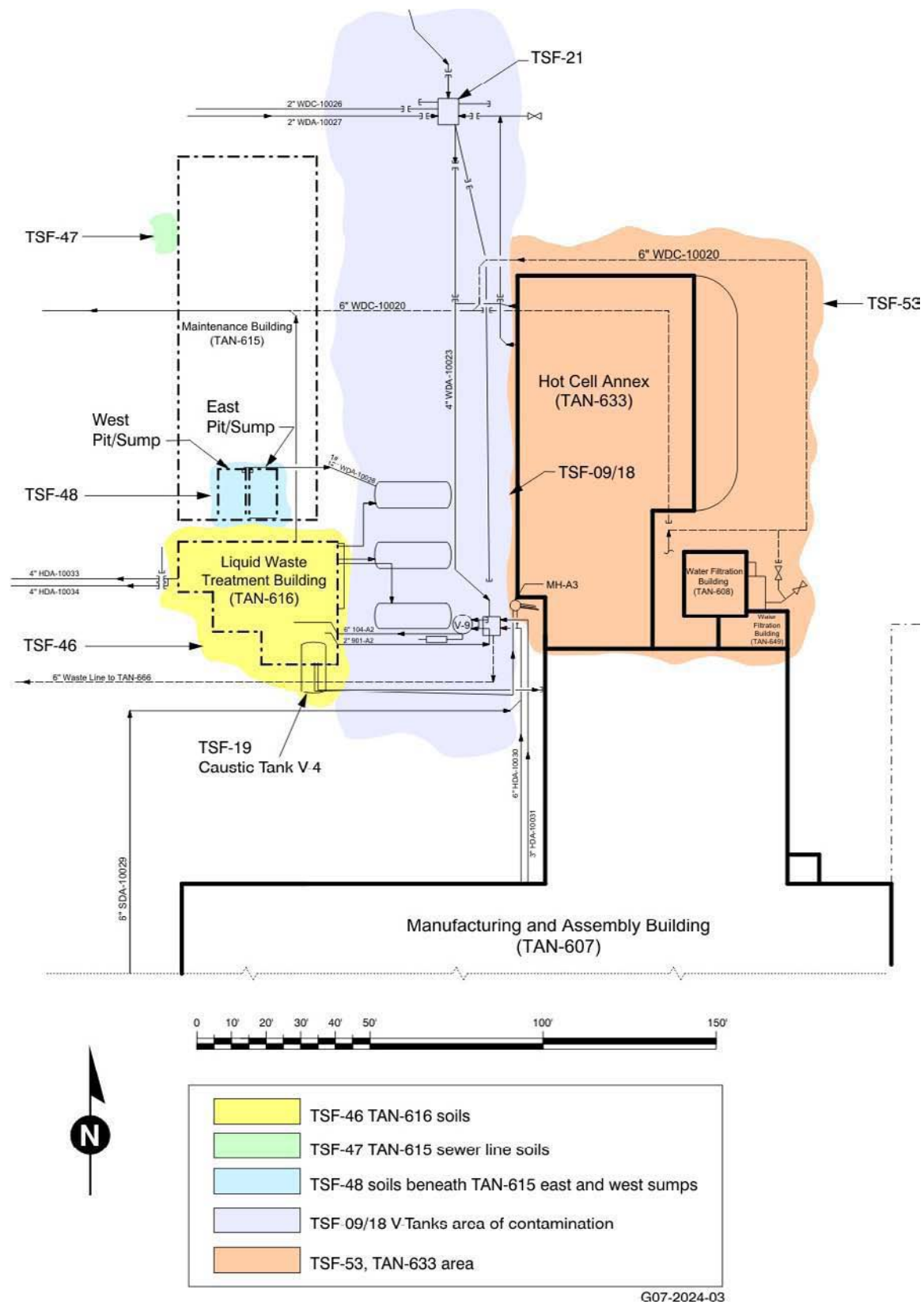


Figure 2-14. Location of new remedial action sites in the vicinity of TSF-09/18.

Table 2-6. Final remedial action objectives for Operable Unit 1-10 remediation sites.

Sites	Remedial Action Objectives
TSF-03	Prevent direct exposure to lead at concentrations over 400 mg/kg, the EPA residential screening level for lead
WRRTF-01	Prevent direct exposure to asbestos
V-Tanks sites including TSF-09/TSF-18, TSF-46, TSF-47, TSF-48, and TSF-53	Reduce risk from all pathways and all COCs to a total excess cancer risk of less than 1 in 10,000 and a total hazard index of less than 1 for the hypothetical resident 100 years in the future and for the current and future worker
V-Tank contents	Prevent release to the environment of the V-Tank contents
TSF-19 contents	Prevent release to the environment of the TSF-19 tank contents
TSF-06 (Area B) and TSF-26 soils	Reduce risk from external radiation exposure from Cs-137 to a total excess cancer risk of less than 1 in 10,000 for the hypothetical resident 100 years in the future and the current and future worker
PM-2A tank contents (V-13 and V-14)	Prevent release to the environment of the PM-2A tank contents
COC	contaminant of concern
EPA	Environmental Protection Agency

Table 2-7. Contaminants of concern and remediation goals at Operable Unit 1-10.

Site (Site Code)	Contaminant of Concern	Remediation Goal
Group 1 Sites		
Soil contamination area south of the turntable (TSF-06 site, Area B)	Cs-137	<23.3 pCi/g ^a
TSF-26 soils	Cs-137	<23.3 pCi/g ^a
Group 2 Sites		
TSF intermediate-level (radioactive) waste disposal system (Tanks V-1, V-2, and V-3) (TSF-09 site), contaminated tank (Tank V-9) southeast of Tank V-3 (TSF-18 site)	Cs-137	<23.3 pCi/g ^a
V-Tank area new sites (TSF-46, TSF-47, and TSF-48)	Cs-137	<23.3 pCi/g ^a
TAN-633 soils (TSF-53)	Cs-137	<23.3 pCi/g ^a
Caustic tank V-4 (TSF-19)	Cs-137	Disposal of tank and contents
Group 3 Sites		
PM-2A tanks (V-13 and V-14) (TSF-26 tanks)	Cs-137	Tanks and contents removal, treatment, and disposal
TSF burn pit (TSF-03)	Lead	<400 mg/kg
WRRTF Burn Pits II and IV (WRRTF-01)	Asbestos	Native soil cover

- a. The remediation goal for the residential scenario at the time of the implementation of the OU 1-10 remedy was 23.3 pCi/g Cs-137 (would decay to 2.3 pCi/g by 2095). Since that time, that remediation goal for the residential scenario has been changed to 6 pCi/g Cs-137 by 2095.

OU operable unit
TSF Technical Support Facility
WRRTF Water Reactor Research Test Facility

2.3.3.3 Remedy Implementation. This review covers the period from October 2004 through September 2009 and is the second 5-year review of OU 1-10. As noted under the remedial action discussion, work under the OU 1-10 ROD is now complete. The following is a list of the work completed during this 5-year period:

- TSF-03 site completed (October 2004)
- WRRTF-01 site completed (October 2004)
- TSF-06 Area B completed (October 2005)
- TSF-26 PM-2A tanks and contents removed, shipped to ICDF, treated as necessary, and disposed of at ICDF (September 2005)
- TSF-26 soils removed and shipped to ICDF and confirmation sampling completed (September 2004)
- V-Tanks area soils (i.e., TSF-09/TSF-18, TSF-46, TSF-47, TSF-48, and TSF-53) removed (contaminated soil), confirmation sampling completed, and site transferred to TAN-607 NTCRA (August 2007)
- V-Tanks and contents (TSF-09/TSF-18) removed, treated, and disposed of (contents) at ICDF along with tanks (September 2007)
- OU 1-10 Remedial Action Report issued (April 2008) (DOE-ID 2008b)
- TAN-607/607A Removal Action Report issued, creating V-Tanks/TAN-607 consolidated IC area (September 2008) (DOE-ID 2008c).

Confirmation sampling and analysis were completed for soil areas of sites TSF-06 Area B, TSF-03, -09, -18, -26, -46, -47, -48, and -53, and WRRTF-01 to verify that soil remediation goals were met. This information was summarized in the OU 1-10 Remedial Action Report (DOE-ID 2008b). Sampling results for PM-2A tanks contents and the V-Tanks contents, including post-treatment sampling, were also summarized in that report. That information is used in this report to estimate IC termination dates.

Remediation of sites under the OU 1-10 ROD was completed in 2007. In 2008, the Remedial Action Report for OU 1-10 (DOE-ID 2008b) was issued, documenting the work completed under the 1999 OU 1-10 ROD (DOE-ID 1999). This Remedial Action Report transferred responsibility for completing soil remediation of the contaminated soils in the TSF-09/TSF-18 area to the TAN-607 NTCRA established by the TAN-607 Action Memorandum (DOE-ID 2007f) (see Section 2.3.3.3.9). On completion of remediation at OU 1-10, ICs were still required for those sites that did qualify for unrestricted access and unlimited use. Results of the confirmation sampling indicate that ICs will still be required for the sites shown in Table 2-8. These sites are addressed along with the other IC sites in Section 10.5.

2.3.3.3.1 TSF-06 Area B Soil Contamination—The TSF-06 Area B soil area is south of the turntable and is an open area bounded by the Technical Support Facility fence on the west and by facility roads and several adjacent structures on the east and south. The area is roughly triangular and measures 206 m (675 ft) wide on the south and 130 m (425 ft) on the west. The contaminated area was radiologically surveyed by TAN personnel and covered with 0.3 to 0.6 m (1 to 2 ft) of soil in 1992 (INEL 1994). The additional soil was referred to as the TSF-06 overburden, and the underlying contaminated soil was referred to as the TSF-06 native soil. Since 1992, the TSF-06 overburden had become contaminated from windblown soil containing Cs-137 that was stockpiled at the PM-2A tanks site.

Table 2-8. Operable Unit 1-10 remedial action sites requiring institutional controls.

Site	Contaminant of Concern
TSF-06 Area B	Cs-137
TSF-09/TSF-18	Cs-137
TSF-26	Cs-137
TSF-46	Cs-137
TSF-47	Cs-137
TSF-48	Cs-137
TSF-53	Cs-137
WRRTF-01	Asbestos

The selected remedy for the soil contamination area south of the turntable was soil excavation and disposal (DOE-ID 1999). The remedy was consistent with previous removal actions at TAN and consolidated the low-level, radionuclide-contaminated soil and sediments in a centralized repository (i.e., ICDF). Excavation involved removal of soil contaminated with Cs-137 above 23.3 pCi/g to a maximum depth of 3 m (10 ft) and includes contaminated soil identified under Snake Avenue as part of the TSF-06 site, Area B remedial action. Confirmation sampling was required to demonstrate compliance with remediation goals and to establish the need for ICs.

Remediation sampling, excavation, removal, disposal, and inspection tasks performed from 2000 to October 2005 are reported in the OU 1-10 Remedial Action Report (DOE-ID 2008b).

ICs are required until this site is available for unrestricted land use. Under the OU 1-10 ROD, the TSF-06 Area B site would be expected to have ICs removed in 2054, based on the 2005 confirmation sampling that measured the Cs-137 concentration at 7.14 pCi/g. However, based on the new residential remediation goal of 6 pCi/g Cs-137 in 2095, the area can be released in 2013. The site will be evaluated during the next 5-year review.

2.3.3.3.2 TSF-26 PM-2A Tanks Soil—The PM-2A tanks site consists of two 189,271-L (50,000-gal) abandoned underground storage tanks (i.e., V-13 and V-14). The tanks were installed in the mid-1950s and were used to store concentrated low-level radioactive waste from the TAN-616 evaporator from 1955 to 1972 (DOE-ID 1998b). In 1972, a new evaporator system (the PM-2A system) was installed in the area to replace the existing TAN-616 evaporator system, which was failing. The tanks served as feed tanks for the new evaporator system in which liquid waste was evaporated, condensed, passed through an ion-exchange column, and discharged as clean water into the disposal pond (TSF-07 site). The system was shut down in 1975 because of operational difficulties and spills (DOE-ID 1998b). Contents of the PM-2A tanks (i.e., V-13 and V-14) consisted of radioactively contaminated sludge, with minimal liquid, because in 1981, the tanks were partially filled with diatomaceous earth to absorb free liquid. Soil surrounding the PM-2A tanks was contaminated from spills that occurred during periodic pumping operations to remove excess liquid from the tanks during operations. The PM-2A tank contents and surrounding soil were contaminated with radionuclides, heavy metals, organic compounds, and polychlorinated biphenyls. Based on sampling, the primary COC in the soil was Cs-137.

Sampling, excavation, removal, disposal, and inspection tasks required to remediate this site were identified, performed, and completed in accordance with and as described in the following documents:

- Post-ROD Field Sampling Plan for OU 1-10 (DOE-ID 2000e)
- Group 1 sites Remedial Design/Remedial Action Work Plan (DOE-ID 2003c)
- 2005 Explanation of Significant Differences for OU 1-10 (DOE-ID 2005c).

In January 2005, the PM-2A tanks (i.e., V-13 and V-14), with contents in place, were shipped to ICDF for disposal of Tank V-13 and treatment and disposal of Tank V-14. Tank V-13 was placed in the ICDF disposal cell, and grout was used to fill the void within the tank. Tank V-14 was staged at ICDF until treatment to meet land disposal restrictions was complete. At that time, Tank V-14 was placed in the ICDF disposal cell and grouted full to remove void space.

Based on photographic evidence, the Agencies determined that a prefinal inspection was unnecessary. The final inspection report was included with the OU 1-10 Remedial Action Report (DOE-ID 2008b). The application of ICs for the TSF-26 site after tank removal is addressed under Group 1 for the TSF-26 soils.

ICs are required until this site is available for unrestricted land use. Under the OU 1-10 ROD—based on the 2004 confirmation sampling that measured the Cs-137 concentration at 7.88 pCi/g—the TSF-26 site would be expected to have ICs removed in 2058. However, based on the new residential remediation goal of 6 pCi/g Cs-137, the area could be released in 2016. Because of the size and complexity of this site, the termination of ICs for this specific site will be addressed in a revision to the IC/O&M Plan. The site will be evaluated during the next 5-year review.

2.3.3.3.3 TSF-09/TSF-18 V-Tanks—The two V-Tank sites (i.e., TSF-09 and TSF-18) had similar attributes and were located in the same area. Because of the similarities between the two sites, they were evaluated together for the 1999 TAN ROD (DOE-ID 1999). Originally, the TSF-09 site included the three abandoned 37,854-L (10,000-gal) underground V-1, V-2, and V-3 storage tanks; the contents of the tanks; the surrounding contaminated soil; and ancillary piping. The TSF-18 site included the abandoned 1,514-L (400-gal) V-9 underground storage tank, a sand filter, tank contents, and surrounding soil. The tank contents were contaminated with radionuclides, heavy metals, organic compounds, and polychlorinated biphenyls. The surrounding soil also was contaminated with radionuclides, heavy metals, and organic compounds from spills that occurred when waste was transferred to and from the tanks. All four V-Tanks were installed in the early 1950s and were used for about 30 years in a system that collected and treated radioactive waste from TAN operations, beginning with the Aircraft Nuclear Propulsion Program in the 1950s and early 1960s. Waste was piped from the adjacent research facilities into Tank V-9, where some solids were removed by settling. The remaining waste was then routed into one or more of the larger tanks (e.g., V-1, V-2, and V-3). Waste was stored in the underground tanks and then treated in the evaporator system located in TAN-616. Tank contents formed an aqueous sludge, and nearly all the contaminants were associated with the solid phase of the sludge. These wastes were then typically transferred to the TSF-26 PM-2A tanks.

Early sampling, excavation, removal, disposal, and inspection tasks required to remediate the TSF-09 and TSF-18 tank sites were identified and performed in accordance with and as described in the following documents:

- Group 2 Sites Remedial Design/Remedial Action Work Plan (DOE-ID, 2002b)
- New Proposed Plan for the V-Tanks Contents (TSF-09 and TSF-18) (DOE-ID 2003e)

- Group 2 sites Remedial Design/Remedial Action Work Plan (DOE-ID 2003f)
- 2004 ROD Amendment and Explanation of Significant Differences (DOE-ID 2004a).

In January 2005, an additional treatment option was approved in the 2005 Explanation of Significant Differences for OU 1-10 (DOE-ID 2005c). The final remedy selected included soil excavation and disposal to meet remediation goals and removal and treatment of the tank contents. Tank contents were to be consolidated and treated at TAN to meet land disposal restriction treatment standards. The treated waste and the tanks were then to be disposed of at ICDF.

Consolidation and treatment tanks were installed adjacent to the V-Tanks excavation. The waste was successfully pumped from the V-Tanks to the consolidation tanks, with the exception of approximately 7.6 L (2 gal) of waste that remained in Tank V-9. The decision was made to treat this residual material separately from the rest of the waste. Air sparging of the waste was proceeding well until the granular activated carbon that was installed to capture the volatilized VOCs caught fire on August 30, 2005. A revised treatment approach was developed to eliminate the granular activated carbon and limit the volatilized VOCs to an acceptable level. The new treatment approach was completed for the consolidated V-Tank waste in March 2006. The treated waste was transferred back to the original V-Tanks, solidifying the liquid waste in the process. This waste was shipped to ICDF for disposal in July 2006.

However, residual waste in Tank V-9 proved problematic for treatment when evidence of elemental mercury was found in the waste. The 2007 Explanation of Significant Differences for OU 1-10 (DOE-ID 2007d) approved an alternative treatment approach, including a site-specific treatment variance with disposal of the waste at ICDF. This approach continued the sparging of VOCs but added a step to stabilize the mercury.

Proximity of the TSF-09 and TSF-18 tank sites to the TAN-607 facility precluded completely finishing removal of contaminated soils. Because the TAN-607 building was scheduled for demolition, a plan was developed to use the V-Tanks area excavation for disposition of building demolition debris that met the remediation goal of 23 pCi/g Cs-137. This approach was presented in the TAN-607 Engineering Evaluation/Cost Analysis (DOE-ID 2007e) and agreed to by the Agencies in the TAN-607 Action Memorandum (DOE-ID 2007f). The OU 1-10 Remedial Action Report (DOE-ID 2008b) confirmed that the TAN-607 NTCRA would complete the steps necessary to backfill and stabilize the site and establish ICs, as necessary. That work is described in Section 2.3.3.3.9.

At the conclusion of the NTCRA for TAN-607, the 95% upper confidence limit on the mean concentration of Cs-137 was 5.05 pCi/g in the 0- to 3-m (0- to 10-ft) soil column and 20.42 pCi/g in the deeper soil, based on 2007 measurements. ICs were established to protect the future resident until such time as the site could be released for unrestricted land use. The final inspection report is included in the OU 1-10 Remedial Action Report (DOE-ID 2008b). Using a remediation goal for Cs-137 of 6 pCi/g, ICs would no longer be required for the soils from 0–10 ft but would be required until 2061 for the deeper soils. Because of the size and complexity of this site, the termination of ICs for this specific site will be addressed in a revision to the IC/O&M Plan.

The waste in the V-9 tanks was successfully treated and disposed of in ICDF in September 2009.

2.3.3.3.4 TSF-03 Burn Pit—The Technical Support Facility burn pit area was used for open burning of nonradioactively contaminated construction debris. The pit was used from 1953 to 1958 and is located in the northeastern corner of the Technical Support Facility, outside the facility fence. The burn pit was believed to be contaminated with lead. While lead does not present a risk that can be

Initial sampling, analysis, cover-emplacement, and inspection tasks required to remediate the TSF-03 burn pit site were identified and performed in accordance with and as described in the following documents:

- Final OU 1-10 ROD (DOE-ID 1999)
- Sample Data Compilation and Risk Assessment Report for OU 1-10 (DOE-ID 2003d)
- Explanation of Significant Differences for OU 1-10 (DOE-ID 2003a).

Results of soil samples and a risk comparison concluded that the primary contaminants had been removed and that the site could be released for unrestricted use. A prefinal inspection was conducted with the Agencies on June 25, 2004. Contaminated soil and debris excavated from the burn pit were disposed of at ICDF. The excavation was backfilled and compacted with clean stockpiled soil and soil from the TAN gravel pit. The backfilled excavation was contoured, and 15 cm (6 in.) of topsoil was placed over the surface. Revegetation of the TSF-03 burn pit was completed in late fall 2004.

2.3.3.3.5 WRRTF-01 Burn Pits—The four Water Reactor Research Test Facility burn pits were used for open burning of nonradioactively contaminated construction debris from 1958 to 1975. They are located approximately 823 m (2,700 ft) north of the Water Reactor Research Test Facility, outside the facility fence. The Water Reactor Research Test Facility burn pits were initially thought to be contaminated with lead. However, a 2003 Explanation of Significant Differences (DOE-ID 2003a) reflects the change in the COCs from lead to asbestos while maintaining the remedy of a native soil cover to pits II and IV.

Early sampling, excavation, removal, disposal, and inspection tasks required to remediate the WRRTF-01 site were identified and performed in accordance with and as described in the following documents:

- Final OU 1-10 ROD (DOE-ID 1999)
- Sample Data Compilation and Risk Assessment Report for OU 1-10 (DOE-ID 2003d)
- 2003 Explanation of Significant Differences for OU 1-10 (DOE-ID 2003a)
- OU 1-10 Remedial Action Report (DOE-ID 2008b).

The OU 1-10 Remedial Action Report (DOE-ID 2008b) was issued in April 2008, documenting remediation that took place at WRRTF-01 and the need for long-term ICs. The INL Site-wide IC/O&M Plan (DOE-ID 2010b) was modified to include appropriate ICs for Water Reactor Research Test Facility Burn Pits II and IV (WRRTF-01). ICs are necessary for this site to prevent intrusion and direct contact with asbestos. No time limit was established for these controls.

2.3.3.3.6 TSF-46, TSF-47, and TSF-48 V-Tank Area New Sites—The 2005 Explanation of Significant Differences (DOE-ID 2005c) added three new sites that were identified in the vicinity of the V-Tanks (the TSF-09 and TSF-18 sites). These new sites are TSF-46, TSF-47, and TSF-48 as identified in Figure 2-14. The TSF-46 site included the soil around the perimeter of Building TAN-616 that was originally identified as a new site in 1998. A Track 1 evaluation completed in September 2000 specifically addressed the contamination in the exterior environment of Building TAN-616 (DOE-ID 2001c). This included the soil beneath Building TAN-616 and the soil on the north, south, and west sides of the building. The TSF-47 site (TAN-615 sewer line soil) was associated with a damaged

15-cm (6-in.) sanitary sewer line discovered during decommissioning and excavation of the north end of Building TAN-615. Work crews identified soil overlying the damaged sanitary sewer line that was radiologically contaminated. The TSF-48 site (soil beneath TAN-615 east and west pits/sumps) was in the south half of the former Building TAN-615. The east pit/sump was located in the fuel assemblies test area. The west pit/sump was located in the decontamination area.

Based on historical data, Sites TSF-46, TSF-47, and TSF-48 and the two V-Tank sites (TSF-09 and TSF-18) had similar COCs in the soil (DOE-ID 2004b) and were located in the same area just north of the TAN-607 facility. As a result, the same remedy and remediation goal as identified for the V-Tanks soil were implemented for these new sites, in accordance with the 2005 OU 1-10 Explanation of Significant Differences (DOE-ID 2005c).

As designated in the OU 1-10 ROD (DOE-ID 1999), contaminated soils were excavated and disposed of at ICDF to meet the remediation goal of 23 pCi/g for Cs-137. When excavation was complete in each area, that area was sampled to confirm compliance with remediation goals and to determine the need for continued ICs. Because each site was remediated in the same manner as the V-Tanks soils and was immediately adjacent to that site, the end state for the entire group of sites—including the V-Tanks soils, TSF-53, and these three V-Tanks new sites—is addressed as one area under the V-Tanks remediation section (Section 2.3.3.3.3).

2.3.3.3.7 TSF-19 TAN-616 Caustic Tank—The TSF-19 site is a caustic tank that was used as the feed tank to provide caustic solution to neutralize waste in the V-Tanks. The unit ceased operation in the late 1970s. Initial investigation in the 1990s indicated that the tank was empty, and the OU 1-10 ROD (DOE-ID 1999) identified TSF-19 as a no action site. However, further investigation—as part of the removal of Building TAN-616—revealed that the TSF-19 caustic tank was not empty and that some radioactive contamination was present. Thus, the status of the tank was changed to removal of tank and tank contents in accordance with the 2005 Explanation of Significant Differences for OU 1-10 (DOE-ID 2005c). The surrounding soils were to be managed as part of TSF-46.

Tank V-4 and its contents were removed and sent off the INL Site for treatment and disposal. An email from EPA (Brown 2006) was received documenting the offsite facility's verification of continued acceptability with respect to EPA's Off-Site Rule. The location of TSF-19 was within the TSF-46 site and the general V-Tanks area excavation, and as such, the residual soil is addressed as part of that site.

2.3.3.3.8 TSF-53 TAN-633 Soils—Soils beneath the TAN-633 building was found to be contaminated when the building was removed. These soils were identified as TSF-53 and submitted to the Agencies as a new site. The Agencies determined that the site should be addressed along with the other soil contamination as part of the V-Tanks soil remediation.

Contaminated soil beneath TAN-633 was excavated and disposed of at ICDF to meet the remediation goal of 23 pCi/g for Cs-137. When excavation was complete, the area was sampled to confirm compliance with remediation goals and determine the need for continued ICs. Because the site was remediated in the same manner as the V-Tanks soils and was immediately adjacent to that site, the end state for the entire group of sites—including the V-Tanks soils, TSF-53, and this site—is addressed as one area under the V-Tanks remediation section.

2.3.3.3.9 Removal Actions—Upon completion of NTCRA's at TAN, the following sites required the application or continuation of ICs: TAN-607/607A, TAN-603 (TSF-59 transferred to OU 10-08 upon completion of the NTCRA), TAN-623 (TSF-28), and TAN-650 as listed in Section 10.5.

2.3.3.3.9.1 Minor Facilities Decommissioned Under the General Decommissioning Action Memorandum—At WAG 1, 30 minor facilities or structures were decommissioned as NTCRAs under the General Decommissioning Action Memorandum from October 1, 2004, through September 30, 2009 (see Table 2-9). The completion of these NTCRAs is documented in RPT-720. These structures were totally removed, and the area was graded to match surrounding contours. Based on specific requirements, waste from these facilities was shipped to an appropriate treatment or disposal facility. Some equipment at these facilities (e.g., office trailers) was reclaimed for use at other locations. Figure 2-15 shows photographs of the facilities identified in Table 2-9. Figure 2-16 is a photograph of the overall area at TAN after those facilities were decommissioned.

Table 2-9. Waste Area Group 1 completed non-time-critical removal actions.

Facility ID	Facility Name	Completion Date ^a
TAN-1729	Cask storage pad	5/23/2006
TAN-1731	TAN-607A substation	10/19/2006
TAN-1734	Emergency generator fuel tank	3/28/2007
TAN-1735	Emergency generator fuel tank	6/21/2007
TAN-1757	V-Tank consolidation yurt	8/28/2006
TAN-603	Service building/steam plant	6/14/2007
TAN-611	Fuel pump house	3/20/2007
TAN-623	Sewage pump house	2/21/2008
TAN-655	Liquid waste lift station	2/1/2008
TAN-668	Heavy equipment cleaning	8/30/2007
TAN-686	Office trailer	10/12/2006
TAN-704	Boiler fuel tank	3/15/2007
TAN-711	Sewage treatment plant	12/17/2007
TAN-717	Helicopter pad	8/15/2007
TAN-722	1,500-kVA substation	10/18/2007
TAN-727	Covered stairs, east of TAN-607	10/12/2006
TAN-733	Water storage tank	4/19/2007
TAN-734	Exhaust stack (TAN-607)	8/23/2007
TAN-774	Concrete slab	9/21/2006
TAN-778	Water blowdown tank (TSF)	5/17/2007
TAN-790	Abnormal waste storage pad	9/7/2006
TAN-791	Spent fuel storage pad	8/28/2006
TAN-795	TAN substation	10/19/2006
TAN-TR-22	TAN-603 change house	1/9/2007
TAN-TR-23	TAN landfill trailer	12/17/2007
TAN-TR-25	LOFT ICP Support Facility I (west)	9/20/2007
TAN-TR-26	LOFT ICP Support Facility II (east)	2/20/2007
TAN-TR-27	TSF ICP Support Facility I (west)	12/17/2007
TAN-TR-28	TSF ICP Support Facility II (east)	12/17/2007
TAN-TR-29	LOFT D&D Craft Trailer #2	5/29/2008
a. DOE-ID (2009) and RPT-720.		
D&D	decontamination and decommissioning	ID identifier
ICP	Idaho Cleanup Project	LOFT Loss-of-Fluid Test (facility)
		TSF Technical Support Facility



TAN-791, Spent Fuel Storage Pad



TAN-790, Abnormal Waste Storage Pad



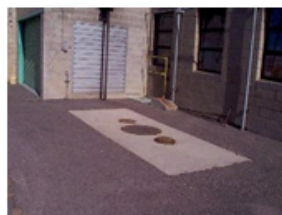
TAN-704, Boiler Fuel Tank

TAN-TR-27 and TAN-TR-28,
TSF ICP Support Facility I and II

TAN-686, Office Trailer



TAN-1734 and TAN-1735, Emergency Generator Fuel Tanks



TAN-733, Water Storage Tank

TAN-1757, V-Tank
Consolidation YurtTAN-TR-25, LOFT ICP Support
Facility I

TAN-603, Steam Plant



TAN-611, Fuel Pump House

TAN General Decommissioning NTCRAs



TAN-727, Covered Stairs

TAN-TR-26, LOFT ICP Support
Facility IITAN-711, Sewage Treatment Plant;
TAN-623, Sewage Pump HouseTAN-655, Liquid Waste
Lift StationTAN-668, Heavy Equipment
Cleaning

TAN-TR-29, Tool Crib Trailer

Figure 2-15. Example photographs of minor facilities decommissioned as non-time-critical removal actions at Test Area North.



Figure 2-16. Photograph of Test Area North Technical Support Facility before (upper left) and after deactivation and decommissioning activities.

Upon completion of the NTCRAs, no contamination remained at these locations that would preclude unrestricted use, with the exception of TAN-603 (TSF-59) and possibly TAN-623 and TAN-711 (TSF-28). Radioactively contaminated soil was discovered beneath the sump in the northwestern corner of the TAN-603 building footprint. The average Cs-137 concentration in that area was approximately 6.7 pCi/g, which precluded releasing the site for unrestricted access. The site was identified as TSF-59, and the information was submitted to the Agencies. The Agencies determined that the site should be managed as a no further action site under WAG 10. TSF-59 will be discussed further in the section on WAG 10.

The TAN-623 and TAN-711 (together identified as TSF-28) NTCRAs removed the sewage treatment plant and the sludge drying beds. This area had previously been identified as TSF-28 for possible releases of radionuclides and paint thinner. The sewage treatment plant was still operating at that time; therefore, the OU 1-10 ROD determined that the site would be managed as an IC site until such time as a further risk assessment was completed, demonstrating that the remaining risk was less than 1E-4. The NTCRA removed the operational facility as well as soil immediately below the facility. Excavations stopped when the field radioactive detection equipment no longer found radioactive contamination (i.e., less than 100 counts above background). This information is insufficient to document that the risk is less than 1E-4. Therefore, the site remains under ICs with no way to estimate when ICs can be terminated.

The TAN-647 and TAN-648 buildings (located within TSF-43) were decontaminated and decommissioned in advance of the General Decommissioning Action Memo in October 2006 (i.e., not CERCLA NTCRAs). Removal of these buildings included the Interim Status RCRA closure of container storage for hazardous waste within TAN-647 under the TAN-647 closure plan (DOE-ID 2003h). DEQ approved certification of that closure on January 9, 2004. Now that the buildings have been removed, the TSF-43 site is accessible for further characterization to assess risk. ICs will be maintained in the interim.

2.3.3.3.9.2 Major Facilities Decommissioned Under Facility-Specific

Action Memoranda—At WAG 1, four facilities were decommissioned as NTCRAs under facility-specific action memoranda from October 1, 2004, through September 30, 2009 (Table 2-10). Most of these structures were removed, the area was backfilled, and the area was graded to match surrounding contours. These facilities are discussed further in the following subsections.

2.3.3.3.9.2.1 TAN-607A and TAN-607

TAN-607A and TAN-607—TAN-607A was decommissioned as a NTCRA in accordance with the Action Memorandum for Decommissioning TAN-607A (DOE-ID 2006c). TAN-607 was decommissioned as a NTCRA in accordance with the Action Memorandum for Decommissioning TAN-607 Hot Shop Area (DOE-ID 2007f). Figure 2-17 shows photographs of the NTCRA. As documented in the Remedial Action Report for OU 1-10 (DOE-ID 2008b), the excavation area created by the TSF-09/TSF-18 remediation was left open to be used for disposition of contaminated debris from the demolition of TAN-607 that met the OU 1-10 remediation goal of 23 pCi/g Cs-137.

As part of the TAN-607A NTCRA, Sites TSF-42, TSF-52, and TSF-54 were addressed. Although TSF-52 and TSF-54 had been assigned to OU 10-08 by the New Site Identification process, the Agencies decided to address these sites as part of the NTCRA during building removal to improve efficiency. Following removal of TSF-42 (a contaminated pipe) and disposal at ICDF, the project confirmed there was no release to the environment. As a result, TSF-42 qualifies for unrestricted land use. TSF-52 (an area of contaminated soils adjacent to the southwest corner of TAN-607A) soils were removed for disposal at ICDF. The maximum Cs-137 concentration in the residual soils was 1.45 pCi/g. TSF-54 (soil contamination beneath the TAN-607A decontamination shop sump) soils were removed for disposal at ICDF. The maximum Cs-137 concentration in the residual soils was 4.54 pCi/g. TSF-52 and TSF-54 were evaluated in the OU 10-08 ROD and determined to be no action sites.

Table 2-10. Waste Area Group 1 non-time-critical removal actions completed under facility-specific action memoranda.

Facility ID	Facility Name	Completion Date	Action Memoranda	Removal Action Report
TAN-607	TAN Hot Shop	5/29/2008	<i>Action Memorandum for Decommissioning of TAN-607 Hot Shop Area (DOE-ID 2007f)</i>	<i>Final Removal Action Report for Test Area North 607A and 607 (DOE-ID 2008c)</i>
TAN-607A	TAN manufacturing and assembly	5/29/2008	<i>Action Memorandum for Decommissioning of TAN-607A (DOE-ID 2006c)</i>	<i>Final Removal Action Report for Test Area North 607A and 607 (DOE-ID 2008c)</i>
TAN-630	LOFT control and equipment building	6/21/2006	<i>Action Memorandum for Decommissioning of TAN-630 and TAN-650 at the Loss-of-Fluid Test (LOFT) Area (DOE-ID 2006b)</i>	<i>Final Removal Action Report for the LOFT Facility (DOE-ID 2008a)</i>
TAN-650	LOFT containment structure	9/28/2006	<i>Action Memorandum for Decommissioning of TAN-630 and TAN-650 at the Loss-of-Fluid Test (LOFT) Area (DOE-ID 2006b)</i>	<i>Final Removal Action Report for the LOFT Facility (DOE-ID 2008a)</i>
ID	identifier			
LOFT	Loss-of-Fluid Test (facility)			
TAN	Test Area North			

Before and as part of the decommissioning process, hazardous materials were removed from the facilities before demolition. The NTCRA included decontamination or clean closure under RCRA (42 USC § 6901 et seq.) standards for the accessible piping. On completion of building demolition, the excavated area was subject to area scans to determine the concentration of Cs-137 to establish appropriate ICs. Once the scans were complete, the area was backfilled and graded to match surrounding contours. The area was reseeded with native vegetation.

Mixed waste was shipped to a permitted facility (e.g., Energy Solutions in Utah), and radioactive waste was shipped to ICDF. Nonradioactive friable asbestos waste was shipped to the CFA landfill. Other industrial-demolition-type waste was sent to the TAN Demolition Waste Landfill at INTEC.

The Final Removal Action Report for TAN-607 and TAN-607A (DOE-ID 2008c) documented the NTCRA in removing TAN-607 and -607A. This report documented that residual soil contamination remaining after remediation of the V-Tanks area (i.e., TSF-09/TSF-18, TSF-46, TSF-47, TSF-48, and TSF-53) and the adjacent TAN-607/607A demolition area met OU 1-10 remediation goals. For purposes of applying ICs, these sites were combined into one larger area. The 95% upper confidence limit on the mean concentration of Cs-137 was 5.05 pCi/g in the 0- to 3-m (0- to 10-ft) soil column and 20.42 pCi/g in the deeper soil. Because these levels precluded release for unrestricted use, ICs were established to protect the future resident until such time as the site could be released for unrestricted access; this would be in approximately 2102, based on the remediation goals in place at the time of the remediation. Based on the residential remediation goal of 6 pCi/g Cs-137, ICs for the deep soils could end in 2061 and would not be required for the shallow soils. Because of the size and complexity of this site, the termination of ICs for this specific site will be addressed in a revision to the IC/O&M Plan.



TAN-607A at start of demolition



TAN-607 Hot Shop and pool



TAN-607A walls being removed



TAN-607 Hot Shop ready for explosives



TAN-607A structure coming down



TAN-607/607A after demo

Figure 2-17. Photographs of TAN-607/607A non-time-critical removal actions.

2.3.3.3.9.2.2 TAN-630 and TAN-650—TAN-630 and TAN-650 (Loss-of-Fluid Test facility) were decommissioned in accordance with the Action Memorandum for Decommissioning of TAN-630 and TAN-650 (DOE-ID 2006b). Hazardous materials were removed from the facilities before and as part of the decommissioning process. This included decontamination or clean closure under RCRA standards for the accessible piping. The building structure was removed to 0.9 m (3 ft) bgs and the area was backfilled, after which the area was graded to match surrounding contours. Figure 2-18 shows photos of the NTCRA.

Mixed waste was shipped to a permitted facility (e.g., Energy Solutions). Radioactive waste was shipped to ICDF. Nonradioactive friable asbestos waste was shipped to the CFA landfill. Other types of waste were sent to the TAN Demolition Waste Landfill.



Figure 2-18. Photographs of TAN-630/650 non-time-critical removal actions.

The Final Removal Action Report for the Loss-of-Fluid Test facility (DOE-ID 2008a) documents the completion of the NTCRA, stating that the RAO will be met by 2095. The Final ROD for TAN OU 1-10 (DOE-ID 1999) established the RAO for radionuclides for WAG 1 to reduce risk from external radiation exposure from Cs-137 to a total excess cancer risk of less than 1 in 10,000 for a hypothetical resident 100 years in the future from the year 1995. The Loss-of-Fluid Test Engineering Evaluation/Cost Analysis (DOE-ID 2006a) identified approximately 0.155 Ci of radionuclides that would be left within the facility upon completion of demolition, based on the radionuclide inventory estimated to be present in 2005. Most of this contamination was expected to be present in piping systems between 4.6 and 9.1 m (15 and 30 ft) bgs. Approximately 87% of these radionuclides were Cs-137, 9% were Co-60, and 3.76% were Sr-90. All other radionuclides totaled approximately 0.24%. The streamlined risk assessment included in the Loss-of-Fluid Test Engineering Evaluation/Cost Analysis (DOE-ID 2006a) estimated that this would result in approximately 1.07 pCi/g of Cs-137 in 2095. This would produce a risk in the future residential scenario of approximately $3\text{E-}6$ in 2095, which would allow for unrestricted use. Using these

same values, the Cs-137 concentration in 2005 at the time of the risk assessment would have been 8.3 pCi/g Cs-137. Cs-137 remaining would decay to the level (i.e., 2.3 pCi/g Cs-137) established in the OU 1-10 ROD as being equivalent to the 1E-4 level in 56 years. Under the OU 1-10 ROD, ICs could be removed from this site in 2061. Based on the change to the residential remediation goal to 6 pCi/g Cs-137, ICs can end in 2019. These controls are implemented in the INL Site-wide IC/O&M Plan (DOE-ID 2010b).

2.3.3.4 Operations and Maintenance. Annual inspections and maintenance are performed in accordance with the current INL Site-wide IC/O&M Plan (DOE-ID 2010). These inspections and associated maintenance, as needed, are reported in the annual reports listed below:

- INL Sitewide ICs Annual Report—FY 2005 (DOE-ID 2005g)
- Weed Control and Revegetation Status Report for FY 2005 and Schedule for FYs 2006 and 2007 (ICP 2006)
- INL Sitewide ICs Annual Report—FY 2006 (DOE-ID 2006e)
- Weed Control and Revegetation Status Report for FY 2006 (RPT-305)
- INL Sitewide ICs Annual Report—FY 2007 (DOE-ID 2007g)
- INL Sitewide IC/O&M Annual Report—FY 2008 (RPT-544)
- INL Sitewide IC/O&M Annual Report—FY 2009 (RPT-672).

O&M activities at WAG 1 consist of annual inspections at TSF-03, TSF-06 Area B, TSF-26, WRRTF-01, and the TAN-607 area sites (includes TSF-09, TSF-18, TSF-46, TSF-47, TSF-48, and TSF-53, as well as the footprint of TAN-607/607A) as identified in Table 2-11. Issues identified during the 2005–2009 inspections included a couple of missing signs, which were replaced, and small areas of subsidence and erosion on the TAN-607 area sites. This erosion/subsidence issue first appeared in the last inspection performed during period covered by this 5-year review. The damaged area was repaired and reseeded. No other issues were found that would affect the implementation or performance of operations, maintenance, and institutional controls at WAG 1 sites.

Table 2-11. Operable Unit 1-10 operations and maintenance sites.

Site	Inspection Requirement
TSF-03	Annual inspection for vegetative growth
TSF-06 Area B	Annual visual inspection for growth of noxious weeds
TSF-26	Annual visual inspection for growth of noxious weeds
TAN-607 area (includes sites TSF-09/TSF-18, -46, -47, -48, -53 and the footprint of TAN-607/607A)	Conduct annual inspections for noxious weeds, soil erosion, and site drainage
WRRTF-01	Annual inspection of native soil cover for animal intrusion, subsidence, erosion, and native vegetation growth; annual inspection of asbestos monuments

2.3.4 Progress Since Last Review

The previous protectiveness statement, from the last 5-year review, was:

The OU 1-10 sites whose remedial actions are completed (i.e., Groups 1 and 3) are protective of human health and the environment. The final remedial action reports documenting that final remedial goals have been met are pending for sites whose remedies are completed; however, ICs are in place as necessary. Remediation of OU 1-10 Group 2 sites is in progress and expected to be protective of human health and the environment. Remediation and construction are being done in accordance with the requirements of the decision documents and design specifications included in the respective RD/RA work plans. In the interim, exposure pathways that could result in unacceptable risks are being controlled.

The previous 5-year review identified one issue for WAG 1. Table 2-12 lists the issue, the recommendation, and the current status.

Table 2-12. Actions taken since the last 5-year review for Waste Area Group 1.

Issues from Previous Review ^a	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Establish and maintain the vegetative cover on WAG 1 OU 1-10 WRRTF Burn Pits II and IV.	Revegetation and weed control measures are implemented in accordance with established O&M requirements. Affected areas will be reseeded with appropriate seed mix for the sites.	DOE	November 2009	The area was reseeded in October 2004 (DOE-ID 2008b). Subsequent inspections show revegetation is successful and sufficient (DOE-ID 2006f, 2007g). This task is completed.	October 2004

a. Issues were identified either in Appendix C of the previous 5-year review (DOE-ID 2007a) or in the addendum to Appendix C enclosed with EPA's letter of concurrence with the previous 5-year review (Opalski 2006).

O&M operations and maintenance
OU operable unit
WAG waste area group
WRRTF Water Reactor Research Test Facility

2.3.5 Data Review and Evaluations

Data were sufficient to estimate IC termination dates for OU 1-10 remedial action sites (see Appendix A and Table 10-5) except for TSF-28 and TSF-43. More information is needed to estimate dates for these two sites.

2.3.6 Technical Assessment

The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. Contamination above the remediation goals was removed in accordance with requirements. The areas have been backfilled and graded to match surrounding contours. Sites have been revegetated according to specifications. The OU 1-10 Remedial Action Report has been issued, documenting these activities. ICs are in place and functioning as intended. However, existing data are not sufficient to evaluate risk, as necessary, to estimate IC termination dates for two sites TSF-28 and TSF-43.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Yes.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

Technical Assessment Summary

The technical assessment for WAG 1 documents that the remedy selected for the remedial action sites is functioning as intended and is protective of human health and the environment. Existing data are not sufficient for estimating IC termination dates for two sites: TSF-28 and TSF-43.

2.3.7 Issues

A minor issue was identified for two IC sites: TSF-28 and TSF-43. Existing data are not sufficient for evaluating risk, as necessary, to estimate IC termination dates. ICs are protective at these two sites, but must be maintained indefinitely in the absence of information.

2.3.8 Recommendations and Follow-Up Actions

Recommendations and follow-up actions are:

- Sample TSF-28 to obtain data for evaluating risk, as necessary, to estimate an end date for ICs.
- Sample TSF-43 to obtain data for evaluating risk, as necessary, to estimate an end date for ICs.

2.3.9 Protectiveness Statement for Operable Unit 1-10

The remedy at OU 1-10 is protective of human health and the environment. Responses are complete in accordance with the OU 1-10 ROD and action memoranda. Those sites that do not qualify for unrestricted land use are managed appropriately under the INL Site-wide IC/O&M Plan (DOE-ID 2010).

2.4 Summary

Over the years, some of the projects at TAN released contamination to the environment. To facilitate cleanup of the contamination, TAN was designated as WAG 1 under the FFA/CO. To better manage the cleanup, WAG 1 was divided into smaller OUs. Two OUs remain subject to 5-year review—OU 1-07B (which consists of TAN groundwater contamination) and OU 1-10 (which consists of the remainder of TAN).

Remedial actions are ongoing for OU 1-07B in accordance with decision documents and work plans. The remedy for OU 1-07B consists of three components: in situ bioremediation for the hot spot, pump-and-treat for the medial zone, and monitored natural attenuation for the distal zone. Monitoring data show the three components are functioning as intended by the 2001 ROD Amendment (DOE-ID 2001a) and decision documents. However, in spite of adjusting injection strategies to affect a larger source area, TCE concentrations have remained elevated at TAN-28 since starting in situ bioremediation.

Responses for the remainder of WAG 1, OU 1-10, are complete, with the only ongoing response consisting of IC/O&M under the INL Site-wide IC/O&M Plan.

Table 2-13 provides the issues for WAG 1, and Table 2-14 provides recommendations and follow-up actions.

The remedy at WAG 1 is currently protective of human health and the environment. Follow-up action documented in this review to address WAG 1 issues will ensure the remedy remains protective for the long term. In the meantime, groundwater remediation will continue, and ICs are in place to control exposure pathways that could result in unacceptable risks.

Because WAG 1 includes ongoing remediation under OU 1-07B and several OU 1-10 sites remain under ICs, 5-year statutory reviews will be required indefinitely. The next 5-year review is expected to cover the period from 2010 through 2014.

Table 2-13. Issues for Waste Area Group 1.

Issues	Affects Current Protectiveness (Yes/No)	Affects Future Protectiveness (Yes/No)
TCE concentrations have not decreased as expected at aquifer monitoring well TAN-28 downgradient of the hot spot.	No	Yes
Cs-137 concentrations have been increasing at the hot spot, and Sr-90 concentrations remain high in the hot spot and several locations in the medial zone.	No	Yes
The monitoring strategy may not be adequate for evaluating plume expansion.	No	Yes
Available information is not sufficient to estimate an end date for ICs at Site TSF-28.	No	Yes
Available information is not sufficient to estimate an end date for ICs at Site TSF-43.	No	Yes
IC institutional control TCE trichloroethene		

Table 2-14. Recommendations and follow-up actions for Waste Area Group 1.

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Yes/No)	
					Current	Future
TCE concentrations have not decreased as expected at aquifer monitoring well TAN-28 downgradient of the hot spot.	Prepare a test plan to address the TCE concentration issue at Well TAN-28 via a rebound test and vadose zone vapor monitoring.	DOE	EPA and DEQ	Submit a draft test plan in FY 2011	No	Yes
Cs-137 concentrations have been increasing at the hot spot, and Sr-90 concentrations remain high in the hot spot and several locations in the medial zone.	Prepare a test plan to address radionuclide concentrations in the hot spot via a rebound test.	DOE	EPA and DEQ	Submit a draft test plan in FY 2011	No	Yes
The monitoring strategy may not be adequate for evaluating plume expansion.	Prepare a test plan to increase monitoring frequency to yearly rather than once every 3 years at Wells TAN-57 and GIN-4. If TCE concentrations at either well or TAN-56 exceed 10 µg/L, install a downgradient monitoring well.	DOE	EPA and DEQ	Submit a draft test plan in FY 2011	No	Yes
Available information is not sufficient to estimate an end date for ICs at Site TSF-28.	Sample TSF-28 to obtain data for estimating an end date for ICs.	DOE	EPA and DEQ	Before the next 5-year review	No	Yes
Available information is not sufficient to estimate an end date for ICs at Site TSF-43.	Sample TSF-43 to obtain data for estimating an end date for ICs.	DOE	EPA and DEQ	Before the next 5-year review	No	Yes
FY	fiscal year					
IC	institutional control					
TCE	trichloroethene					

2.5 References

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3. WASTE AREA GROUP 2—ADVANCED TEST REACTOR COMPLEX

3.1 Introduction

The Advanced Test Reactor (ATR) Complex, formerly known as the Reactor Technology Complex, and the Test Reactor Area before that, was established in the early 1950s to study the effects of radiation on materials, fuels, and equipment. To aid in this research, a number of facilities were constructed, including three major test reactors: the Materials Test Reactor (1952 to 1970), the Engineering Test Reactor (1957 to 1982), and the Advanced Test Reactor (1967 to present).

Some of the operations at these and other ATR Complex facilities released radioactive and nonradioactive contaminants. Consequently, the ATR Complex was designated as WAG 2 under the FFA/CO (DOE-ID 1991a). The FFA/CO further divided WAG 2 into 13 OUs that contain a total of 55 release sites. In 1997, all of these sites were rolled into OU 2-13 (DOE-ID 1997a).

3.2 Site Chronology

Table 3-1 summarizes the chronology of significant documents and events relevant to CERCLA response actions at the ATR Complex.

Table 3-1. Chronology of significant documents and events at the Advanced Test Reactor Complex.

Date	Document or Event
December 1991	<i>Declaration for the Warm Waste Pond at the Test Reactor Area at the Idaho National Engineering Laboratory—Declaration of the Record of Decision</i> (DOE-ID 1991b)
1992	Completed OU 2-10 removal of windblown contamination at the warm waste pond
December 1992	<i>Record of Decision, Test Reactor Area Perched Water System, Operable Unit 2-12</i> (DOE-ID 1992)
March 1993	<i>Explanation of Significant Differences for the Warm Waste Pond Sediments Record of Decision at the Test Reactor Area at the Idaho National Engineering Laboratory</i> (Jensen and Montgomery 1993)
June 1993	<i>Post Record of Decision Monitoring Plan for the Test Reactor Area Perched Water System Operable Unit 2-12</i> (INEL 1993)
December 1993	Completed OU 2-10 warm waste pond interim action
1996	Completed OU 2-04 NTCRA at TRA-34
August 1996	Completed 3-year statutory review of the deep perched water system
February 1997	<i>Comprehensive Remedial Investigation/Feasibility Study for the Test Reactor Area Operable Unit 2-13 at the Idaho National Engineering and Environmental Laboratory</i> (DOE-ID 1997a)
December 1997	<i>Final Record of Decision, Test Reactor Area, Operable Unit 2-13</i> (DOE-ID 1997b)
July 1998	<i>Groundwater Monitoring Plan for the Test Reactor Area Operable Unit 2-13</i> (DOE-ID 1998a)
September 1998	<i>Comprehensive Remedial Design/Remedial Action Work Plan for the Test Reactor Area, Operable Unit 2-13</i> (DOE-ID 1998b)
September 1998	Completed 5-year statutory review of the warm waste pond interim action
March 8, 1999	Began OU 2-13 remedial action
December 1999	Completed comprehensive OU 2-13 remedial action

Table 3-1. (continued).

Date	Document or Event
March 2000	<i>Operations and Maintenance Plan for the Final Selected Remedies and Institutional Controls at Test Reactor Area, Operable Unit 2-13 (DOE-ID 2000a)</i>
May 2000	<i>Explanation of Significant Differences to the Record of Decision for Test Reactor Area Operable Unit 2-13 (DOE-ID 2000b)</i>
September 2003	<i>First Five-Year Review Report for the Test Reactor Area, Operable Unit 2-13, at the Idaho National Engineering and Environmental Laboratory (DOE-ID 2003)</i>
September 2004	<i>Groundwater Monitoring Plan for the Test Reactor Area Operable Unit 2-13 (Rev. 5 DOE-ID 2004a)</i>
May 2005	<i>Response to the First Five-Year Review Report for the Test Reactor Area, Operable Unit 2-13, at the Idaho National Engineering and Environmental Laboratory (DOE-ID 2005a)</i>
October 2005	<i>Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory (DOE-ID 2007a)^a</i>
October 2006	<i>Action Memorandum for General Decommissioning Activities under the Idaho Cleanup Project (DOE-ID 2006a)</i>
January 2007	<i>Action Memorandum for Decommissioning the Engineering Test Reactor Complex under the Idaho Cleanup Project was signed by the Agencies (DOE-ID 2007b)</i>
August 2007	<i>Action Memorandum for the Materials Test Reactor Facility End State and Vessel Disposal (DOE-ID 2007c)</i>
a. Revision 0 of the 5-year review was completed in October 2005. Subsequent revisions did not affect analysis of WAG 2. CERCLA Comprehensive Environmental, Response, Compensation, and Liability Act NTCRA non-time-critical removal action OU operable unit	

3.3 Background

The ATR Complex was established in the early 1950s to study the effects of radiation on materials, fuels, and equipment. To aid in this research, a number of facilities were constructed, including the Materials Test Reactor (1952 to 1970), the Engineering Test Reactor (1957 to 1982), and ATR (1967 to present), and miscellaneous support facilities.

3.3.1 Physical Characteristics

The ATR Complex is located in the south-central portion of the INL Site (Figure 1-1). The land surface is relatively flat, with elevations ranging from 4,908 ft (1,503 m) to 4,946 ft (1,507 m) (DOE-ID 1997a). ATR Complex includes numerous buildings and structures within a double security fence that encompasses about 70 acres.

The facility is located on an alluvial plain consisting of surficial sediment with thickness ranging from 9 to 23 m (30 to 75 ft). A series of basalt flows interbedded with sedimentary deposits of eolian and fluvial origin underlie the surficial sediments. Shallow and deep perched-water bodies have formed in the vadose zone beneath the ATR Complex in response to infiltration of wastewater disposed of in unlined ponds. The SRPA underlies the entire area and consists of thick sequences of basalt flows separated by thinner sedimentary interbeds. The depth to groundwater beneath the facility is approximately 137 m (450 ft).

The Big Lost River is the major surface water feature in the vicinity, and the river channel passes within approximately 1,609 m (1 mile) of the southwest corner of the facility (Figure 1-1). The Big Lost River is an intermittent stream that flows northeastward through the INL Site to its terminus at the Big

Lost River sinks, where the remainder of the water infiltrates into the ground. Peak river flows are typically in summer due to snowmelt, and there is often no flow in the river at other times of year.

3.3.2 Land and Resource Use

The land underlying the WAG 2 area is entirely contained within the INL Site. Land use at the site is discussed in Section 1.3.2. Current land use at the ATR Complex is limited to industrial use associated with the nuclear energy research mission. The Agencies have agreed that residential land use is not a reasonable or anticipated future use for the interior portion of the complex.

In addition to limitations on future development imposed by anticipated physical characteristics, ICs will continue to be implemented at the ATR Complex for as long as land use or access restrictions are necessary to protect human health and the environment. The use of ICs has been established in the OU 2-13 ROD to prevent exposure to contaminated groundwater and soil until the risks reach acceptable levels (DOE-ID 1997b).

3.3.3 History of Contamination

Release sites at ATR facilities have included wastewater holding ponds, percolation ponds, underground storage tanks, rubble piles, cooling towers, an injection well, french drains, and assorted spill sites (DOE-ID 1997a). The FFA/CO included a total of 51 potential release sites grouped within 13 OUs requiring remedial action (DOE-ID 1991a).

WAG 2 includes three main sources of contamination: (1) contamination injected directly into the SRPA at the Test Reactor Area disposal well and Well USGS-53 (Figure 3-1), (2) contamination in perched water derived from several wastewater ponds, and (3) contaminated surface and near-surface soils and pond sediments (DOE-ID 1997a). The principal contaminants at the ATR Complex are chromium, tritium, Sr-90, Co-60, and fuel hydrocarbons. Historical information regarding the primary contaminant sources is summarized below.

Two different wells were used for disposal of wastewater at the Test Reactor Area. From 1964 until 1972, the Test Reactor Area disposal well (Figure 3-1) was used to dispose of the secondary reactor cooling water. The disposal well injected chromium and radionuclides directly into the SRPA. As such, the disposal well did not contribute contaminants to the perched water system (DOE-ID 1992). After 1972, hexavalent chromium was no longer used as a corrosion inhibitor in the reactor cooling systems and was no longer discharged to the disposal well or to the ponds. Use of the Test Reactor Area disposal well ceased in 1982. The total amount of chromium discharged to the disposal well was estimated at approximately 14,121 kg (31,131 lb). In addition to the Test Reactor Area disposal well, a second well, USGS-53, was used intermittently for wastewater disposal during 1960 to 1964. This well (Figure 3-1) was completed at a shallower depth and discharged wastewater to the perched water system.

In addition to wastewater disposal through the two injection wells, four shallow infiltration ponds were also employed historically at the ATR Complex, including the warm waste pond, the cold waste pond, the chemical waste pond, and the sanitary waste (sewage) pond (Figure 3-1). Infiltration of water from the ponds resulted in the accumulation of contaminated perched water beneath the ATR Complex as well as contamination of the underlying SRPA (DOE-ID 1992, 2007d). Additional information follows regarding the history of contamination from the infiltration ponds.

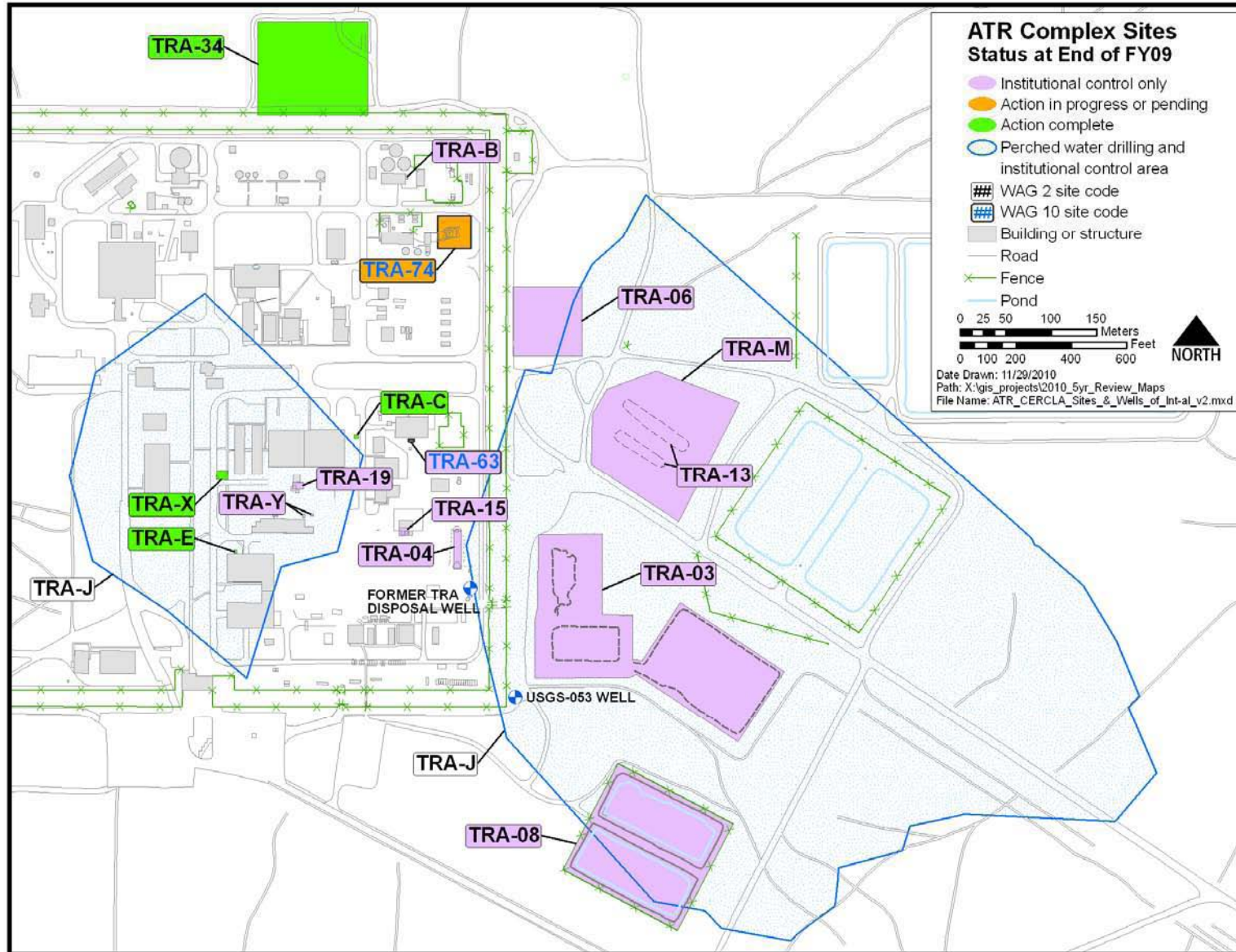


Figure 3-1. Waste Area Group 2 release sites that required remediation.

3.3.3.1 Warm Waste Pond (TRA-03). The warm waste pond encompassed an area of approximately 3.74 acres and was located east of the Test Reactor Area facility along the security fence (Figure 3-1). Prior to 1962, all wastewater generated at the Test Reactor Area (except sanitary sewage) was discharged directly to the warm waste pond (DOE-ID 1992). From 1952 to 1962, radionuclides, water softener and ion exchange column regeneration fluids, reactor cooling water containing hexavalent chromium, and other miscellaneous wastes were all disposed of to the warm waste pond. Beginning in 1962, the ion exchange regeneration fluids were diverted to the chemical waste pond for disposal. Water used in the secondary reactor cooling system that contained hexavalent chromium was disposed of to the warm waste pond from 1952 until November 1964. According to the Comprehensive Remedial Investigation/Feasibility Study (DOE-ID 1997a), the warm waste pond received approximately 8,070 kg (17,791 lb) of chromium and 8,920 Ci of tritium. The warm waste pond included three cells: (1) Cell 1952, (2) Cell 1957, and (3) Cell 1964 (named for the year in which each was constructed). All three cells received low-level radionuclides and RCRA-listed hazardous, contaminated wastewater discharged from Test Reactor Area reactor operations until 1993, when a lined evaporation pond replaced the warm waste pond.

3.3.3.2 Chemical Waste Pond (TRA-06). The chemical waste pond was located east of the north part of ATR Complex (Figure 3-1) and was excavated and put into service in 1962. It was an unlined surface impoundment 4.6 m (15 ft) deep and 51.8 m (170 ft) square and was surrounded by a 0.6–0.9-m (2–3-ft) -high berm. The chemical waste pond was designed as an infiltration pond to receive effluent containing mineral salts from the Test Reactor Area demineralization plant. In addition, until 1982, solid and liquid wastes were disposed of directly into the pond, including corrosives and other wastes. Accurate records were not kept and details of the disposals to this waste pond are not known.

3.3.3.3 Sewage Leach Pond (TRA-13). The sewage leach pond was located east of the Test Reactor Area boundary fence (Figure 3-1) and consisted of two cells: (1) Cell 1950 and (2) Cell 1965. Both cells received discharge from sanitary sewer drains. Process knowledge indicates that effluent was limited to domestic sewage. However, low-level radionuclides were detected in the bottom of Cell 1950 and in a sludge pit located south of the sewage treatment plant. The contamination source has been attributed to windblown soil contamination originating from the warm waste pond. The sewage leach pond was removed from service in 1995.

3.3.3.4 Sewage Leach Pond Berm and Soil Contamination Area (TRA-M). The sewage leach pond berm and soil-contamination area is a fence-enclosed radiation control area surrounding the former sewage leach pond (Figure 3-1). Radiological contamination on the south side of the southern berm is attributed to warm waste pond sediments. However, radiological contamination on the north side of the southern berm may have resulted from windblown sewage leach pond sediments and/or the warm waste pond windblown sediments.

3.3.4 Initial Response

Beginning in 1964, the Test Reactor Area disposal well (Figure 3-1) was used to dispose of the secondary reactor cooling water containing chromium and radionuclides, primarily tritium. The wastewater was discharged directly into the SRPA via the 1,275-ft-deep disposal well. The use of corrosion inhibitors containing hexavalent chromium was discontinued in October 1972 (Barraclough, Lewis, and Jensen 1981), and the disposal well was permanently taken out of service in 1982 when it was replaced by the Cold Waste Pond (TRA-08) (DOE-ID 1992). USGS installed several monitoring wells during the 1960s to track the groundwater contaminant plume emanating from the Test Reactor Area disposal well and nearby wastewater percolation ponds (Robertson, Schoen and Barraclough 1974).

In 1993, the warm waste pond was taken out of service and replaced by a lined evaporation pond. To immediately reduce risk, an interim remedial action was conducted during 1993 (DOE-ID 2000c). In the 1993 warm waste pond interim action, sediments that exceeded 690 pCi/g for Cs-137 were removed from Cell 1964 and placed into Cell 1952, along with material generated during the 1992 warm waste pond removal action of the windblown soil-contamination area. In addition, Cs-137 hot spots were excavated from the sewage leach pond berm, and the excavated soil was also placed in Cell 1952. Cell 1964 was backfilled with approximately 3 m (10 ft) of clean soil. Cell 1952 was covered with a 0.3-m (1.0-ft) layer of clean fill and seeded. Cell 1957 was covered with a 0.15-m (0.5-ft) layer of clean fill. In 1995 and 1996, contaminated soil from OU 10-06 removal actions was placed in the Cell 1957 and again, 0.15 m (0.5 ft) of clean fill was placed over the contaminated soil (DOE-ID 2000c).

3.3.5 Basis for Taking Action

In 1997, the Comprehensive Remedial Investigation/Feasibility Study was completed to ascertain the extent of, and risks from, contamination at the 55 OU 2-13 release sites and the SRPA (DOE-ID 1997a). The Remedial Investigation/Feasibility Study concluded that contaminant concentrations at eight of the sites presented unacceptable risks to human health or the environment. The eight sites included four disposal ponds (Warm Waste Pond [TRA-03], Chemical Waste Pond [TRA-06], Cold Waste Pond [TRA-08], and the Sewage Leach Pond [TRA-13]), three subsurface contaminant release sites (Soil Surrounding Hot Waste Tanks at Building 613 [TRA-15], Tanks 1 and 2 at Building 630 [TRA-19], and the Brass Cap Area [TRA-Y]), and one area of surficial windblown contamination (Sewage Leach Pond Berms and Soil Contamination Area). The response actions required to reduce the potential threats to human health and the environment to acceptable levels were specified in the OU 2-13 ROD (DOE-ID 1997b), as discussed further below.

3.4 Operable Unit 2-13 Remedial Action

The OU 2-13 ROD is based on the Comprehensive Remedial Investigation/Feasibility Study for WAG 2, and represents the final selected remedy for the entire ATR Complex. The ROD incorporated all WAG 2 OUs; therefore, this 5-year review evaluates protectiveness for all of WAG 2 as a whole; individual OUs are no longer assessed separately. Subsections that follow describe the comprehensive selected remedy for OU 2-13, implementation of the remedy, and current IC and O&M requirements. Those sites where ICs are the only ongoing response are addressed in Section 10.5.

3.4.1 Remedy Selection

Of the 55 sites evaluated under the OU 2-13 Comprehensive Remedial Investigation/Feasibility Study, the ROD (DOE-ID 1997b) specified remedial actions for eight sites where contamination presented an unacceptable risk to human health and/or the environment (Table 3-2; Figure 3-1). Of these, four sites required removal or containment, and four were designated as limited action sites requiring ICs only (two included contingent excavation and disposal options).

In addition to the items listed in Table 3-2, the ROD reinforced monitoring requirements initially established under the OU 2-12 ROD and required a new monitoring plan to integrate the combined monitoring needs of OU 2-12 and 2-13. Monitoring verifies that contaminant concentration trends follow those predicted by the groundwater model. Computer modeling shows that, through natural radioactive decay, natural attenuation, and dispersion, contaminants in the groundwater will steadily decrease to acceptable levels within the next 20 years.

Table 3-2. Operable Unit 2-13 sites requiring remedial action.

Site Code	Site Name	Operable Unit 2-13 Selected Remedy ^a
TRA-03	Warm waste pond	Containment with ICs
TRA-06	Chemical waste pond	Containment with ICs
TRA-08	Cold waste pond	Soil excavation and disposal
TRA-13	Sewage leach ponds	Containment with ICs
TRA-M	Sewage leach pond berm and soil-contamination area	Limited action
TRA-15	Soil surrounding hot waste tanks at TRA-613	Limited action
TRA-19	Soil surrounding Tanks 1 and 2 at TRA-630	Limited action ^b
TRA-Y	Brass cap area (underground pipeline leak)	Limited action ^b
a. Remedy details in ROD for OU 2-13 (DOE-ID 1997b) and ESD to the ROD for OU 2-13 (DOE-ID 2000b). b. Limited action remedy includes contingent excavation and disposal option. ESD explanation of significant differences IC institutional control OU operable unit ROD Record of Decision		

3.4.1.1 Remedial Action Objectives. RAOs for the eight sites requiring remedial action were as follows (DOE-ID 1997b):

- Inhibit direct exposure to radionuclide COCs in soil that would result in a total excess cancer risk of greater than 1 in 10,000 to 1,000,000 (1E-04 to 1E-06) to current and future workers and future residents
- Inhibit ingestion of chemical and radionuclide COCs in soil by all affected exposure routes (including ingestion of soil, groundwater, and homegrown produce) that would result in a total excess cancer risk of greater than 1 in 10,000 to 1,000,000 (1E-04 to 1E-06) or a hazard index greater than 1 to current and future workers and future residents
- Inhibit the degradation of any low-level waste repository covers (e.g., warm waste pond cell covers) that would result in exposure to either the buried waste or the migration of contaminants to the surface and pose a total excess cancer risk (for all contaminants) of greater than 1 in 10,000 to 1,000,000 (1E-04 to 1E-06) or a hazard index greater than 1 to current and future workers and future residents.

The RAOs for protection of the environment are as follows:

- Inhibit adverse effects to resident populations of flora and fauna, as determined by the ecological risk evaluation from soil, surface water, or air containing COCs
- Inhibit adverse effects at sites where COCs remain in place, which could result in exposure to COCs or migration of COCs to the surface.

3.4.1.2 Cleanup Levels. To meet the RAOs, quantitative cleanup levels (Table 3-3) were established based on the results of the Baseline Risk Assessment and an evaluation of expected exposures and risks for selected alternatives (DOE-ID 1997b).

Table 3-3. Operable Unit 2-13 cleanup goals.

Site (Site Code)	Contaminants of Concern	Cleanup Goals ^{a,b}
Warm waste pond (TRA-03)	Ag-108m Cs-137 Eu-152	0.39 pCi/g 7.78 pCi/g 99.9 pCi/g
Chemical waste pond (TRA-06)	Barium Manganese Mercury Zinc	926 mg/kg 146 mg/kg 0.47 mg/kg 43.3 mg/kg
Cold waste pond (TRA-08)	Arsenic Cs-137	18.3 mg/kg 23.3 pCi/g
Sewage leach ponds (TRA-13)	Mercury Zinc Ag-108m Cs-137	0.94 mg/kg 86.6 mg/kg 0.58 pCi/g 11.7 pCi/g
Sewage leach pond berm and soil-contamination area (TRA-M) ^c	Cs-137	23.3 pCi/g
Soil surrounding hot waste tanks at the TRA-613 building (TRA-15) ^d	Cs-137	23.3 pCi/g
Soil surrounding Tanks 1 and 2 at the TRA-630 building (TRA-19) ^d	Cs-137	23.3 pCi/g
Brass cap area (TRA-Y) ^d	Cs-137	23.3 pCi/g

a. Remediation goals are soil concentrations of COCs that would result in a cumulative excess cancer risk of 1 in 10,000 or a hazard index greater than 1 for the 100-year residential exposure scenario. These might vary during the actual cleanup, in recognition of natural background levels, as established in *Background Dose Equivalent Rates and Surficial Soil Metal and Radionuclide Concentrations for the Idaho National Engineering Laboratory* (Rood, Harris, and White 1996), and in recognition that cleanup within the acceptable risk range could be achieved with a different mix of the COCs than was assumed in establishing these remediation goal values.

b. These remediation goals were not relevant to the sites where containment was the selected remedy. The remedial action objectives will be met by installing a cover to the exposure pathway.

c. The sewage leach pond berm and soil-contamination area were remediated concurrently with the sewage leach ponds.

d. Limited-action site.

COC contaminant of concern

TRA Test Reactor Area

Source: Table 7-1 in the Final ROD for OU 2-13 (DOE-ID 1997b)

Containment with capping was the selected remedy for the warm waste pond (TRA-03), the chemical waste pond (TRA-06), and the sewage leach pond (TRA-13). Because contaminants were to remain in place at these three sites, numerical cleanup levels are not applicable. Rather, the OU 2-13 ROD (DOE-ID 1997b) specified the following containment system performance standards:

- Installation of covers that are designed to remain in existence for the length of time an unacceptable risk is posed to discourage any individual from inadvertently intruding into the buried waste or from contacting the waste

- Application of maintenance and surface monitoring programs for the containment systems capable of providing early warning of releases of radionuclides and nonradionuclide COCs from the disposal sites before they leave the OU 2-13 boundary
- Institution of restrictions limiting land use for at least 100 years
- Implementation of surface water controls to direct surface water away from the disposed waste
- Elimination, to the extent practicable, of ongoing active maintenance of the disposal sites following closure so that only surveillance, monitoring, or minor custodial care are required
- Placement of adequate cover to inhibit erosion by natural processes for the specified design lives of the covers
- Incorporation of features to inhibit biotic intrusion into warm waste pond Cells 1952 and 1957.

3.4.2 Remedy Implementation

Remedial actions were completed during FY 1999 at the sites listed in Table 3-2. Only the four disposal pond sites that required active remediation (removal or containment) will be discussed further in this chapter. The IC sites are addressed in Section 10.5.

The Remedial Action Report OU 2-13 (DOE-ID 2000c) contains the details of the work performed. Briefly, contaminated sediments were removed from the cold waste pond (TRA-08) and placed in the warm waste pond for disposal. Earthen covers were then emplaced over the three remaining containment sites: the warm waste pond (TRA-03, all three cells), the chemical waste pond (TRA-06), and the sewage leach pond (TRA-13). Follow-on ICs are required for these three sites. In addition, the remediated cold waste pond (TRA-08) requires ICs to preserve the underlying Remedial Investigation/Feasibility Study assumption of industrial land use only for 100 years, because contamination remains that precludes unlimited land use for 100 years. The following sections provide additional information regarding the remedial actions performed at these sites.

3.4.2.1 Warm Waste Pond (TRA-03). In 1995, radiologically contaminated soil from the OU 10-06 removal action was placed in Cell 1957, including contaminated soil from the north storage area, Boiling Water Reactor Experiment (BORAX), TAN, and Argonne National Laboratory-West (now the Materials and Fuels Complex [MFC]).

Final remediation was conducted at the warm waste pond in 1999 under OU 2-13. Engineered soil covers were placed over the covers that were constructed during the previous interim actions. Cell 1964 was covered with native soil, and Cell 1952 was covered with pea gravel, cobble, and a second layer of pea gravel. After radiologically contaminated soil from the north cold waste pond was placed in Cell 1957, it was covered with soil, pea gravel, cobble, and another layer of pea gravel. All three cells were then covered by a 0.6-m (2-ft) -thick riprap layer to inhibit human intrusion. And ICs were established to restrict access and land use. The presence of metals may preclude terminating ICs in the future.

3.4.2.2 Chemical Waste Pond (TRA-06). Remedial activities were completed at the chemical waste pond in 1999. A three-layer, native soil cover was constructed over the former waste pond, including (1) a gravel and coarse-sand layer; (2) a compacted, low-permeability layer; and (3) a topsoil layer. The topsoil layer was reseeded with native vegetation to control erosion. ICs were established, restricting residential land use where a mercury hazard remains. Industrial land use is unrestricted.

3.4.2.3 Sewage Leach Ponds (TRA-13). Remediation of the sewage leach ponds occurred in 1999. Approximately 1,094 m³ (1,431 yd³) of soil contaminated with Cs-137 concentrations exceeding 23.3 pCi/g was excavated from the sewage leach pond berms and placed in the bottom of the sewage leach pond. A three-layer native soil cover with a minimum thickness of 3 m (10 ft) was then constructed over the ponds. The cover consisted of (1) a gravel and coarse-sand layer; (2) a compacted, low-permeability layer; and (3) a topsoil layer. Six inches of clean soil was placed over the soil-contamination area that surrounds the sewage leach pond. The topsoil layer and the soil-contamination area were reseeded with native vegetation to control erosion. ICs were established, restricting the site to occupational access for more than 30 years and to industrial land use until residential risk is less than 10⁻⁴.

3.4.2.4 Cold Waste Pond (TRA-08). The presence of Cs-137 in the cold waste pond was believed to be from windblown soil contamination originating from the warm waste pond (DOE-ID 2000c). As a result of the elimination of arsenic as a COC at this site, the remediation goal for Cs-137 was increased from 11.7 to 23.3 pCi/g (DOE-ID 1997b, 2000c). Remedial actions were completed during 1999 at the cold waste pond. Approximately 61 m³ (80 yd³) of Cs-137-contaminated soil was removed from the northern ponds and placed in Cell 1957 of the warm waste pond for disposal. ICs were established, thereby restricting the site to all but industrial land use until residential risk is less than 10⁻⁴. The ATR Complex Cold Waste Pond continues to receive nonradioactive nonhazardous waste water from the facilities at the ATR Complex in accordance with Industrial Wastewater Reuse Permit No. LA-000161-01, Minor Modification "B" (Eager 2008; Johnston 2008).

3.4.2.5 Removal Actions. Although the general decommissioning of buildings and structures is not specifically addressed in previous RODs at the INL Site, NTCRAs are consistent with the RAOs of previous RODs and support the overall cleanup objectives established through the FFA/CO (DOE-ID 1991a).

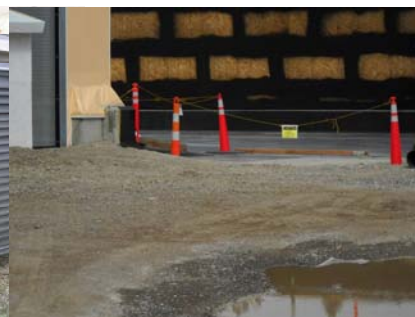
3.4.2.5.1 Minor WAG 2 Facilities Decommissioned Under the General Decommissioning Action Memorandum—At WAG 2, 11 facilities or structures were decommissioned as NTCRAs under the General Decommissioning Action Memorandum from October 24, 2006, until September 30, 2009 (Table 3-4, Figure 3-2). These structures were removed

Table 3-4. Waste Area Group 2 NTCRAs completed under the General Decommissioning Action Memorandum.

Facility ID	Facility Name	Completion Date
TRA-613	Metal weather enclosure	8/19/2008
TRA-626	Maintenance storage building	2/26/2009
TRA-635	Reactor services building	4/17/2009
TRA-654	ETR Critical Facility	3/20/2008
TRA-657	MTR contaminated storage and enclosure	7/19/2007
TRA-661	Reactor wing south extension	6/18/2009
TRA-665	Neutron chopper 20-m house	4/10/2008
TRA-668	Reactor wing north extension	1/22/2009
TRA-709	MTR air intake	9/9/2008
TRA-761	Tank truck loading facility	6/11/2008
TRA-784	Liquid nitrogen tank	3/21/2007
ETR ID MTR	Engineering Test Reactor identifier Materials Test Reactor	



TRA-668, Reactor Wing North Extension, before and after NTCRA



TRA-709, MTR Air Intake, before and after NTCRA



TRA-613, Hot Waste Storage Pump House, before and after NTCRA



TRA-635, Reactor Services Building, before and after NTCRA



TRA-626, Maintenance Storage Building, before and after NTCRA



TRA-661, Reactor Wing South Extension, before and after NTCRA

Figure 3-2. Minor Waste Area Group 2 facilities decommissioned under the General Decommissioning Action Memorandum.

and the area graded to match surrounding contours. Based on specific requirements, the waste from these facilities was shipped to an appropriate treatment or disposal facility. Mixed waste was shipped to a permitted facility (e.g., the Energy Solutions disposal facility in Utah). Radioactive waste was shipped to ICDF. Nonradioactive friable asbestos was shipped to the CFA landfill. Other wastes were sent to the Idaho Nuclear Technology and Engineering Center (INTEC) CERCLA Demolition Waste Landfill. Other than TRA-661, no contamination remains at the former location of these facilities that would preclude release of these locations for unrestricted use. At TRA-661, some residual contaminated surfaces remained in the piping tunnel below TRA-661. In addition, some soil contamination was encountered below the floor slab of the alpha cave. This contamination is planned for further evaluation during overall characterization of the catch tank courtyard soil contamination following decommissioning of the TRA-632 hot cells and Hazardous Waste Management Act/RCRA closure of the ATR Complex catch tanks system. This evaluation will be performed in accordance with the provisions of the OU 10-08 ROD for Miscellaneous Sites and is anticipated to be submitted to the CERCLA Agencies in FY 2012.

3.4.2.5.2 Minor WAG 2 Facilities Being Decommissioned Under the General Decommissioning Action Memorandum—At WAG 2, five facilities or structures had decommissioning underway on September 30, 2009, under the General Decommissioning Action Memorandum (Table 3-5, Figure 3-3). These structures are being removed, and the area will be graded to match surrounding contours. Based on specific requirements, the waste from these facilities will be shipped to an appropriate treatment or disposal facility. For the TRA-713B, C, and D tanks, Voluntary Consent Order activities will be completed outside the scope of the NTCRA. Mixed waste will typically be shipped to a permitted facility (e.g., Energy Solutions disposal facility). Radioactive waste will typically be shipped to the ICDF. Nonradioactive friable asbestos waste will typically be shipped to the CFA landfill. Other wastes will be sent to the INTEC CERCLA Demolition Waste Landfill. Decommissioning of these facilities is expected to be complete before the next 5-year review. No contamination is expected to be left upon completion of these NTCRAs that would preclude release for unrestricted use.

3.4.2.5.3 Major WAG 2 Facilities Decommissioned Under Facility-Specific Action Memoranda—At WAG 2, seven facilities were decommissioned as NTCRAs under the Engineering Test Reactor facility-specific action memorandum (DOE-ID 2007b) from October 1, 2004, until September 30, 2009 (Table 3-6, Figure 3-4). The final removal action report is pending.

The selected alternative included removal and disposal of the Engineering Test Reactor vessel at ICDF and demolishing the aboveground portions of the Engineering Test Reactor Complex buildings to ground surface. The buildings in the action memorandum included the TRA-642, Engineering Test Reactor Building; TRA-643, Engineering Test Reactor Compressor Building; TRA-644, Engineering Test Reactor Heat Exchanger Building; TRA-648, Engineering Test Reactor Electrical Building; TRA-706, Delay Tanks and Vault; and TRA-704, -705, and -755 Filter Pits and the General Electric Experimental Loop Tunnel. Risks from residual contamination following the decommissioning were evaluated in the Engineering Evaluation/Cost Analysis for Decommissioning the Engineering Test Reactor Complex (DOE-ID 2006b).

Hazardous waste (e.g., lead, circuit boards, and mercury switches) was sent to offsite hazardous waste disposal facilities. The resultant uncontaminated demolition material was used as backfill. Radiologically contaminated debris and asbestos was disposed of at ICDF, and uncontaminated debris and asbestos were disposed of at the INTEC CERCLA Demolition Waste Landfill. Materials left in place included inert, nonputrescible material located below the ground surface, (e.g., piping, equipment, electrical conduit, utility systems, structural steel, and other residual clean or contaminated materials) that

Table 3-5. Waste Area Group 2 facilities being decommissioned under the General Decommissioning Action Memorandum.

Facility ID	Facility Name
TRA-604	MTR building Wing A (laboratories)
TRA-610	MTR fan house
TRA-713B	Hot waste storage tank
TRA-713C	Hot waste storage tank
TRA-713D	Hot waste storage tank
ID	identifier
MTR	Materials Test Reactor



TRA-604, MTR Building Wing A (laboratories), before and during NTCRA



TRA-610, MTR Fan House, before initiation of NTCRA

Figure 3-3. Minor Waste Area Group 2 facilities being decommissioned under the General Decommissioning Action Memorandum.

Table 3-6. Waste Area Group 2 non-time-critical removal action completed under the Engineering Test Reactor facility-specific action memorandum.

Facility ID	Facility Name	Completion Date
TRA-642	ETR building	3/13/2008
TRA-643	ETR compressor building	9/15/2006
TRA-644	ETR heat exchanger building	12/14/2006
TRA-648	ETR electrical building	5/10/2007
TRA-705	ETR secondary filter pit	3/26/2007
TRA-706	Delay tanks	10/16/2007
TRA-755	ETR filter pit	3/6/2008
ETR ID	Engineering Test Reactor identifier	



TRA-642, Engineering Test Reactor Building



TRA-648, ETR Electrical Building



TRA-643, ETR Compressor Building



TRA-644, ETR Heat Exchanger Building



TRA-603, MTR Building NTCRA



TRA-632, Hot Cell Building

Figure 3-4. Major Waste Area Group 2 facilities decommissioned under facility-specific action memoranda.

did not present an unacceptable risk, in accordance with the RAOs for the WAG 2 comprehensive ROD (DOE-ID 1997b) and its associated Explanation of Significant Differences (DOE-ID 2000b). The area was brought to grade, and no aboveground features remain.

Although contaminated equipment was removed and disposed of, residual contamination remained in the basements of TRA-642, as fixed contamination in experimental cubicles and residual contamination within ventilation ductwork. Residual contamination also remained in the subsurface within the General Electric Experimental Loop associated with TRA-755 and within the former primary coolant pipe within building TRA-644. This residual contamination was accounted for in the risk analysis (soil, groundwater, and ecological) conducted to support the Engineering Evaluation/Cost Analysis (DOE-ID 2006b) and found to not present an unacceptable risk.

Further discussion of the Engineering Test Reactor Complex decommissioning and end state will be included in a final removal action report for the Materials Test Reactor and the Engineering Test Reactor Complex, to be completed upon the conclusion of decommissioning activities at the Materials Test Reactor, which is currently underway.

3.4.2.5.4 Major WAG 2 Facilities Where Decommissioning Has Begun Under Facility-Specific Action Memoranda—At WAG 2, two facilities are being decommissioned as NTCRAs under facility-specific action memoranda (Table 3-7). These facilities are further discussed in the following sections.

Table 3-7. Waste Area Group 2 non-time-critical removal actions completed under facility-specific action memoranda.

Facility ID	Facility Name	Action Memorandum
TRA-603	MTR reactor building	<i>Action Memorandum for the Materials Test Reactor (MTR) Facility End-State and Vessel Disposal (DOE-ID 2007c)</i>
TRA-632	ATR Complex hot cells	<i>Action Memorandum for Decommissioning of the TRA-632 Hot Cells (DOE-ID 2009b)</i>
ATR ID	Advanced Test Reactor identifier	
MTR	Materials Test Reactor	

3.4.2.5.4.1 TRA-603, MTR Reactor Building—Decommissioning of the TRA-603 Materials Test Reactor Reactor Building is described in the Action Memorandum for the Materials Test Reactor (DOE-ID 2007c). The selected alternative for TRA-603, Materials Test Reactor Reactor Building, includes removing and disposing of the Materials Test Reactor vessel at ICDF and demolishing the reactor building to below the ground surface. The resultant demolition material will be used as backfill or disposed of in accordance with the applicable disposal site waste acceptance criteria. As of September 30, 2009, the bottom portions of the Materials Test Reactor vessel (C, D, and E rings) have been filled with grout to reduce the dose and prepare the vessel for disposal at ICDF. The top portions of the vessel (A and B rings) have been removed for disposal at ICDF. During removal of lead shielding above piping below the Materials Test Reactor basement floor slab, soil contamination in the underlying soils was discovered. The soils were sampled in 2008 to develop a source term for risk analysis. The soils data and risk analysis are currently under Agency review to determine if further action is warranted or if the risks are acceptable to warrant no further action under the NTCRA.

Materials left in place will include inert, nonputrescible material located below the ground surface (e.g., piping, equipment, electrical conduit, utility systems, structural steel, and other residual clean or contaminated materials) that do not present an unacceptable risk, in accordance with the RAOs established in the WAG 2 comprehensive ROD (DOE-ID 1997b) and its associated Explanation of Significant Differences (DOE-ID 2000b). Excavations and remaining belowgrade structures will be grouted, as necessary, and backfilled to grade. Clean soil and gravel will cover the locations of the TRA-603 building and structures.

Further discussion of the TRA-603 Materials Test Reactor Reactor Building decommissioning and end state will be included in a final removal action report for the Materials Test Reactor and the Engineering Test Reactor Complex, to be completed upon conclusion of decommissioning at the Materials Test Reactor, which is currently underway. These activities are expected to be completed prior to the next 5-year review.

3.4.2.5.4.2 TRA-632, Hot Cells—Decommissioning of the TRA-632 hot cells is described in the *Action Memorandum for Decommissioning of the TRA-632 Hot Cells* (DOE-ID 2009b). The scope of the NTCRA addresses the TRA-632 building and the three hot cells contained within the building. The TRA-632 floor slab containing the hot waste drain lines and any associated soil contamination are not addressed by the NTCRA. The hot waste drain lines are addressed under the Voluntary Consent Order, and the lines will be addressed by a Hazardous Waste Management Act/RCRA closure plan and, if necessary, a subsequent CERCLA response action to address potential radiological contamination. The selected alternative is to remove the hot cells for disposal at ICDF and to remove and dispose of the building at an appropriate disposal location. Removal of hazardous waste from the cells would not be performed under the NTCRA. The decommissioning activities at TRA-632 are expected to be completed prior to the next 5-year review.

3.4.2.5.5 Future NTCRAs at WAG 2—Two additional facilities at WAG 2 have been identified for decommissioning as NTCRAs under the General Decommissioning Action Memorandum. These facilities are listed in Table 3-8. If additional facilities are identified for decommissioning, these facilities will be submitted to the Agencies either for inclusion in the General Decommissioning Action Memorandum or for preparation of facility-specific action memoranda. The currently identified facilities are expected to be decommissioned prior to the next 5-year review.

Table 3-8. Waste Area Group 2 facilities planned for decommissioning under the General Decommissioning Action Memorandum.

Facility Identifier	Facility Name
TRA-712	Retention Basin
TRA-760	Retention Basin Monitoring Station

3.4.3 Operations and Maintenance

As stipulated in the OU 2-13 ROD (DOE-ID 1997b) and the INL Site-Wide IC/O&M Plan (DOE-ID 2010), O&M requirements are applicable at Sites TRA-03, -06, -13, and -M soil-contamination area. O&M requirements include inspections for animal intrusions, subsidence, erosion, and vegetative growth and performance of radiological surveys. Table 3-9 summarizes WAG 2 O&M requirements and the results of the most recent inspections performed in June 2009 (from RPT-672).

Table 3-9. Waste Area Group 2 operations and maintenance inspection log - 2009.

Operations and Maintenance Inspection Activity	TRA-03	TRA-06	TRA-13	TRA-M	Comments and Recommended Repair
Revegetated Areas					
1. Inspect for nongrowth areas	NA	X	X	X	Vegetation is improving at TRA-06, TRA-13 and TRA-M.
2. Inspect for sparse growth areas	NA	X	X	X	Vegetation is improving at TRA-06, TRA-13 and TRA-M.
3. Inspect for weed encroachment	NA	X	X	X	Some invasive weeds evident at all sites. No noxious weeds.
Native Soil Cover					
1. Inspect for erosion areas/animal intrusion	NA	X	X	X	No evidence of animal intrusion or erosion was observed.
2. Inspect for subsidence areas or slope movement	NA	X	X	X	No subsidence or slope movement was observed.

Table 3-9. (continued).

Operations and Maintenance Inspection Activity	TRA-03	TRA-06	TRA-13	TRA-M	Comments and Recommended Repair
3. Inspect cover integrity and evaluate surface drainage away from the cover.	X	X	X	X	Cover integrity is adequate and surface drainage appears to be appropriate.
Perimeter of Radiological Survey					
1. Perform perimeter radiological survey	X	NA	NA	NA	A radiological survey around the perimeter of TRA-03 indicated that the radiation levels are generally stable or declining.
Radiological Survey of Surface of Soil Cover					
1. Perform surface radiological survey	NA	NA	X	X	A radiological survey over the surface of TRA-13 and TRA-M indicated that radiation levels are generally stable or declining.
Riprap Barrier TRA-03 (Warm Waste Pond)					
1. Inspect for erosion areas	X	NA	NA	NA	No erosion noted.
2. Inspect for subsidence areas and slope movement	X	NA	NA	NA	No subsidence noted.
3. Inspect for biological intrusion	X	NA	NA	NA	Some evidence of small animal trails was observed; however, no biological intrusion was noted.
4. Inspect for effectiveness of surface water run-off	X	NA	NA	NA	Surface water run-off appears to be appropriate.
X = activity performed. NA not applicable O&M operations and maintenance					
Source: Table 5 in the INL Site-wide IC/O&M Annual Report – FY 2009 (RPT-672).					

As in years past, the 2009 perimeter survey at the warm waste pond (TRA-03) indicated radiation activities less than 50 $\mu\text{rem}/\text{hour}$ at all points surveyed. Results ranged between 8 and 15 $\mu\text{rem}/\text{hour}$, which indicate that radiation fields are at acceptable levels. Radiation surveys on the surface of TRA-13 and TRA-M (soil-contamination area) indicate that radiation levels are acceptable and generally appear to be declining (RPT-672). There is no evidence that the contamination is spreading.

Vegetated native soil covers were installed during 1999 at TRA-06, -13, and -M to minimize the potential for erosion of the cover material by wind and water (DOE-ID 1998b) and to prevent the growth of noxious weeds. As required in the IC/O&M Plan (DOE-ID 2010), vegetation inspections have been performed annually where these covers are placed. The previous 5-year review noted that the vegetation on these sites was sparse (Section 3.5, Table 3-10), and the annual O&M reports for 2006–2008 confirmed that vegetation has been slow to become established on the native soil covers (DOE-ID 2006c, 2007e; RPT-544). However, the 2009 O&M inspection reported that plant cover on the capped ponds was gradually improving, and although invasive weed species were present, no noxious weeds were observed (RPT-672). The report concluded that no further corrective actions were required. Figure 3-5 shows the current condition of vegetation on the native soil covers.

In summary, annual inspections have shown that O&M at the ATR Complex are functioning as intended, and radiation levels are within acceptable ranges. Although still not optimal, plant cover appears to be improving. Therefore, no corrective actions are necessary at this time.



Figure 3-5. Photos taken in summer 2008 showing plant growth on native soil covers at TRA-06 (left) and TRA-13 and TRA-M (right).

3.5 Progress Since the Last Review

Table 3-10 lists the issues and recommendations for WAG 2 from the previous 5-year review, along with the actions taken and outcomes.

3.5.1 Protectiveness Statements from the Last Review

The protectiveness statements in the last 5-year review (DOE-ID 2007a) were as follows:

Based on the data reviewed and the site inspections, the remedies are functioning as intended by the OU 2-13 ROD (DOE-ID 1997b) and as modified by the ESD (DOE-ID 2000a). No changes in the physical conditions of the sites have occurred that would affect the protectiveness of the remedies. No changes have occurred in the toxicity factors or risk factors for the COCs. Several issues have been identified that warrant further evaluation; however, there is no information that negates the protectiveness of the remedies at this time.

3.5.2 Recommendations and Follow-Up Actions from the Last Review

The last 5-year review (DOE-ID 2007a) noted two issues for WAG 2, as shown in Table 3-10. The following sections describe the actions performed in response to the recommendations made in the previous 5-year review (DOE-ID 2007a) and concerns that arose subsequent to that report.

3.5.2.1 Follow-Up Actions – Diesel Fuel in the Vadose Zone. Selected perched water wells, PW-13, TRA-1933, and TRA-1934, have been monitored annually for fuel hydrocarbon compounds. The thickness of the fuel hydrocarbon layer is also monitored in these wells, and passive removal of diesel fuel product using petroleum (petro) trap skimmer devices has been performed since 2005. Monitoring results and diesel fuel product recovery from perched water monitoring wells is discussed in Section 3.6.2.3. Criteria for discontinuing petro monitoring and product recovery were incorporated into the field sample plan and its associated data quality objectives (DOE-ID 2007d).

Table 3-10. Actions taken since the last 5-year review for Waste Area Group 2.

Issues from Previous Review ^a	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Diesel fuel is present in perched aquifer Well PW 13, OU 2-13 (Opalski 2006).	Continue annual monitoring to track concentration of diesel in the perched aquifer and the rate of removal via the petroleum traps.	DOE	Annually until next 5-year review	Annual monitoring and recovery of the diesel fuel in the perched water wells has been performed since the previous 5-year review. Results demonstrate that the floating product thickness has diminished since the petro traps were installed in 2004 (i.e., RPT-651). Monitoring and maintenance requirements and protocol for continuing or discontinuing monitoring and product recovery were incorporated into the FSP and its associated data quality objectives, published March 2007 (DOE-ID 2007d).	March 2007
This task is complete.					
Establish and maintain desirable vegetation on the native soil covers for the chemical waste pond, the sewage leach pond, and the sewage leach pond soil-contamination area (DOE-ID 2007a).	Revegetation and weed control measures are implemented in accordance with established operation and maintenance requirements. Affected areas will be reseeded with appropriate seed mix for the sites.	DOE	November 2007	Vegetative growth on the sewage leach pond cover and the chemical waste pond cover has been monitored annually in accordance with O&M requirements (DOE-ID 2010). Vegetation is becoming established without reseeding. Inspection results are discussed in the annual IC/O&M reports, with the latest published in December 2009 (RPT-672) and in the body of this document.	December 2009
This task is complete.					
a. Issues were identified either in Appendix C of the previous 5-year review (DOE-ID 2007a) or in the addendum to Appendix C enclosed with EPA's letter of concurrence with the previous 5-year review (Opalski 2006). EPA U.S. Environmental Protection Agency FSP field sampling plan IC institutional control O&M operations and maintenance OU operable unit					

3.5.2.2 Follow-Up Actions – Vegetation on the Native Soil Covers. In accordance with the OU 2-13 Remedial Design/Remedial Action Work Plan (DOE-ID 1998b), vegetated native soil covers were installed during 1999 at the chemical waste pond (TRA-06), the sewage leach pond (TRA-13), and the sewage leach pond soil-contamination area (TRA-M). The purpose of revegetation was to minimize the potential for erosion of the cover material by wind and water (DOE-ID 1998b) and to prevent the incursion of noxious weeds (e.g., Russian thistle) (DOE-ID 1989).

Requirements for annual inspections of vegetated covers were included in the OU 2-13 O&M Plan (DOE-ID 2000a) and the INL Site-wide IC/O&M Plan (DOE-ID 2010). Since the initial reseeding effort was performed in 1999, invasive annual weeds (e.g., cheatgrass) have become established on the native soil covers at these two sites (Figure 3-5). The status of vegetation growth on the native soil covers is discussed in more detail in Section 3.4.3 (Operations and Maintenance). Experience at the INL Site and elsewhere in Idaho has shown that cheatgrass invasion tends to be irreversible (DOE-ID 1989). However, erosion of the covers at these sites has not been a problem, and noxious weeds are not present on the covers (Section 3.4.3).

3.6 Data Review and Evaluation

The following sections review groundwater and vadose zone monitoring data collected since the previous 5-year review.

3.6.1 Groundwater Monitoring

As specified in the Groundwater Monitoring Plan OU 2-13 (DOE-ID 2007d), aquifer wells are sampled annually for COCs, and water levels are measured each year. Wells have been sampled annually since FY 2007, but, in FY 2005 and FY 2006, the wells were sampled twice each year. Water-level data were collected from aquifer wells to evaluate groundwater flow directions in all years since the last 5-year review, except for FY 2006.

3.6.1.1 Groundwater Levels. The SRPA occurs approximately 142 m (465 ft) below the ATR Complex and consists of a series of saturated basalt flows and sedimentary materials. The SRPA is relatively permeable because of the presence of fractures, fissures, and rubble zones at contacts between individual basalt flows.

Water levels were measured in SRPA wells near the ATR Complex to ascertain the direction of groundwater flow. Groundwater elevations were calculated by subtracting depth-to-water measurements from surveyed brass cap elevation data and then correcting for well stickup and borehole deviation in wells with established correction factors.

In general, groundwater flows in a southwest to south direction near the ATR Complex (Figure 3-6). Groundwater levels observed in October 2008 are consistent with past measurements for the WAG 2 area. The general direction of groundwater flow is inferred because the SRPA's highly heterogeneous matrix creates anisotropy that can result in flow paths not perpendicular to the water level contours. On average, water levels in the SRPA near the ATR Complex declined by approximately 1 m (3.5 ft) from June 2004 to October 2008.

3.6.1.2 Groundwater Quality. Groundwater samples are collected annually from aquifer wells TRA-06A, TRA-07, TRA-08, USGS-065, USGS-058, MIDDLE-1823, and Highway-3 (Figure 3-7). The groundwater samples are analyzed for chromium (filtered and unfiltered), Sr-90, gamma isotopes, tritium, gross alpha, and gross beta. The following subsections summarize analytical results for samples collected since the last 5-year review.

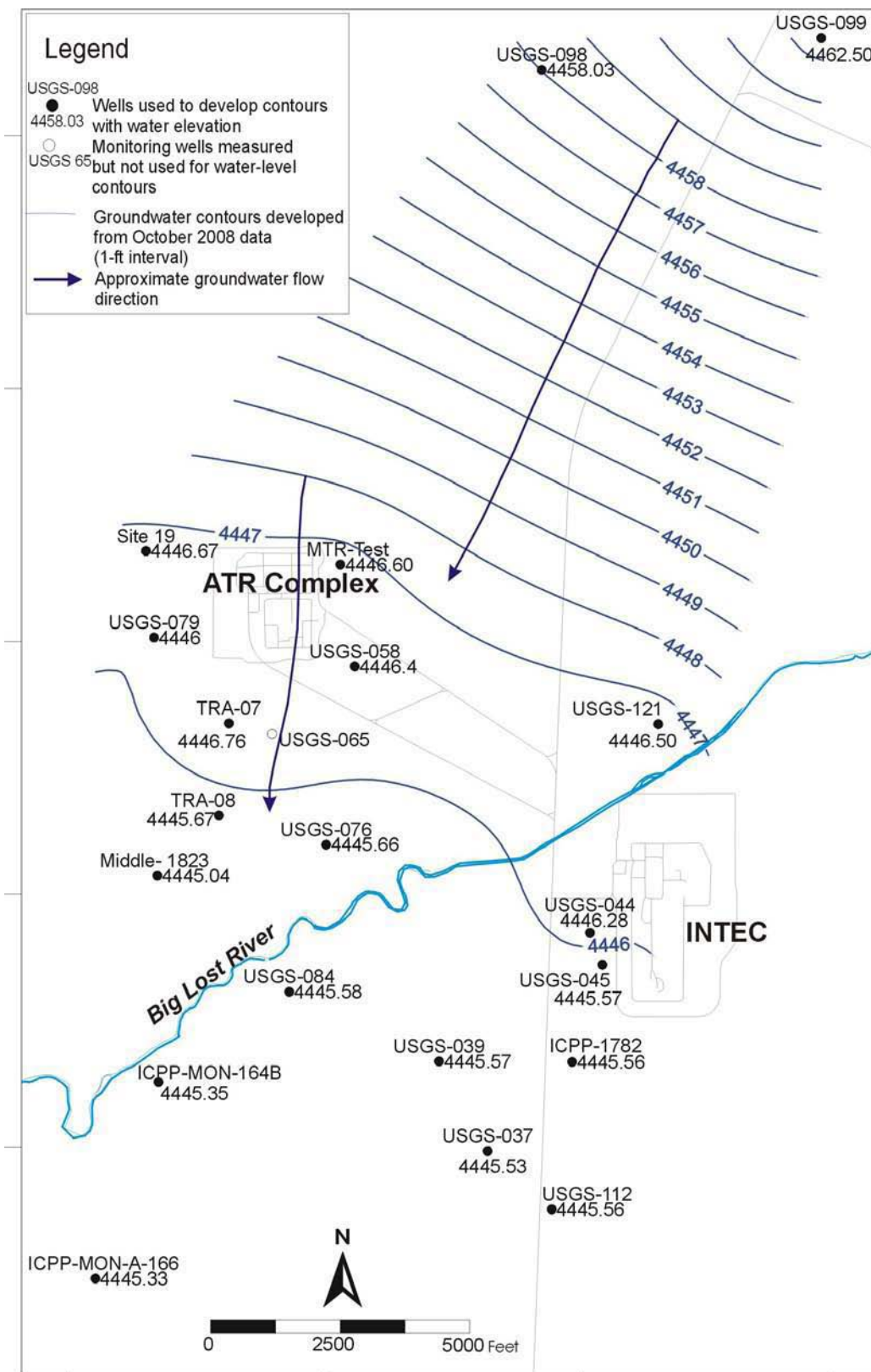


Figure 3-6. Snake River Plain Aquifer water table configuration for October 2008.

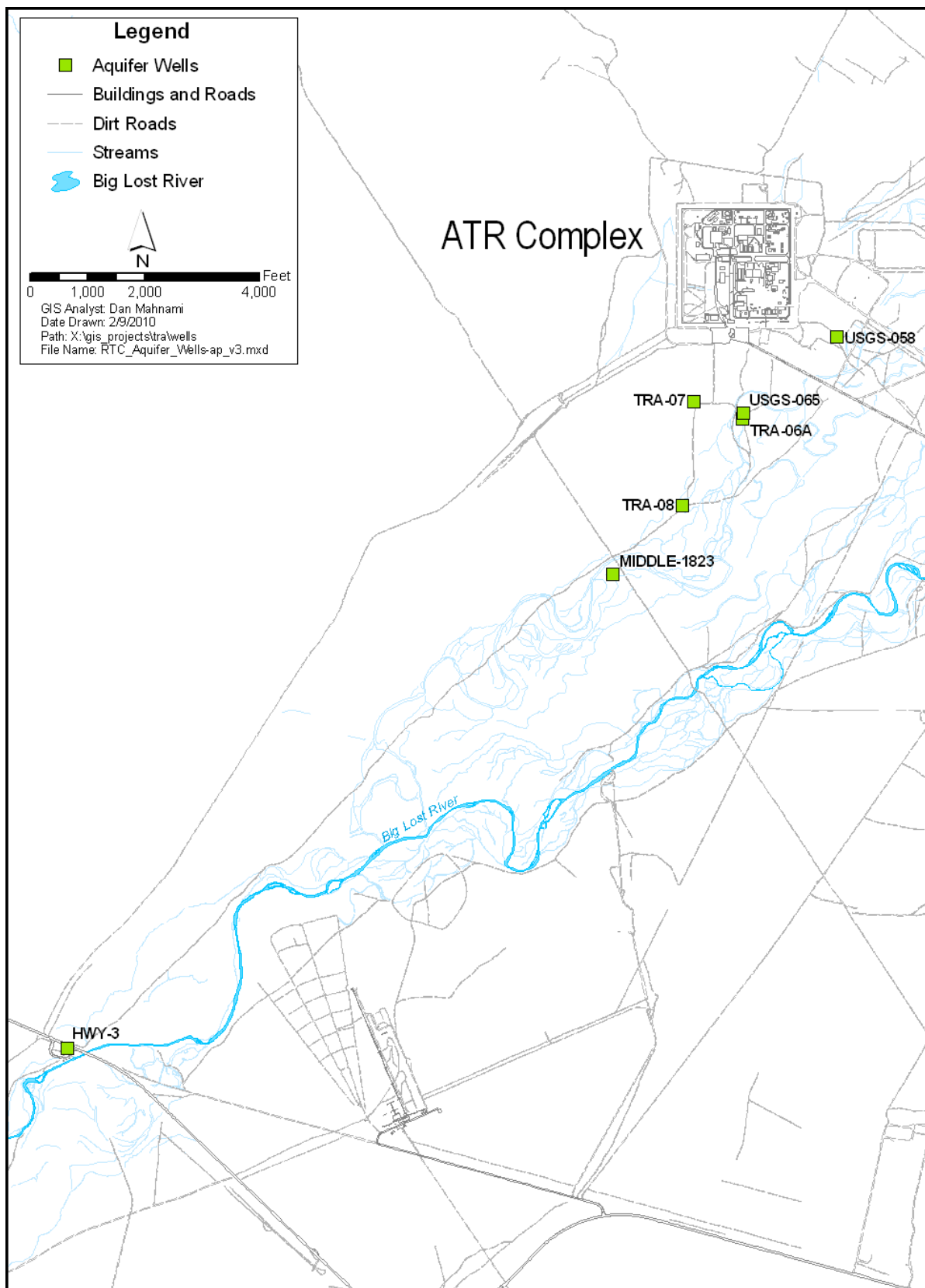


Figure 3-7. Map showing location of aquifer wells sampled at the Advanced Test Reactor Complex.

3.6.1.2.1 Chromium in the SRPA—Chromium has been detected in all WAG 2 aquifer wells. Although filtered chromium concentrations dropped below the EPA-defined MCL of 100 µg/L in all wells in FY 2009 (Figure 3-8), chromium concentrations remain close to the MCL at USGS-065 (98.1 µg/L in FY 2009). Filtered chromium concentrations in Well TRA-07 were above the MCL until FY 2009, when concentrations dropped from 106 µg/L in FY 2008 to 36.3 µg/L in FY 2009. Both Wells TRA-07 and USGS-065 show decreasing trends in chromium concentrations since 1999 (Figure 3-9). Although the rate of decrease in chromium concentrations in USGS-065 has slowed since 2003, chromium concentrations in both USGS-065 and TRA-07 are on a downward trend, and both wells dropped below the MCL in FY 2009. Filtered chromium concentrations have dropped below the MCL in all wells before the 2016 date predicted by the pre-ROD TARGET model, the 2034 date predicted by the updated TARGET model, and the 2022 date predicted by the TOUGH2 modeling (DOE-ID 2005a).

3.6.1.2.2 Tritium in the SRPA—Although tritium was detected in all aquifer wells sampled except the Highway 3 well, tritium concentrations have been below the 20,000-pCi/L MCL in every well since the previous 5 year review. Since the last 5-year review, the highest tritium concentration has typically occurred in Well TRA-07, with the exception of FY 2009, when the highest tritium concentration occurred in Well USGS-065. The tritium concentration in TRA-07 is declining (Figure 3-10). In contrast, the tritium data from USGS-065 showed a consistent declining trend until 2005 but has since been nearly steady (Figure 3-10). Tritium concentrations dropped below the tritium MCL much sooner than predicted by the modeling (DOE-ID 2005a).

3.6.1.2.3 Strontium-90 in the SRPA—Sr-90 has been detected at Well TRA-08 since FY 2006 (November 2005). Since an initial detection at a concentration of over 7,000 pCi/L, the Sr-90 concentration in TRA-08 has declined from 13.4 pCi/L in October 2006, to 10.7 pCi/L in November 2007, to 6.56 pCi/L in October 2008 (FY 2009) (Figure 3-11). In FY 2009, Sr-90 dropped below the MCL (8 pCi/L). Sr-90 has been detected in Wells MIDDLE-1823 and TRA-07, but the reported concentrations have been near the detection limit and sporadic.

Wells MIDDLE-1823, TRA-07, TRA-08, and USGS-065 were sampled for anions (including nitrate) and the full metals suite to determine the source of the Sr-90 in Well TRA-08 in FY 2009. The metals and anions data collected in October 2008 were compared to the data collected in 2004 (DOE-ID 2005a), prior to the occurrence of Sr-90 in TRA-08, to determine if the water sources affecting TRA-08 had changed. The sulfate data confirmed that the source of water affecting TRA-08 had changed and indicated more influence from the cold waste ponds (RPT-651). However, chloride and potassium concentrations were not consistent with any known Sr-90 source area within the ATR Complex (RPT-651). Anion and metals data suggested that cold waste ponds were aiding the migration of Sr-90 from a source in the ATR Complex area.

3.6.1.2.4 Gamma Spectrometry Results—No gamma-emitting isotopes were detected during the FY 2008 and 2009 aquifer sampling. In FY 2005, 2006, and 2007, scattered detections of Ra-226 occurred, but the detections were not substantiated by the gross alpha results and did not occur consistently.

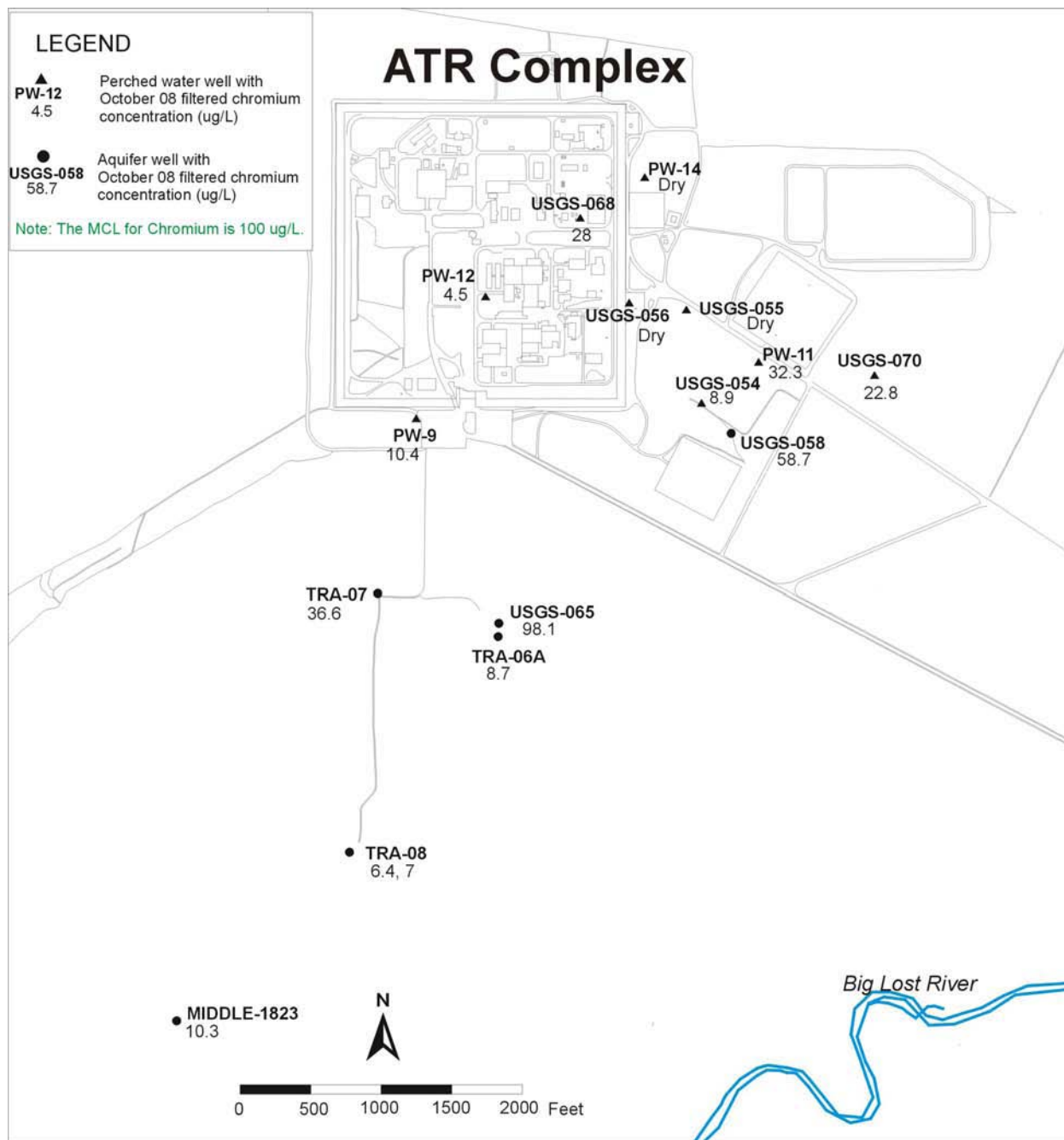


Figure 3-8. Chromium concentrations ($\mu\text{g/L}$) in perched water and groundwater - October 2008.

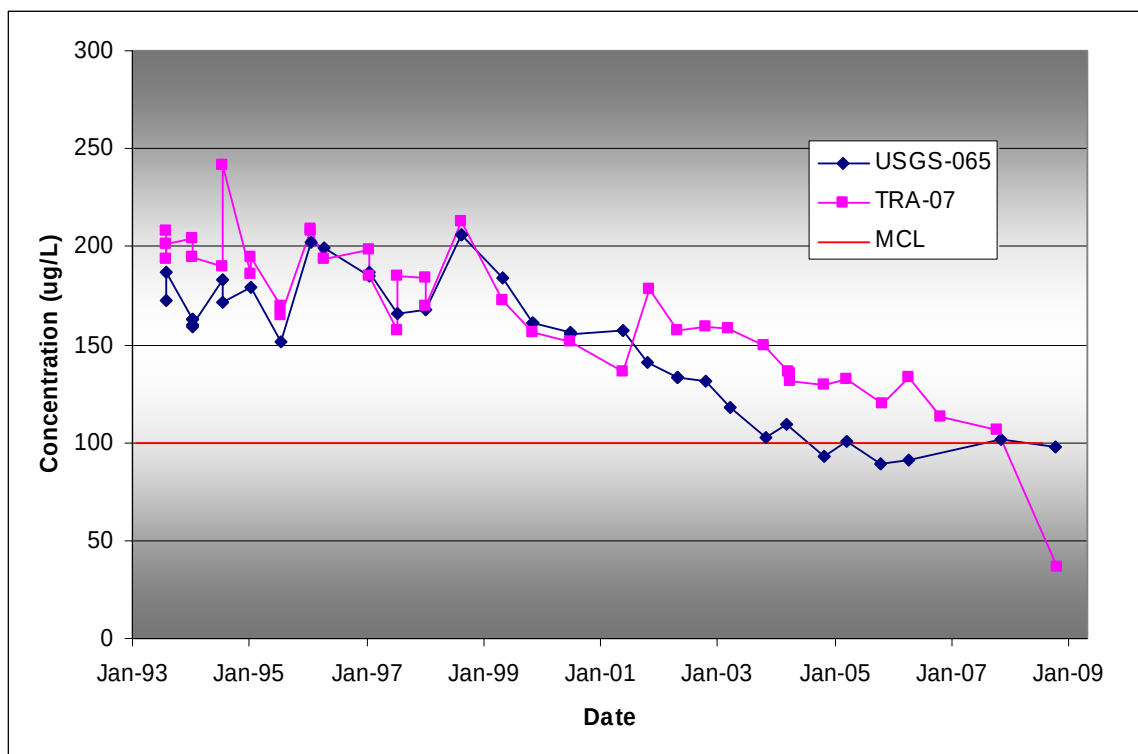


Figure 3-9. Filtered chromium concentration trends in Wells TRA-07 and USGS-065.

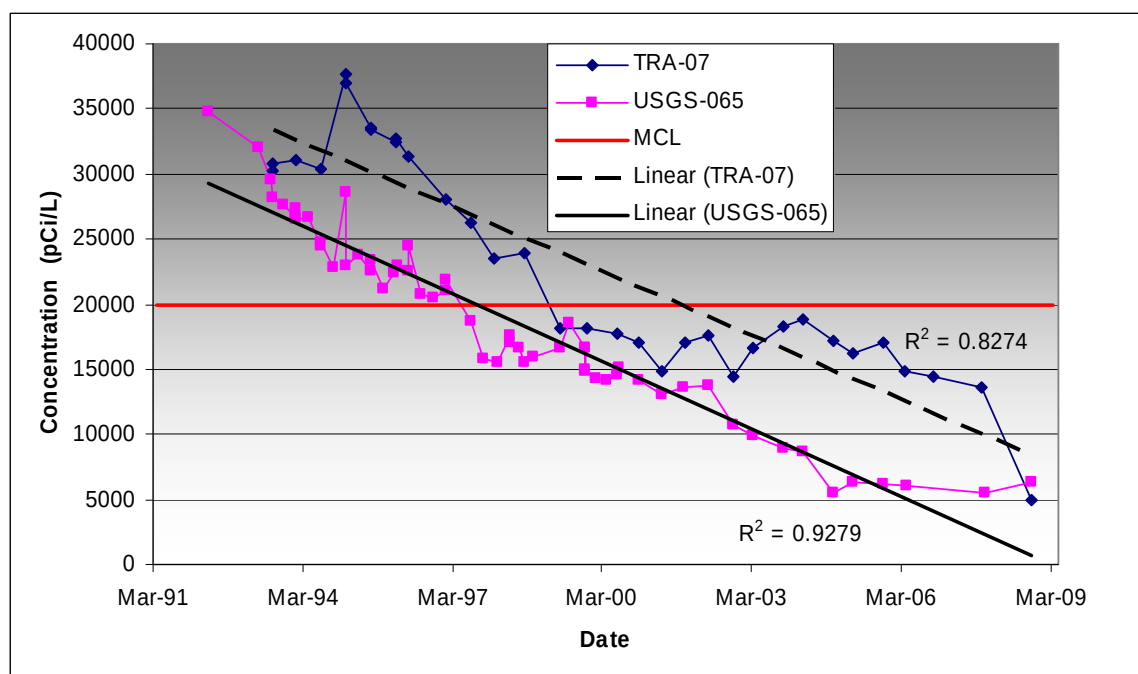


Figure 3-10. Tritium concentration in selected Snake River Plain Aquifer wells near the Advanced Test Reactor Complex for long-term trends.

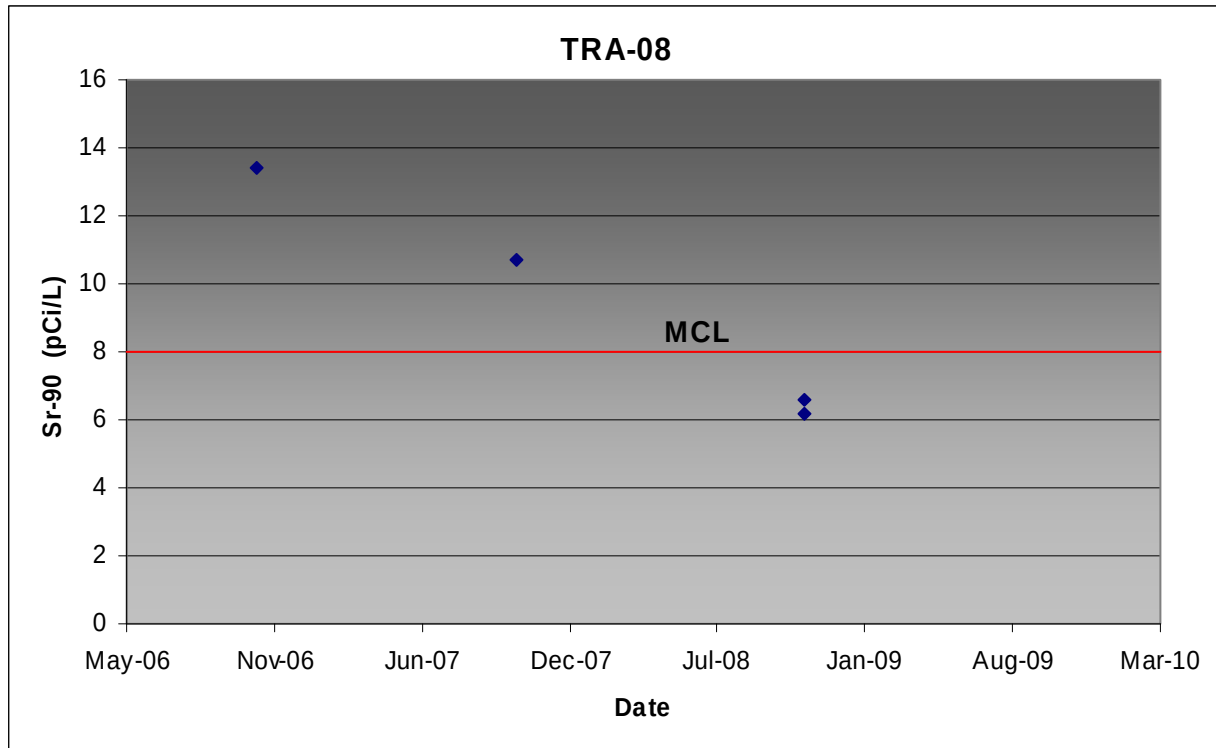


Figure 3-11. Strontium-90 concentration trend in Well TRA-08 groundwater.

3.6.1.2.5 Gross Alpha and Gross Beta in the SRPA—Except for one occurrence, gross alpha results for all wells were below the gross alpha MCL of 15 pCi/L. In the FY 2008 sampling event, gross alpha occurred above the MCL of 15 pCi/L at MIDDLE-1823 at a concentration of 26.9 pCi/L. The cause of the elevated gross alpha was investigated by analyzing samples from MIDDLE-1823 and other wells in the ATR Complex area for total uranium in FY 2009. All wells sampled for total uranium and gross alpha had concentrations that were similar to background. The elevated gross alpha in MIDDLE-1823 appeared to be an anomalous detection and not traceable to a source within the ATR Complex area.

Gross beta analysis has been used to confirm Sr-90 detections. If Sr-90 were present, then gross beta results should also be elevated, confirming the Sr-90 data. Gross beta results for the aquifer wells were similar to background, except at TRA-08. The gross beta results for TRA-08 appear to verify the Sr-90 detections in this well.

3.6.2 Vadose Zone Monitoring

Under the Groundwater Monitoring Plan OU 2-13 (DOE-ID 2007d), perched water wells are sampled for the COCs, chromium (filtered and unfiltered), tritium, Co-60, and Sr-90, along with gross alpha and gross beta. The current monitoring plan specifies groundwater sampling annually for deep perched water wells PW-9, -11, -12, -13, -14, and USGS-054, -055, and -056. Because USGS-055 and USGS-056 are frequently dry, Well USGS-070 is substituted for USGS-055, and USGS-068 is substituted for USGS-056 (Figure 3-12). In addition, if PW-9 is dry, then either USGS-053 or USGS-073 is substituted. Since the last 5-year review, the list of perched water wells sampled has changed. Well USGS-053 changed from a required well to an alternate because the well has been frequently dry. Wells have been sampled annually since FY 2007. In FY 2005 and FY 2006, wells were sampled twice a year.

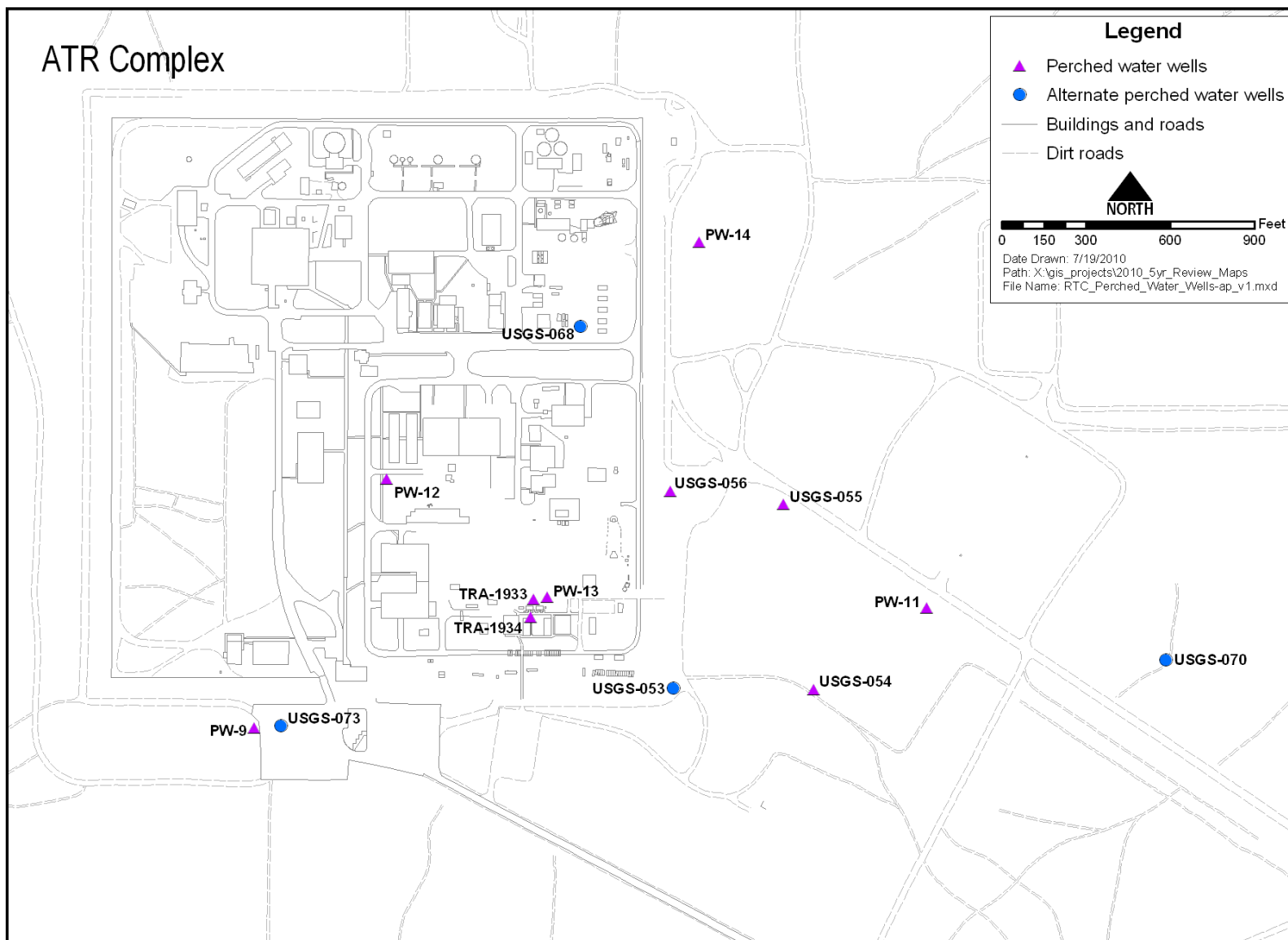


Figure 3-12. Map showing location of perched water monitoring wells sampled at the Advanced Test Reactor Complex.

Wells PW-13, TRA-1933, and TRA-1934 were sampled for gasoline-range organics and diesel-range organics to evaluate impacts from a diesel leak near an underground storage tank. Additionally, Wells PW-13, TRA-1933, and TRA-1934 were monitored with an interface probe to ascertain the presence and thickness of a floating hydrocarbon layer, and the petro traps placed in these wells were used to recover any free-phase product present.

In addition to perched water sampling, water levels are measured in monitoring wells located near the ATR Complex as part of routine monitoring activities. In the past 5 years, water levels were measured annually in aquifer and perched monitoring wells, except for FY 2006. Water levels were only measured for wells that were sampled in FY 2006.

3.6.2.1 Perched Water Levels. Perched water zones resulting from discharges of water to the cold waste pond (TRA-08) at the ATR Complex have been the largest recharge source to the perched water zones. In the past, other surface sources of water included the former warm waste pond (TRA-03) and the chemical waste pond (TRA-06), but these sources represented a much smaller percentage of the total recharge. As noted in the previous 5-year review, a strong correlation exists between water-level patterns in the perched water system and the discharge rates to the cold waste pond. The relationship between pond discharge and the footprint of the perched water bodies has been tracked and described in numerous reports (Hull 1989; Doornbos et al. 1991; Dames & Moore 1992). At least two perched water bodies have been recognized. The first perched water zone is formed on a layer of fine-grained sediments at the alluvium-basalt contact at a depth of about 15 m (50 ft) bgs. The second perched water zone is approximately 17 to 58 m (70 to 190 ft) bgs and is referred to as the deep perched water zone. The deep zone is elongated in a northwest-to-southeast direction and generally has a broad, flat top with steeply sloping flanks (Figure 3-13). Water levels and water quality are currently monitored in the deep perched water.

The water-level contour map for the deep perched water shows that the highest perched water levels are located around the southeast corner of the ATR Complex near the cold waste ponds (Figure 3-13). The principal source of perched water in this area is recharge from the cold waste ponds. The shape of the perched water zone is similar to that of previous maps and approximately the same as in October 2007 (RPT-509) and May 2007 (RPT-406). However, the FY 2009 perched water levels have declined by 1.5 to 4.6 m (5 to 16 ft), as compared to the perched water map for 2003 (DOE-ID 2005a). The overall decrease in perched water levels is most likely the reason that Wells USGS-053, -055, and -056 are now frequently dry. The water-level trend for USGS-054 shows a steep decline since October 2004 (Figure 3-14). Well PW-14 has been dry for many years, since discharges to the chemical waste pond were discontinued.

Perched water levels in monitoring wells were measured to assess potential impacts of continued ATR Complex operations on the perched water system. In addition, the Groundwater Monitoring Plan (DOE-ID 2007d) was revised, with some changes to the perched water wells being monitored in response to dropping water levels in the perched water. Perched water and groundwater wells are monitored annually in accordance with the Groundwater Monitoring Plan (DOE-ID 2004a) and the Revised Plan (DOE-ID 2007d).

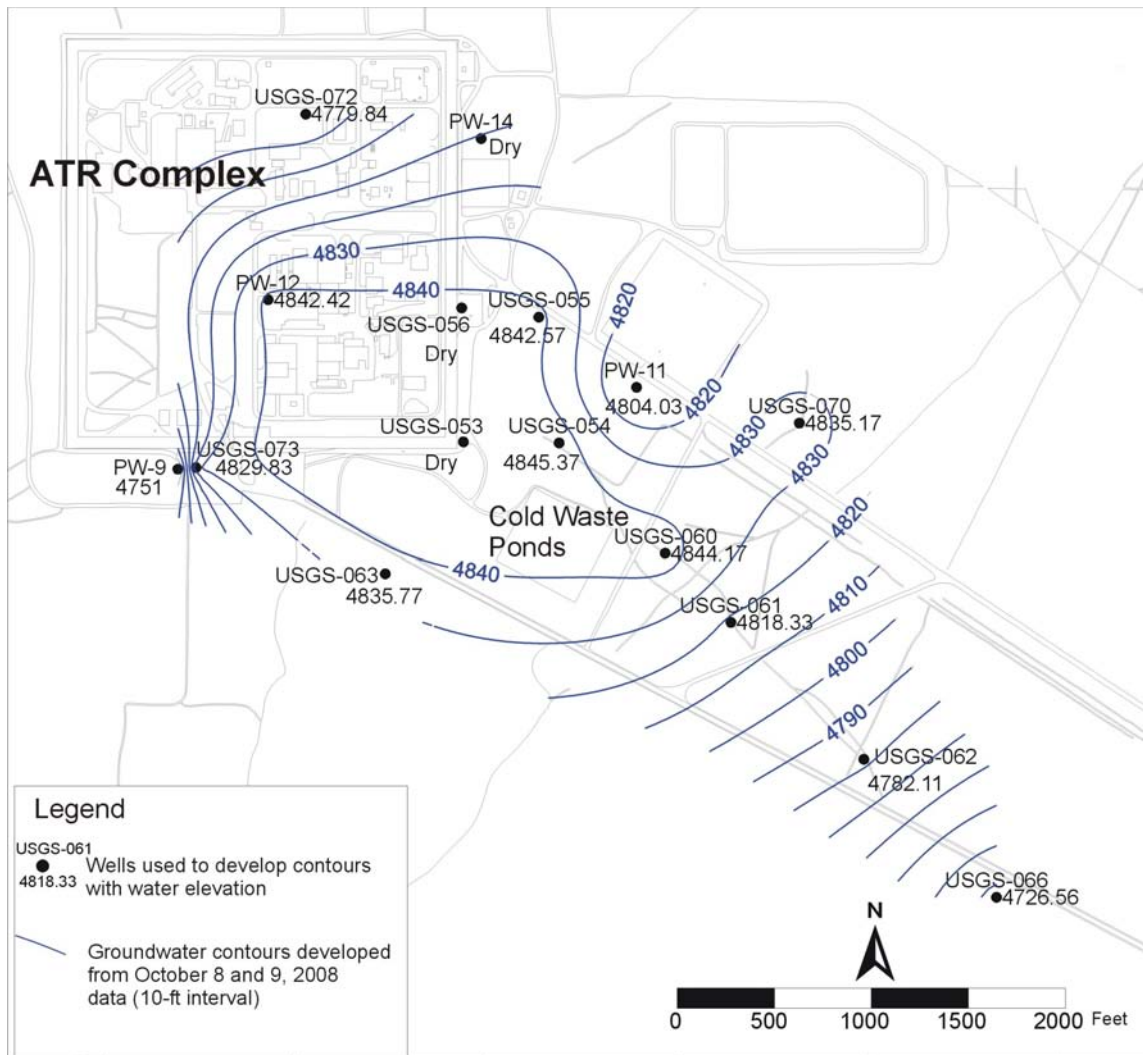


Figure 3-13. Configuration of the deep perched water zone at the Advanced Test Reactor Complex (October 2008).

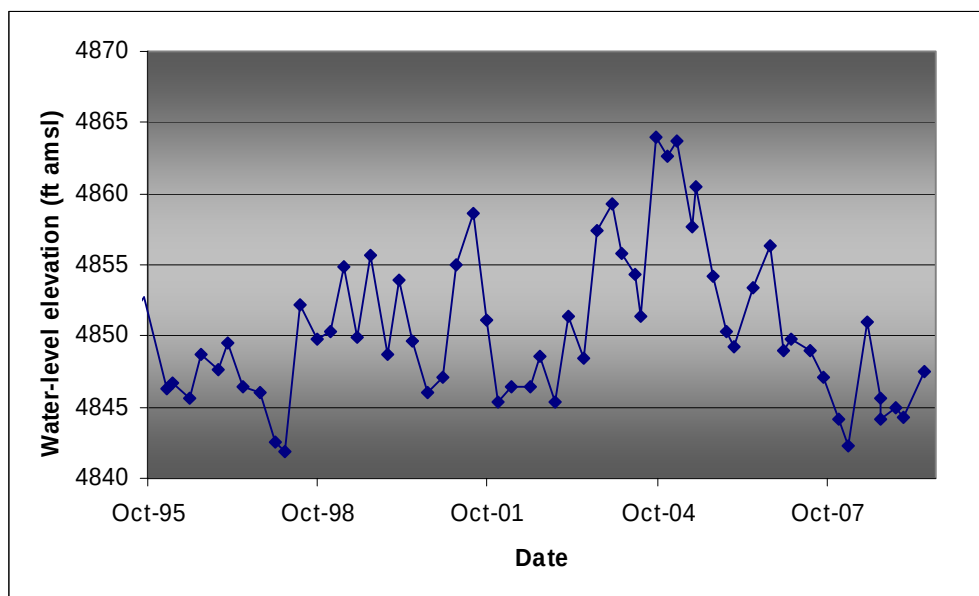


Figure 3-14. Water-level plot for Well USGS-054.

3.6.2.2 Perched Water Quality. COCs in the perched water are discussed and compared to MCLs in the following paragraphs; however, this comparison is not intended to convey that the perched water represents an aquifer capable of sustained long-term use.

3.6.2.2.1 Chromium in Perched Water—Filtered and unfiltered samples were collected for chromium analysis. The federal drinking water standard for chromium (total chromium) is 100 µg/L. Chromium concentrations in unfiltered samples are influenced by variability in the amount of particulate matter (suspended solids or turbidity), while filtered samples are representative of the more mobile, dissolved metals (plus small colloidal particles). Filtered samples are preferred for evaluation of the chromium plume because chromium concentrations in unfiltered samples are subject to variations in the amount and type of turbidity (sediment) in the sample.

Chromium exceeded the MCL in Well USGS-056 during FY 2007 (127 µg/L), but, in FY 2008 and 2009, this well was dry. In one instance, chromium was above the MCL in TRA-1934. However, the occurrence of chromium in this well was inconsistent with the reducing redox conditions present in this well, because chromium is more soluble in oxidizing conditions. Reducing conditions are indicated for TRA-1934 by the consistent presence of hydrocarbons (every year) and lack of nitrate (DOE-ID 2005a). Analytical results for filtered chromium from all the other perched water wells were below the EPA-defined MCL of 100 µg/L since the last 5-year review. Another well that had a history of elevated chromium concentrations was USGS-055. However, this well had also gone dry by FY 2009. As of FY 2009, the highest filtered chromium concentration occurred at PW-11 (32.3 µg/L).

3.6.2.2.2 Strontium-90 in Perched Water—Sr-90 results ranged from nondetect to 113 pCi/L in the perched water wells sampled since the last 5-year review. Samples from Wells PW-12, PW-13, TRA-1933, TRA-1934 and USGS-054, -056, -055, -053, and -070 exceeded the EPA-defined MCL of 8 pCi/L in at least one sampling event. The highest Sr-90 concentration since the last 5-year review was 113 pCi/L, which occurred in the sample from TRA-1934. Not enough data exist to trend Sr-90 in TRA-1934; but PW-12 has a generally increasing trend since 1996, whereas USGS-054 has a long-term declining trend (Figure 3-15). Other wells exhibit mixed trends. The highest historical Sr-90 concentration was 817 pCi/L in October 1972 at USGS-054 and is approximately a factor of 20 higher than the FY 2009 concentration in this well (43.7 pCi/L).

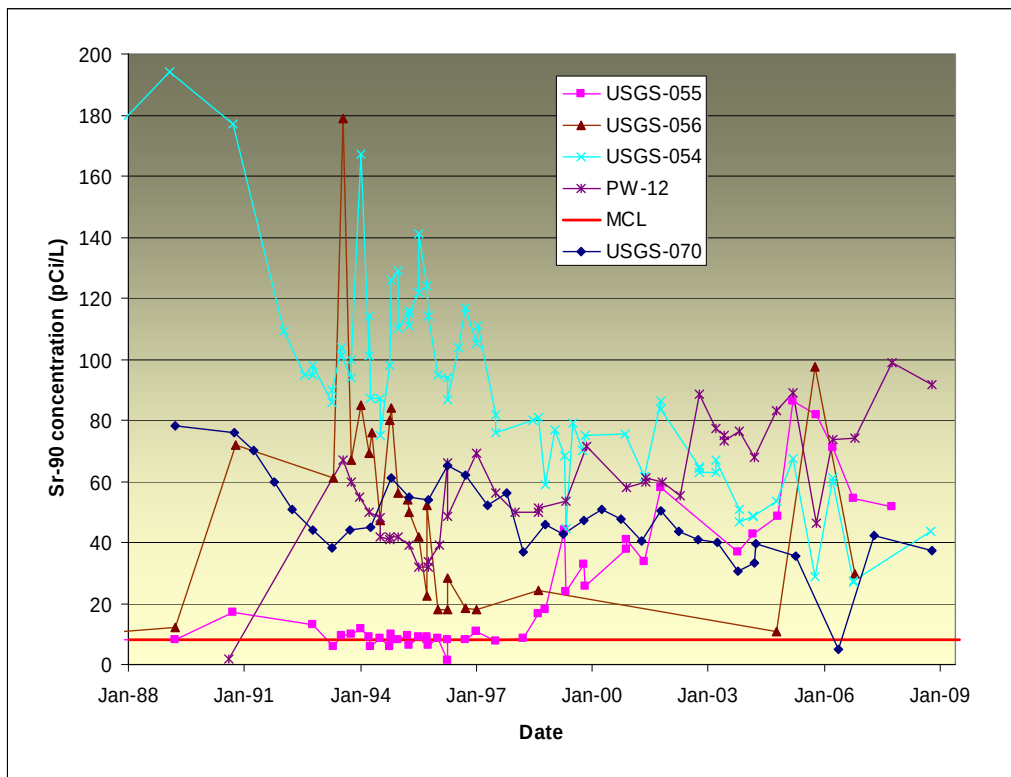


Figure 3-15. Strontium-90 concentration trends (pCi/L) in Wells PW-12, USGS-054, -055, -056 and -070 (note that USGS-055 and USGS-056 were dry in October 2008).

3.6.2.2.3 Tritium in Perched Water—The MCL for tritium is 20,000 pCi/L, which has a half-life of 12.3 years. Reductions in the activity of measured tritium can result from both dilution and radioactive decay. Tritium has been detected in most of the perched wells, but, in the last 5 years, it exceeded the MCL only at Wells PW-9 and PW-11. The tritium concentration in PW-9 has decreased from 46,200 to 22,200 pCi/L since the last 5-year review. Tritium concentrations display a long-term downtrend in PW-9, but the rate of decline has decreased since 2000 (Figure 3-16). The tritium concentration trend for Well PW-11 shows a statistically significant trend of decreasing concentrations, with a correlation coefficient of 0.95 (Figure 3-16). The concentration trends for PW-9 and PW-11 suggest that tritium concentrations will drop below the MCL within the next few years.

3.6.2.2.4 Gamma-Emitting Isotopes in Perched Water—The principal analyte of interest in the gamma analysis is Co-60. The MCL for Co-60 is 100 pCi/L, which has a half-life of 5.2 years. As shown in Figure 3-17, the Co-60 concentration in PW-12 has declined to near the minimum detectable activity after peaking at 330 pCi/L in 2003. Co-60 was not detected in PW-12 during the FY 2009 sampling event.

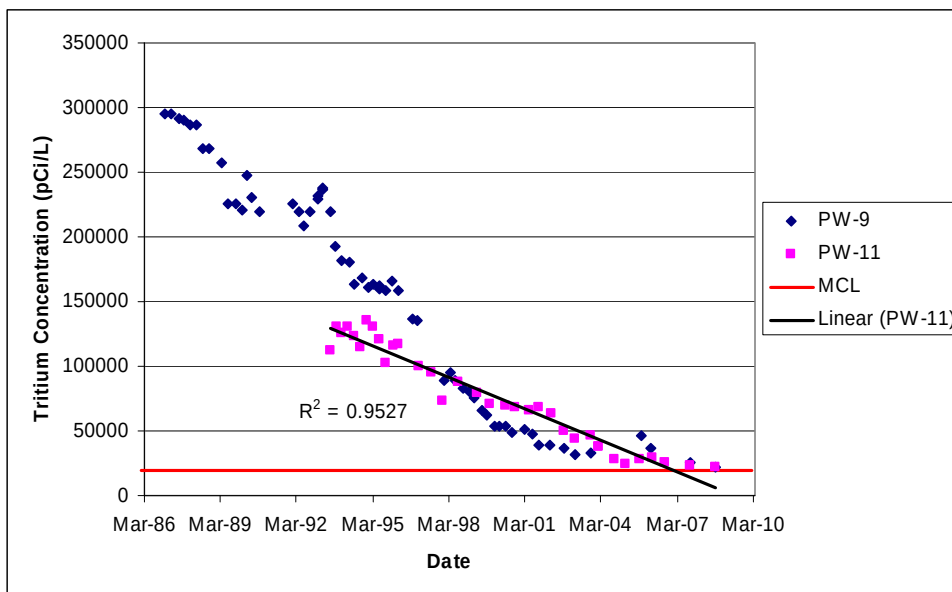


Figure 3-16. Tritium concentrations (pCi/L) in Wells PW-9 and PW-11.

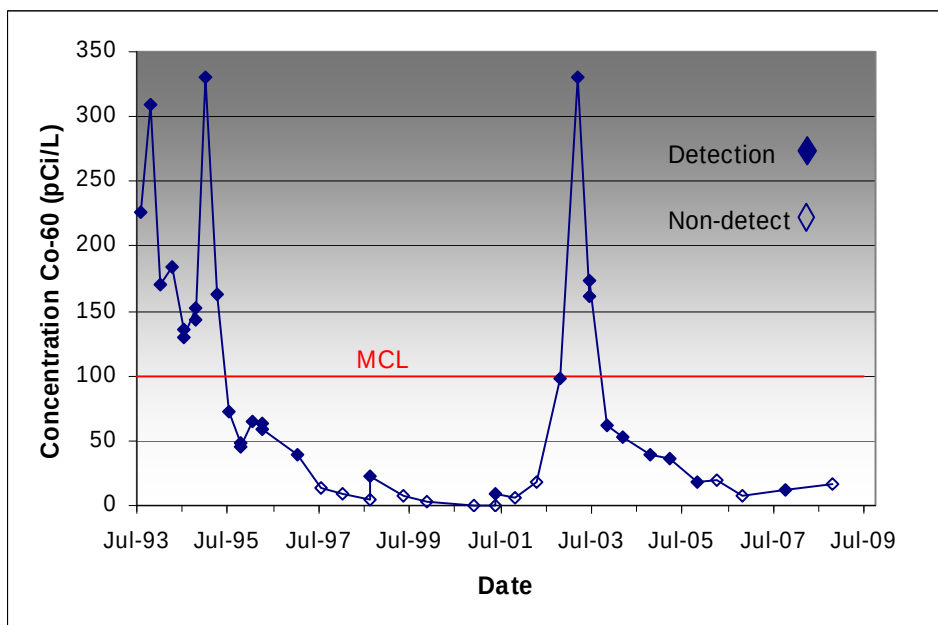


Figure 3-17. Cobalt-60 concentration (pCi/L) in Well PW-12.

A detailed study of the Co-60 spike in PW-12 was conducted and documented in the Response to the First 5-Year Report for OU 2-13 (DOE-ID 2005a). This report concluded that the spike likely resulted from remobilization of existing Co-60 because of changes in hydrogeologic conditions.

Detections of Ra-226 up to 117 pCi/L in FY 2005 and up to 166 pCi/L in FY 2006 were not verified with gross alpha, and detections of Ra-226 did not occur consistently in the same wells. The gamma spectroscopy method is a questionable method for determining alpha emitters like Ra-226.

3.6.2.2.5 Gross Alpha and Gross Beta in Perched Water—Gross alpha and gross beta analyses were used as a check on the Sr-90 and Ra-226 detections reported in FY 2005 and FY 2006 sampling events. Gross beta results correlated with Sr-90 results, with the highest gross beta concentrations in the perched water occurring in PW-12 along with the highest Sr-90 concentrations. Gross alpha results did not confirm the Ra-226 detections. Gross alpha results were below the MCL of 15 pCi/L in all the perched water wells sampled since being added as an analyte in March 2006.

Piping systems at the ATR Complex have been investigated under the Voluntary Consent Order program. In part, this work has addressed elevated Co-60 concentrations in perched water samples collected from monitoring well PW-12. Co-60 levels in PW-12 dissipated rapidly shortly after the previous 5-year review.

3.6.2.2.6 Diesel-Range Organics and Gasoline-Range Organics Results—Samples for diesel-range organics and gasoline-range organics were collected from perched water wells PW-13, TRA-1933, and TRA-1934 (Figure 3-18). The highest diesel-range organics (226 mg/L) concentration was from PW-13 and occurred in March 2005. The highest gasoline-range organics (1,610 µg/L) concentration occurred in TRA-1933 in October 2004. The diesel-range organics and gasoline-range organics concentrations were the lowest in TRA-1934. In general, diesel-range organics and gasoline-range organics concentrations appear to be declining in PW-13 (Figures 3-19 and 3-20). At TRA-1933, diesel-range organics concentrations have remained within a narrow range, and gasoline-range organics concentrations have generally declined since first sampled. However, gasoline-range organics concentrations increased in FY 2009 compared to results for the previous year. At TRA-1934, both gasoline-range organics and diesel-range organics show a general decline since the first sampling event; however, both increased in the FY 2009 sampling event.

3.6.2.3 Petroleum Trap and Interface Probe Monitoring. As recommended in the Response to the First 5-Year Review Report for OU 2-13 (DOE-ID 2005a), petro traps were installed during 2004–2005 in PW-13, TRA-1933, and TRA-1934 (Figure 3-18) to collect free-phase fuel hydrocarbon product floating on the perched water. The floating product is likely the result of a spill of No. 2 diesel fuel that occurred in the late 1970s and early 1980s (INEL 1994). The frequency of petro trap monitoring was changed from monthly to quarterly in FY 2008. Petro trap maintenance activities included measuring water level and free-phase product levels using an interface probe, removing collected free-phase product, and adjusting petro trap depth.

3.6.2.3.1 Well PW-13—The petro trap in PW-13 was installed on November 11, 2004, per the manufacturer's guidelines. Since the installation of the petro trap in Well PW-13, the free-phase product thickness and free-phase product recovery has oscillated significantly (Figure 3-21). Since February 2005, the free-phase product thickness has varied from 0–0.5 ft. Figure 3-22 is a graphical representation of free-phase product thickness since the petro trap was installed in PW-13. Since installation of the petro traps, the total volume of free-phase product that has been removed is approximately 69 L (18 gal). The floating-product thickness measurements and quantities of diesel recovered indicate that the petro trap in PW-13 has been effective, and free-product thickness and product recovery rates have generally declined since the petro trap was installed.

3.6.2.3.2 Well TRA-1933—The petro trap in TRA-1933 was installed on November 11, 2004. Since the initial measurement taken during the November 2004 installation of the petro trap, TRA-1933 has shown only limited free-phase product accumulation, with only three instances of measurable thickness. The total volume of free-phase product recovered since installation of the petro trap is 6.7 L (1.7 gal). The lower free-phase product volumes and thicknesses in comparison to PW-13 are most likely due to the greater distance from the original release location, attenuation of the free-phase product, or decreased connectivity to pockets of free-phase product.

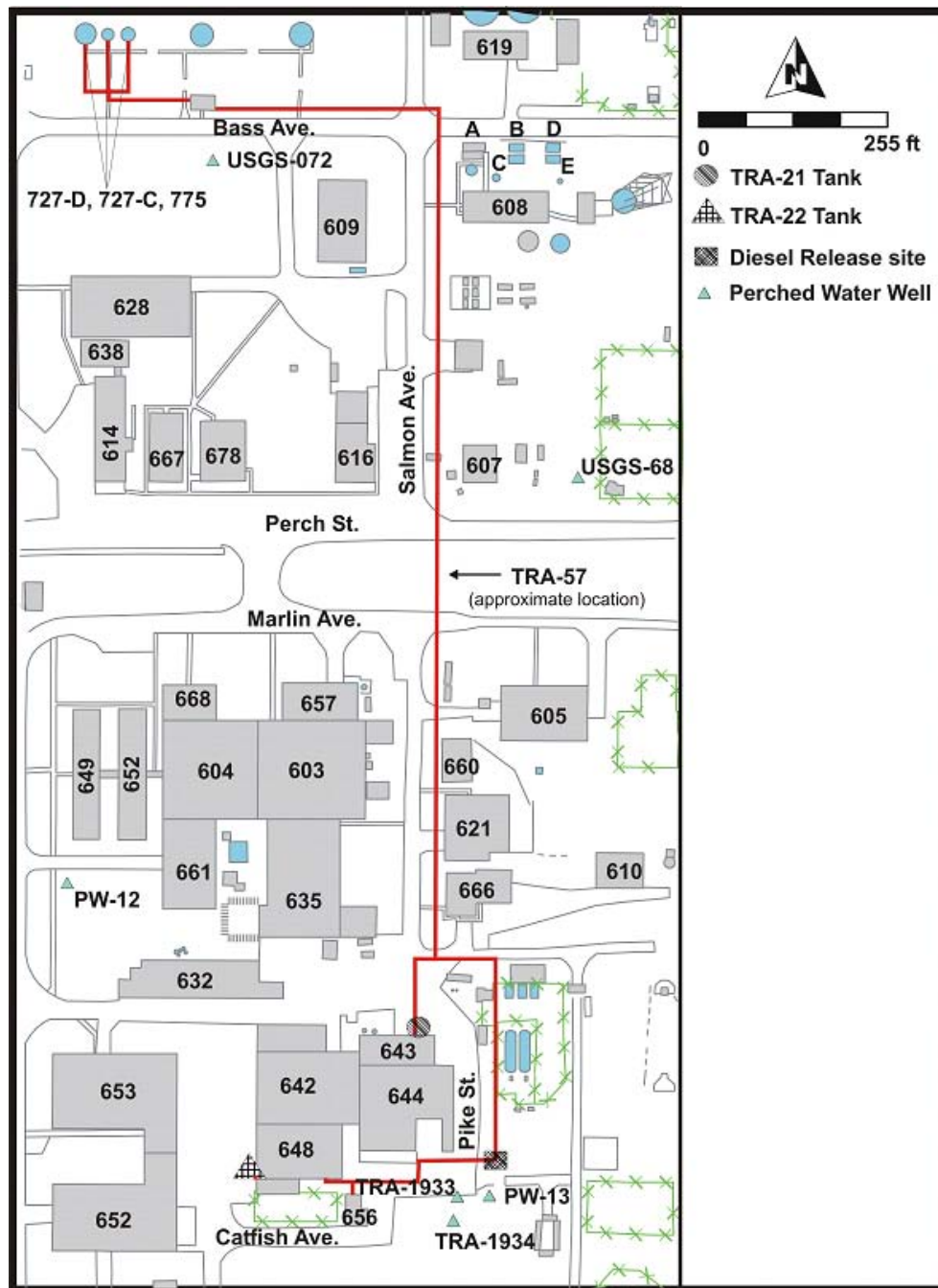


Figure 3-18. Map of the Advanced Test Reactor Complex showing approximate locations of the TRA-57 fuel transfer line and the diesel release, and monitoring wells PW-13, TRA-1933, and TRA-1934.

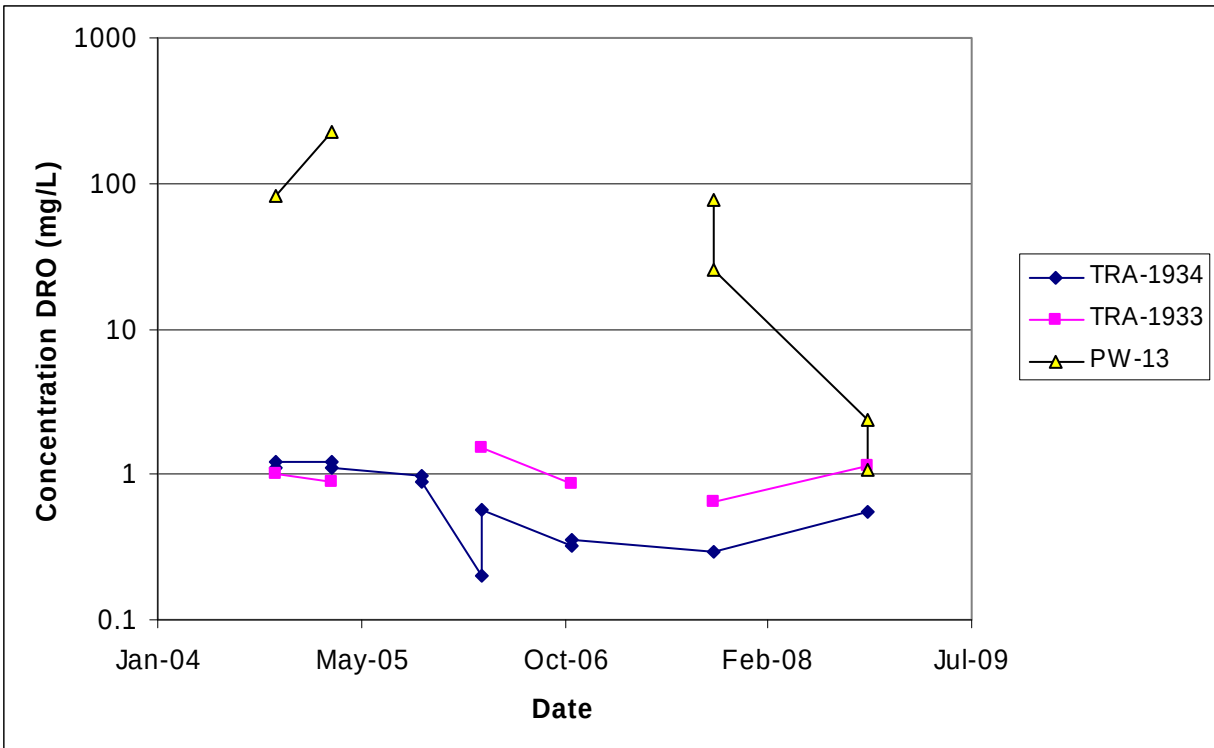


Figure 3-19. Diesel-range organics trends for Wells TRA-1934, TRA-1933, and PW-13.

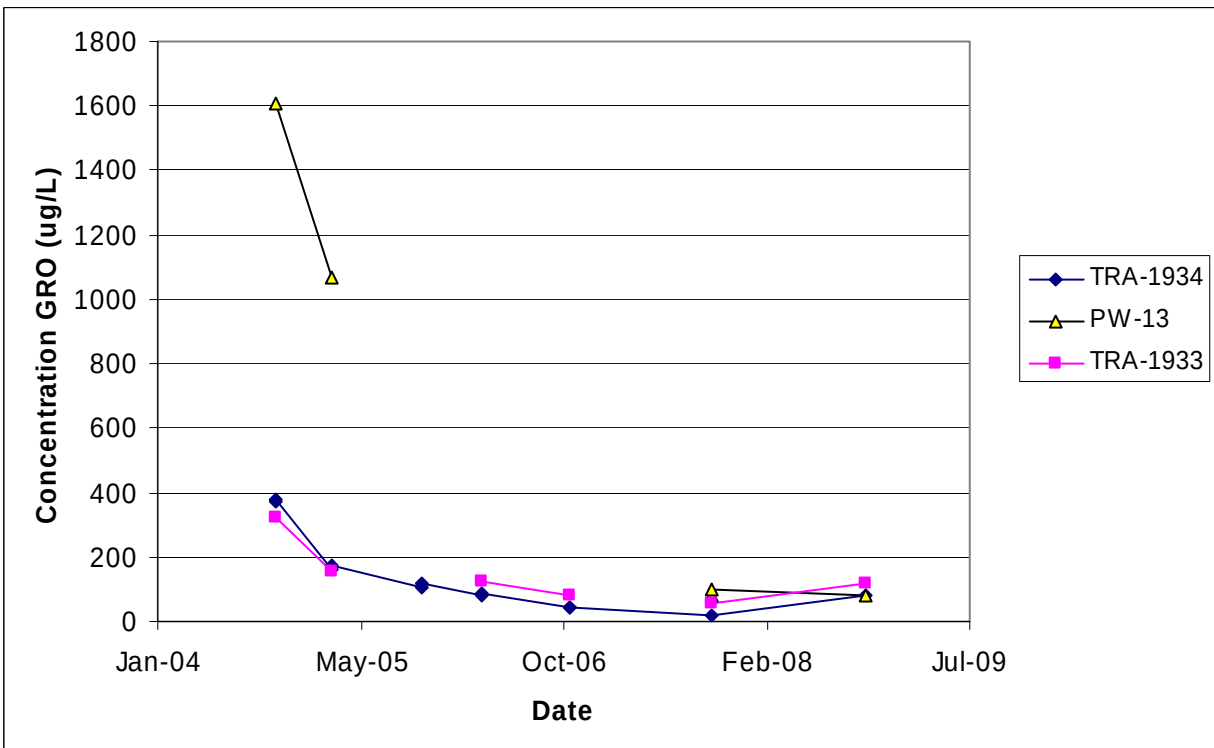


Figure 3-20. Gasoline-range organics trends for Wells TRA-1934, TRA-1933, and PW-13.

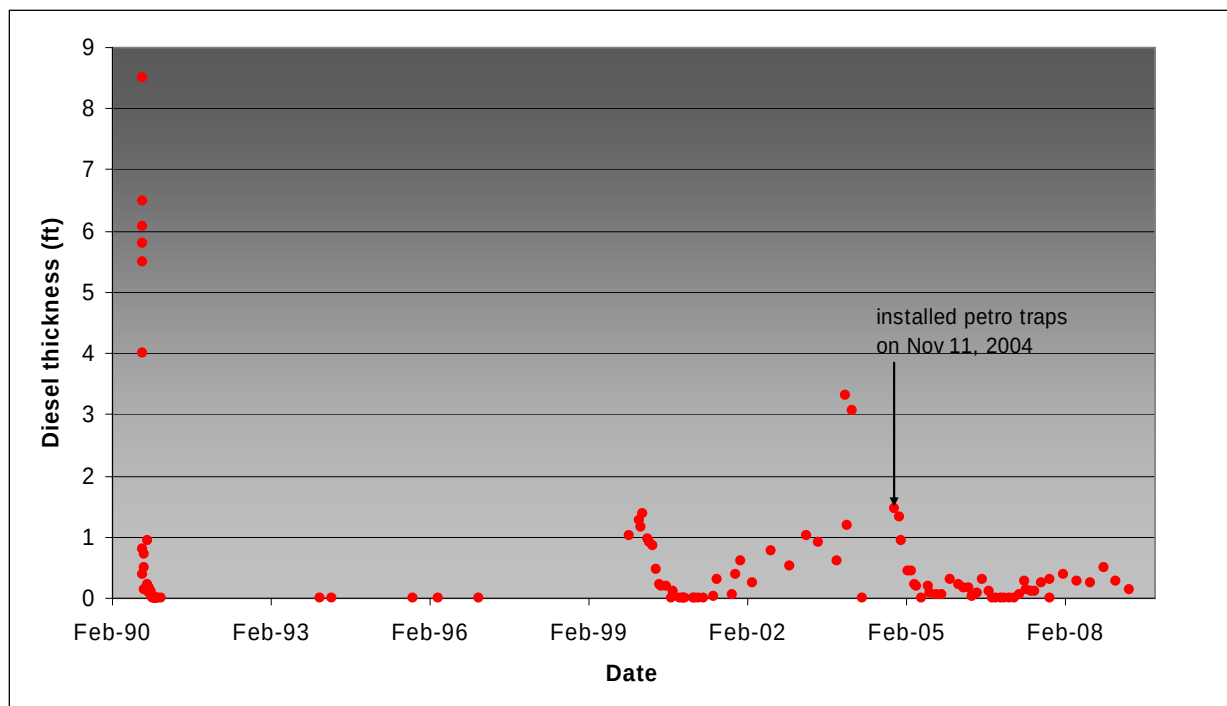


Figure 3-21. Free-phase product thicknesses over time in Well PW-13.

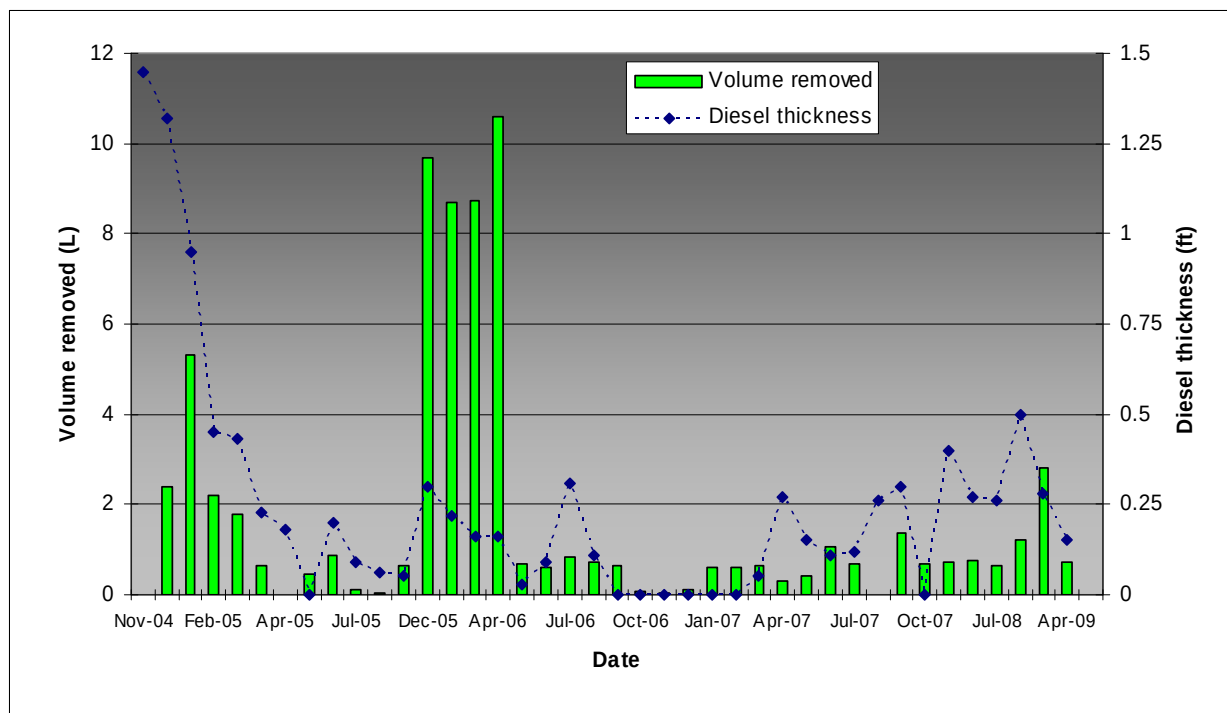


Figure 3-22. Free-phase product thickness and volume removed from Well PW-13.

3.6.2.3.3 Well TRA-1934—The petro trap in TRA-1934 was installed on January 5, 2005. No measurable thickness of free-phase product has been noted in this well. Before July 2008, only traces of free-phase product (0.052 L [1.75 oz]) were collected by the petro trap in TRA-1934. However, a total of 1.0 L (34 oz.) was recovered from July 2008 through April 2009. Since installation, approximately 1.1 L (37 oz.) of product has been recovered from TRA-1934. This location is farthest from the diesel source, located approximately 18 m (60 ft) southwest of PW-13 (Figure 3-18).

3.6.3 Site Inspections

As required by the OU 2-13 ROD (DOE-ID 1997b) and the IC/O&M Plan (DOE-ID 2010), site inspections are conducted annually at IC sites at WAG 2. Inspections provide a mechanism for determining if ICs are functioning as intended, for identifying maintenance needs, and for determining if the implemented remedies are functioning as intended. Site inspectors visually evaluate site conditions and documentation of conditions on inspection checklists, review site information in the Institutional Control Site (ICS) database, and assess access controls (e.g., signs and markers). Depending on site-specific requirements, inspectors may also evaluate vegetative growth, examine intrusion or subsidence, or perform radiological surveys. The inspection results are presented in annual ICs and O&M reports for 2004 (DOE-ID 2004b, 2005b), 2005 (DOE-ID 2005c, d), 2006 (DOE-ID 2006c, d), 2007 (DOE-ID 2007e, f), 2008 (RPT-544), and 2009 (RPT-672).

In general, WAG 2 annual inspections found acceptable site conditions. The inspections provide evidence that the engineered covers and ICs are functioning as intended. Noteworthy observations include the following:

- Radiological surveys at Sites TRA-03, TRA-13/TRA-M indicate that contamination is not spreading, and no unexplained radiological anomalies are present
- Signs and markers are present and maintained, as necessary
- Excavations, drilling, and other site disturbances have been coordinated through the regulatory Agencies
- Wellhead security measures at the WAG 2 wells indicate that the wells are adequately locked and identified
- Vegetative growth has been slow to establish itself at Sites TRA-06 and TRA-13/TRA-M but has made gradual improvement
- Evidence of small animal burrows was found on the shoulders of Sites TRA-06 and TRA-13/TRA-M during 2008, and maintenance was performed to eliminate the burrows. No burrows were observed during the 2009 inspection.

The inspections performed during 2004–2009 demonstrate that the WAG 2 remedies are functioning as intended, and no additional corrective actions are indicated for WAG 2 sites.

3.7 Technical Assessment

The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. WAG 2 remedial actions completed in 1999 are functioning as intended, and subsequent NTCRAs have successfully removed contaminated structures. Groundwater and perched water monitoring results demonstrate that COC concentrations are generally declining over time. As of

FY 2009, concentrations of chromium, tritium, and Sr-90 had dropped below MCLs in all WAG 2 aquifer monitoring wells. Since 2005, passive skimmers have been effective in removing diesel fuel product from several perched water monitoring wells. Radiation surveys performed at containment sites TRA-03, TRA-13 and TRA-M indicate that radiation levels are acceptable, and there is no indication that radionuclides are spreading.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Yes.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

Technical Assessment Summary

Remedial actions were completed in 1999 at all of the OU 2-13 CERCLA sites. Based on data collected since then, the remedial actions at these sites were successful, and the remedies are functioning as intended. The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selections are still valid, and no new information has come to light that could call into question the protectiveness of the remedies. ICs have been implemented where necessary and are functioning as required. In general, COC concentrations in groundwater are declining faster than was predicted by contaminant transport models. No additional actions appear necessary.

3.8 Issues and Recommendations

No issues are identified, and therefore, recommendations are not necessary. The technical assessment did not give rise to any new issues, and all issues from the previous 5-year review have been satisfactorily completed.

3.9 Protectiveness Statement for Waste Area Group 2

Because the remedial actions at all OUs in WAG 2 are protective, the site is protective of human health and the environment. Ongoing inspections and perched water and groundwater monitoring indicate that the OU 2-13 remedies are functioning as intended in the decision documents, and the overall remedy remains protective of human health and the environment.

3.10 Summary and Conclusions

The ATR Complex was designated as WAG 2 under the FFA/CO (DOE-ID 1991a). The FFA/CO further divided WAG 2 into 13 OUs that contain a total of 55 release sites. In 1997, all of these sites were rolled into the WAG 2 Comprehensive Remedial Investigation/Feasibility Study for OU 2-13 (DOE-ID 1997a) and sites with unacceptable risks were remediated under the comprehensive ROD (DOE-ID 1997b).

WAG 2 remedial actions are functioning as intended. Groundwater and perched water monitoring results demonstrate that COC concentrations are generally declining over time. As of FY 2009, concentrations of chromium, tritium, and Sr-90 had dropped below MCLs in all WAG 2 aquifer monitoring wells. Since 2005, passive skimmers have been effective in removing diesel fuel product

from several perched water monitoring wells. Radiation surveys performed at containment sites TRA-03, TRA-13 and TRA-M indicate that radiation levels are acceptable, and there is no indication that radionuclides are spreading.

No issues requiring resolution were identified during this 5-year review of the remedial actions conducted at WAG 2. Issues identified in the previous 5-year review have been addressed, and no further follow-up is required.

Remediation has been completed at all WAG 2 sites, and the OU 2-13 remedies are functioning as intended. Inspections, maintenance, and monitoring continue in accordance with requirements. Ongoing inspections and perched water and groundwater monitoring indicate WAG 2 remedies are functioning as intended in the decision documents.

Because the OU 2-13 selected remedy includes containment remedies and monitoring requirements, 5-year statutory reviews will be required indefinitely. The next 5-year review is expected to cover the period from FYs 2010 through 2014.

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4. WASTE AREA GROUP 3—IDAHO NUCLEAR TECHNOLOGY AND ENGINEERING CENTER

4.1 Introduction

INTEC, formerly known as the Idaho Chemical Processing Plant, was established in 1952, and its primary mission was to reprocess (recover) uranium from spent nuclear fuel. The INTEC facility includes approximately 265 acres and is located in the south-central portion of the INL Site approximately 72.5 km (45 miles) west of Idaho Falls, Idaho (Figure 1-1). The plant's original missions included storage and reprocessing of spent nuclear fuel, as well as nuclear research. DOE phased out the reprocessing operations in 1992 and redirected the plant's mission to:

- Receive and temporarily store spent nuclear fuel and other radioactive waste for future disposition
- Manage current and past (legacy) wastes
- Perform remedial actions.

INTEC was designated as WAG 3 under the FFA/CO (DOE-ID 1991) to address releases of radiological and hazardous materials released during facility operations. The FFA/CO divided WAG 3 into 13 OUs, with OU 3-13 intended to provide a comprehensive investigation of WAG 3. Figure 4-1 is a map of INTEC showing locations of OU 3-13 CERCLA sites. The OU 3-13 ROD was signed in October 1999 and established final remedies for perched water and most of the contaminated soil sites. OU 3-13 sites designated for remedial action were divided into the following groups:

- Group 1: Tank Farm Soils
- Group 2: Soils Under Buildings and Structures
- Group 3: Other Surface Soils
- Group 4: Perched Water
- Group 5: Snake River Plain Aquifer
- Group 6: Buried Gas Cylinders
- Group 7: SFE-20 Hot Waste Tank System.

However, data gaps and uncertainties associated with contaminant source estimates, the extent of contamination, potential releases from the tank farm soil, and site risk prevented the Agencies from reaching a final remedial decision on the former INTEC injection well, groundwater inside the INTEC security fence, and the tank farm soils. As a result, the Agencies created OU 3-14 to address the final action, while interim actions were implemented for tank farm soil and groundwater under the OU 3-13 ROD, which was signed in October 1999 (DOE-ID 1999a). The interim actions were designed to control the principal threat wastes at the tank farm site due to direct radiation exposure and due to potential leaching and transport of contaminants to the perched water or the SRPA. The interim actions were in place until the final remedy for these sites was selected and implemented as part of the OU 3-14 Remedial Investigation/Feasibility Study process. The OU 3-14 Remedial Investigation was performed during 2005–2006 to establish remedies for Group 1 (Tank Farm Soils) and Group 5 (Snake River Plain Aquifer), and the OU 3-14 ROD was signed in May 2007.

This section summarizes the combined remedial actions conducted under OU 3-13 and OU 3-14 and discusses activities performed at the ICDF, which is located at the southwest corner of INTEC. Because the ICDF plays a significant role in the disposal of contaminated materials from all CERCLA facilities at the INL Site, ICDF information is presented as a separate section in this chapter. Those sites where ICs comprise the only ongoing response are addressed in Section 10.5.

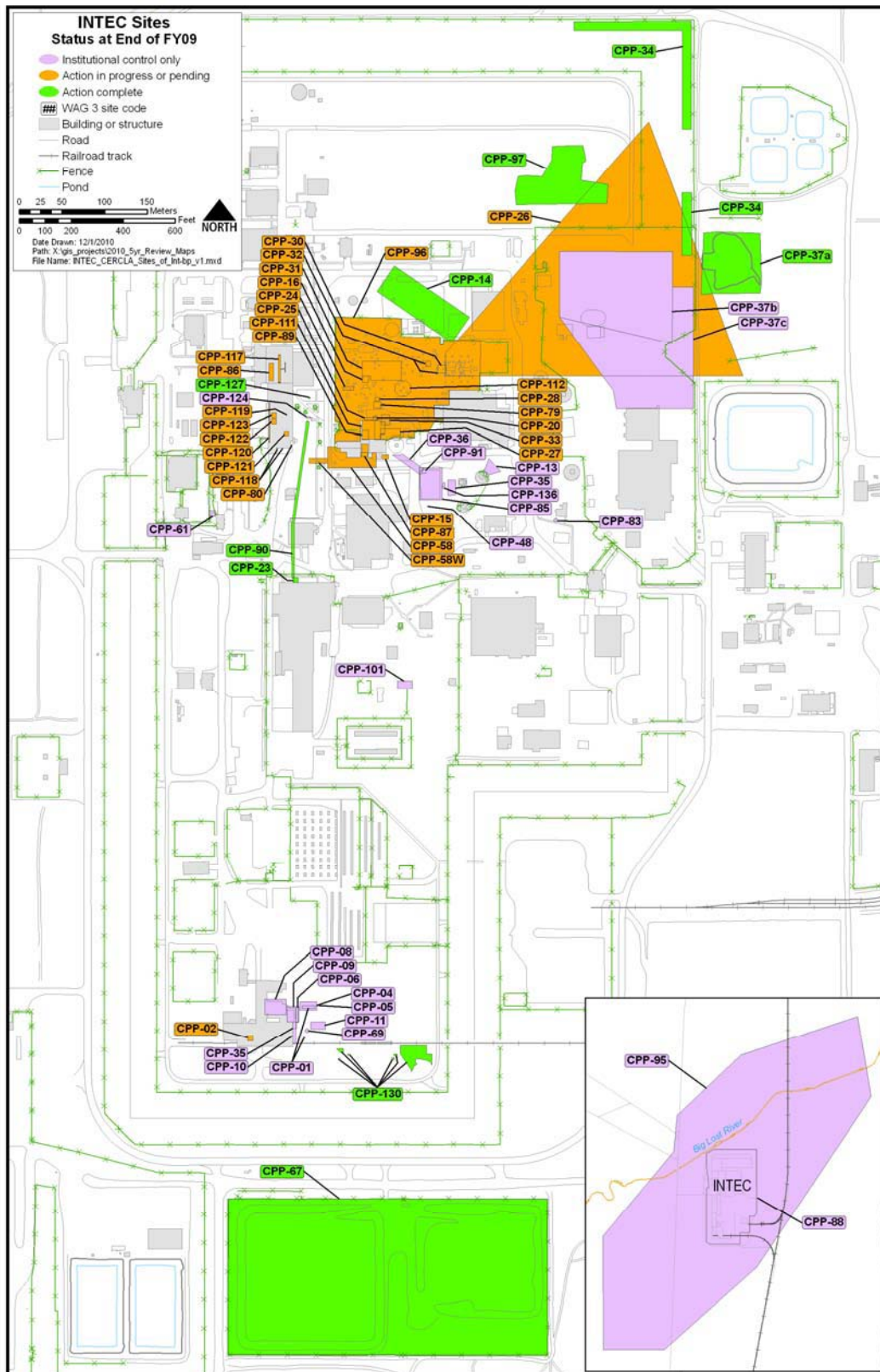


Figure 4-1. Comprehensive Environmental, Response, Compensation, and Liability Act sites at the Idaho Nuclear Technology and Engineering Center.

4.2 Site Chronology

The INTEC facility has been in operation since 1952. Nuclear research, storage of spent nuclear fuel, and reprocessing spent nuclear fuel for the recovery of enriched uranium were the plant's original missions. DOE phased out the reprocessing operations in 1992 and redirected the plant's mission to (1) receive and temporarily store spent nuclear fuel and other radioactive waste for future disposition, (2) manage current and past waste, and (3) perform remedial actions. Table 4-1 provides a chronology of significant documents and events for INTEC.

Table 4-1. Chronology of significant documents and events for the Idaho Nuclear Technology and Engineering Center.

Date	Document or Event
1992	Shut down ICPP fuel reprocessing operations
October 1999	<i>Final Record of Decision Idaho Nuclear Technology and Engineering Center, Operable Unit 3-13</i> (DOE-ID 1999a)
November 1999	Closed WCF under RCRA (42 USC § 6901 et seq.) and completed capping
September 2000	<i>Remedial Design/Remedial Action Work Plan for Group 1 Tank Farm Interim Action</i> (DOE-ID 2000a)
September 2000	<i>Monitoring System and Installation Plan for Operable Unit 3-13, Group 4, Perched Water Well Installation</i> (DOE-ID 2000b) (remedial action process for perched water began)
November 2000	<i>Monitoring System and Installation Plan for Operable Unit 3-13, Group 5, Snake River Plain Aquifer</i> (DOE-ID 2000c)
December 2000	Removed Group 6 gas cylinders from CPP-94
July 2002	"Interim Remedial Action Report for the WAG 3 OU 3-13, Group 1, Tank Farm Interim Action (Draft)" ^a
July 2002	<i>Monitoring System and Installation Plan for Operable Unit 3-13, Group 5, Snake River Plain Aquifer</i> (DOE-ID 2002a)
November 2002	Notice of Violation, based on incomplete tank farm interim action (Kreizenbeck 2002)
February 2003	Agency-approved tank farm interim action Agreement to Resolve Dispute (Bowhan 2003)
May 2003	Detected elevated Tc-99 concentrations in the SRPA
June 2003	<i>Remedial Design/Remedial Action Work Plan for the VES-SFE-20 Hot Waste Tank System</i> (DOE-ID 2003a)
September 2003	Resumed work on tank farm interim action; revised <i>Remedial Design/Remedial Action Work Plan for Group 1, Tank Farm Interim Action</i> (DOE-ID 2003b)
September 2003	ICDF opened (Drake and Edgett 2003)
September 2003	"Monitoring Report/Decision Summary for Operable Unit 3-13, Group 5, Snake River Plain Aquifer (Draft)" ^b
January 2004	<i>Explanation of Significant Differences for the Final Record of Decision for the Idaho Nuclear Technology and Engineering Center, Operable Unit 3-13</i> (DOE-ID 2004a)
February 2004	<i>Operable Unit 3-13, Group 3, Other Surface Soils Remediation Sets 1–3 (Phase I) Remedial Design/Remedial Action Work Plan</i> (DOE-ID 2004b)
June 2004	<i>Operable Unit 3-14 Tank Farm Soil and Groundwater Remedial Investigation/Feasibility Study Work Plan</i> (Rev. 1) (DOE-ID 2004c)
June 2004	<i>Action Memorandum for the Decontamination and Decommissioning of Building CPP-627, the Remote Analytical Facility</i> (DOE-ID 2004d)

Table 4-1. (continued).

Date	Document or Event
July 2004	<i>Remedial Design/Remedial Action Work Plan for Operable Unit 3-13, Group 6, Buried Gas Cylinders</i> (DOE-ID 2004e)
August 2004	Removed cylinders from CPP-84
December 2004	<i>Monitoring Report/Decision Summary for Operable Unit 3-13, Group 5, Snake River Plain Aquifer</i> (DOE-ID 2004f)
December 2004	<i>FY-04 Annual Operations Report for INTEC Operable Unit 3-13, Group 1, Tank Farm Interim Action</i> (DOE-ID 2004g)
January 2005	<i>Action Memorandum for the Non-Time Critical Removal Action at the CPP-603A Basins, Idaho Nuclear Technology and Engineering Center</i> (DOE-ID 2005a)
April 2005	Completed Phase I of SFE-20 tank remediation
June 2005	<i>Remedial Action Report for the Tank Farm Interim Action, WAG 3, OU 3-13, Group 1, Tank Farm Soils</i> (DOE-ID 2005b)
June 2005	<i>Remedial Action Report for Operable Unit 3-13, Group 6, Buried Gas Cylinders</i> (DOE-ID 2005c)
October 2005	<i>Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory</i> (DOE-ID 2007a) ^c
November 2005	<i>INTEC Water Balance Report for Operable Unit 3-13, Group 4, Perched Water</i> (DOE-ID 2005d)
April 2006	<i>Operable Unit 3-14 Tank Farm Soil and Groundwater Remedial Investigation/Baseline Risk Assessment</i> (DOE-ID 2006a)
May 2006	<i>Operable Unit 3-14 Tank Farm Soil and Groundwater Feasibility Study</i> (DOE-ID 2006b)
July 2006	<i>2005 Annual Operations Report for INTEC Operable Unit 3-13, Group 1, Tank Farm Interim Action</i> (DOE-ID 2006c)
July 2006	<i>Operable Unit 3-13, Group 3, Other Surface Soils Remediation Sets 4-6 (Phase II) Remedial Design/Remedial Action Work Plan</i> (DOE-ID 2006d)
October 2006	<i>Action Memorandum for General Decommissioning Activities under the Idaho Cleanup Project</i> (DOE-ID 2006e)
January 2007	<i>Final Removal Action Report for the CPP-603A Basin Facility</i> (DOE-ID 2007b)
February 2007	<i>2006 Annual Operations Report for INTEC Operable Unit 3-13, Group 1, Tank Farm Interim Action</i> (DOE-ID 2007c)
May 2007	<i>Record of Decision for Tank Farm Soil and INTEC Groundwater, Operable Unit 3-14,</i> (DOE-ID 2007d)
July 2007	<i>Operable Unit 3-13, Group 3, Other Surface Soils (Phase I) Remedial Action Report</i> (DOE-ID 2007e)
October 2007	<i>Monitoring Report/Decision Summary for Operable Unit 3-13, Group 4, Perched Water</i> (DOE-ID 2007f)
June 2008	<i>Operable Unit 3-14, Tank Farm Soil and INTEC Groundwater Remedial Design/Remedial Action Work Plan</i> (DOE-ID 2008a)
August 2008	<i>Action Memorandum for Decommissioning CPP-601/640 Fuel Reprocessing Facilities</i> (DOE-ID 2008b)
October 2008	Completed Phase II SFE-20 tank remediation
June 2009	<i>2008 Annual Report for Operable Unit 3-14, Tank Farm Soil and INTEC Groundwater</i> (DOE-ID 2009a)

Table 4-1. (continued).

Date	Document or Event
June 2009	<i>Operable Unit 3-13, Group 7, SFE-20 Hot Waste Tank System Remedial Action Report</i> (DOE-ID 2009b)
a. "Interim Remedial Action Report for the WAG 3 OU 3-13, Group 1, Tank Farm Interim Action (Draft)," DOE/ID-11007, Rev. 0, U.S. Department of Energy Idaho Operations Office, July 2002. b. "Monitoring Report/Decision Summary for Operable Unit 3-13, Group 5, Snake River Plain Aquifer (Draft)," DOE/ID-11098, Rev. 0, U.S. Department of Energy Idaho Operations Office, September 2003. c. Revision 0 of the 5-year review was completed in October 2005. Subsequent revisions did not affect analysis of the Idaho Nuclear Technology and Engineering Center. ICDF Idaho CERCLA Disposal Facility ICPP Idaho Chemical Processing Plant OU operable unit RCRA Resource Conservation and Recovery Act SRPA Snake River Plain Aquifer WAG waste area group WCF Waste Calcining Facility	

4.3 Background

4.3.1 Physical Characteristics

INTEC is in the south-central portion of the INL Site. The land surface is relatively flat at an elevation of approximately 4,910 ft (1,500 m). INTEC includes numerous buildings and structures within a double security fence that encloses approximately 200 acres.

The site is underlain by approximately 40 ft of gravelly alluvium overlying basalt bedrock. Perched water bodies have formed in the vadose zone in response to infiltration of precipitation and anthropogenic recharge from facility operations. The SRPA underlies the entire area and consists of thick sequences of water-saturated basalt flows, which are separated by thinner sedimentary interbeds. The depth to groundwater beneath the facility is approximately 137 m (450 ft).

The Big Lost River is the major nearby surface water feature, and the river channel passes within approximately 100 ft of the northwest corner of INTEC (see Section 4.12.4.2, Figure 4-23). The Big Lost River is an intermittent stream that flows northeastward through the INL Site to its terminus at the Big Lost River sinks, where the remainder of the water infiltrates into the ground. Peak river flows typically occur in summer due to snowmelt, and there is often no flow in the river at other times of year.

4.3.2 Land and Resource Use

Current land use at INTEC is limited to industrial use associated with INTEC's missions of storage and treatment of nuclear fuel and wastes, remediation of legacy contamination, and decommissioning of excess facilities. The Agencies have agreed that residential land use is not a reasonable or anticipated future use for the interior portion of INTEC that overlies the tank farm and closed facilities, such as the former Waste Calcining Facility. Therefore, an industrial use area has been established to include these areas (see Section 4.12.2.1, Figure 4-20).

In addition to limitations on future development imposed by anticipated physical characteristics, ICs will continue to be implemented at INTEC for as long as land use or access restrictions are necessary to protect human health and the environment. The use of ICs has been established in the OU 3-13 ROD to prevent exposure to contaminated groundwater and soil until the risks reach acceptable levels.

4.3.3 History of Contamination

Beginning in 1952, groundwater quality beneath and downgradient (south) of INTEC has been impacted by facility operations. The most significant water quality impacts resulted from the former INTEC injection well. The injection well (CPP-23) was routinely used to discharge INTEC service wastewater to the aquifer from 1952 to February 1984. It was taken out of service in 1984 after the percolation ponds opened. During its operation, the injection well constituted a source of low-level radioactivity to the aquifer (EDF-3943). The principal radionuclides of environmental significance discharged to the injection well were tritium, Sr-90, I-129, Cs-137, and Tc-99. By the early 1990s, low but detectable concentrations (below MCLs) of H-3, Cl-36, Tc 99, and I-129 derived from the injection well had reached the southern INL Site boundary some 8 miles south of INTEC (DOE-ID 2007f).

Perched water zones are present at various depths within the 460-ft-thick vadose zone beneath INTEC. The northern perched water system consists of the shallow and deep perched water zones. The shallow perched water system generally corresponds with the 110- and 140-ft sedimentary interbeds, while the deep perched water zone coincides with the 380-ft interbed. The perched water underlying INTEC does not currently pose a direct human health and/or environmental threat, nor is it used as a source of drinking water. Rather, the perched water exists primarily as a result of facility water use and discharges, and most of the perched water is expected to disappear when INTEC operations cease. However, because it is contaminated as a result of past releases, the perched water does pose a threat as a contaminant transport pathway to the SRPA, and radionuclides already in the perched water potentially constitute secondary source contaminants that could impact the underlying aquifer. The perched water contaminant of greatest environmental concern at INTEC is Sr-90, as discussed further in Section 4.12.4.4.

4.3.4 Initial Response

Several remedial actions were performed at INTEC prior to signing of the OU 3-13 ROD in 1999. Based on historical records, limited soil cleanup actions were performed during the 1950s through 1970s following various radionuclide releases in and around the tank farm (DOE-ID 2006a). Some of these soil removals were conducted to reduce radiation exposure for workers involved in adjacent tank farm upgrade projects.

Following increasing pressure from the State of Idaho to reduce adverse groundwater-quality impacts to the underlying aquifer, the INTEC injection well was taken out of service in 1984 and was subsequently plugged and abandoned in 1989 (DOE-ID 2004f). Since that time, wastewater from the facility has been discharged to percolation ponds.

Four polychlorinated biphenyl sites had undergone removal actions prior to the signing of the FFA/CO in 1991 (DOE-ID 1997a); these sites (CPP-49, -50, -51, and -61) composed OU 3-01. Four WAG 3 CERCLA removal actions were completed during the 1990s prior to signature of the OU 3-13 ROD. The contents of a buried acid pipeline were removed during summer 1993 at Site CPP-81. The pipe was cleaned but was left in place. A second removal action was performed in summer 1993 on Calcine Bin Set 3 to prevent precipitation run-off from migrating through soil that was previously contaminated by a calcine spill. The contaminated soil was removed and disposed of. A third removal action, completed in fall 1993, consisted of removing sludge from the Horizontal Filter Basin (CPP-740) and a dry well (CPP-301). The fourth removal action, completed in fall 1998, consisted of consolidating four Cs-137-contaminated soil stockpiles from INTEC into the Test Reactor Area (now the ATR Complex) Warm Waste Pond 1957 Cell. The stockpiles identified as Acid Recycle, New Control Room, Electrical Utility System Upgrade, and Irradiated Fuel Storage Facility all contained low-activity radionuclide-contaminated soil.

4.3.5 Basis for Taking Action

The FFA/CO designated INTEC as WAG 3 and required that the WAG 3 Comprehensive Remedial Investigation/Feasibility Study would be performed under OU 3-13 (DOE-ID 1991). A Baseline Risk Assessment performed for the OU 3-13 Remedial Investigation/Feasibility Study (DOE-ID 1997a) concluded that, without further action, WAG 3 sites posed an unacceptable risk to human health and the environment.

In 1997, the OU 3-13 Remedial Investigation/Baseline Risk Assessment was conducted to determine the comprehensive risks posed by past releases at WAG 3 (DOE-ID 1997a). That document addressed all known release sites, including those previously subject to Track 1 or Track 2 investigations. The OU 3-13 Baseline Risk Assessment concluded that remedial actions would be necessary at many of the sites to reduce risks to acceptable levels.

The OU 3-13 ROD (DOE-ID 1999a) evaluated 101 release sites at INTEC. Of these, 61 sites were determined to exhibit unacceptable risks to human health and the environment in the absence of any further remedial action. This ROD prescribed remedies for 55 sites under WAG 3, while assigning the remaining 6 sites to other WAGs or regulatory programs.

The OU 3-13 ROD had established final remedies for most soil sites and for the perched water. But, as a result of inadequate available information, the ROD contained only interim remedies for tank farm soils (OU 3-13, Group 1) and for INTEC groundwater (OU 3-13, Group 5). The Agencies determined that more information was needed before a final remedial decision could be reached for tank farm soils and SRPA groundwater. Therefore, OU 3-14 was created to conduct further investigations and select the final remedy for tank farm soil and INTEC groundwater, while interim actions continued to be implemented under the OU 3-13 ROD.

The OU 3-14 Remedial Investigation/Baseline Risk Assessment (DOE-ID 2006a) was a focused study designed to address data gaps that were identified during the previous OU 3-13 Remedial Investigation/Baseline Risk Assessment. The OU 3-14 Remedial Investigation/Baseline Risk Assessment included reassessment of contaminant source terms for tank farm release sites, limited field investigation at five of the most significant release sites, and updated vadose zone and groundwater contaminant transport modeling to assess present and future impacts on groundwater quality. The OU 3-14 Baseline Risk Assessment concluded that (1) tank farm soil release sites pose an unacceptable risk to workers from external exposure to Cs-137 and (2) additional remedial actions would be necessary to ensure that Sr-90 levels in groundwater fall below the MCL (8 pCi/L) by 2095.

The final remedy specified in the OU 3-14 ROD (DOE-ID 2007d) included remedial actions for tank farm soil and INTEC groundwater and no action for a group of sites outside the tank farm. In addition to groundwater monitoring and maintaining ICs, the selected OU 3-14 remedy included installing a low-permeability cover over the tank farm and the surrounding area (recharge control zone) and implementing additional recharge controls to reduce anthropogenic and stormwater recharge to the northern perched water zones. The OU 3-14 ROD superseded the OU 3-13 interim actions previously specified for Group 1 and Group 5.

4.4 Operable Unit 3-13, Group 1 – Tank Farm Soils

4.4.1 Background

Group 1, as defined in the OU 3-13 ROD, consists of sites located in the area of the tank farm (Sites CPP-16, -20, -24, -25, -26, -28, -30, -31, -32, and -79) and adjacent to the process equipment waste

evaporator building (Sites CPP-15, -27, -33, and 58), all of which were consolidated into Site CPP-96 (tank farm interstitial soils). A final remedial action selection decision for Group 1 was postponed to be developed following additional site characterization, risk analysis, and remedial alternative evaluation under a newly created OU (OU 3-14). An interim action was selected at the tank farm until a final decision was made by the Agencies. The remedy selected for the Tank Farm Interim Action (TFIA) consisted of ICs with surface water control.

The principal threats posed by tank farm soils are direct radiation exposure to workers or the public and the potential leaching and transport of contaminants to perched water or the SRPA. To implement the interim action remedy, the RD/RA Work Plan for the Group 1 TFIA (DOE-ID 2000a) was finalized and distributed to the Agencies in September 2000. The plan provided the framework for defining the remedial design requirements, preparing the design documentation, and defining and implementing the construction and operations phases of OU 3-13 TFIA that were to be performed at INTEC.

The design criteria for the remedial action were divided into three major components:

- Improving the storm water drainage system in and around the tank farm
- Installing a storm water evaporation pond to collect the storm water run-off
- Installing a surface seal over the unpaved surfaces within the tank farm and the majority of the unpaved surfaces within a 46-m (150-ft) control zone surrounding the tank farm.

Construction on the TFIA project began in October 2000 as per the design in the RD/RA Work Plan and continued until August 1, 2001, when, due to funding limitations, the subcontractor was directed to halt construction of the evaporation pond and leak detection system. Work continued on the storm water collection system to allow the project to be put into a safe condition. On November 29, 2001, the subcontractor demobilized and construction activities stopped.

The RD/RA Work Plan called for completing TFIA construction by September 28, 2001, and a draft remedial action report was to be completed and submitted by July 29, 2002. An extension was requested but was denied by the Agencies. In February 2002, work began on the remedial action report for the work completed. The document described the work performed as part of the TFIA, described the work outlined in the RD/RA Work Plan that had not been accomplished, and documented the current status of the project (Hain 2002). A draft of the document was completed in May 2002 and submitted to the Agencies for review. The Remedial Action Report was rejected and on December 4, 2002, a Notice of Violation and Penalty Assessment was delivered. The Notice of Violation alleged a violation of failing to submit the remedial action report for OU 3-13, Group 1, in accordance with the established deadline. Specifically, the Notice of Violation (Kreizenbeck 2002) alleged violations due to the failure to complete work as required under the RD/RA Work Plan for the Group 1 TFIA. Ensuing discussions resulted in the creation of an Agreement to Resolve Dispute (DOE 2003), which was transmitted to the Agencies on March 4, 2003 (Bowhan 2003). In this Agreement to Resolve Dispute, the following statements were agreed upon, altering the design of the selected remedy of the TFIA:

- Complete and put into operation the following work outside the tank farm fence: lining ditches, installing culverts, and lining the evaporation pond
- Place an infiltration barrier over the affected areas of release Sites CPP-28, CPP-31, and CPP 79 in the tank farm.

In March 2003, an agreement was reached among the Agencies on the areas that were to be covered outside the tank farm. A cover was not constructed over some of the areas outside the tank farm fence that were originally shown in the RD/RA Work Plan (DOE-ID 2000a) as to be covered. The

Agreement to Resolve Dispute (DOE 2003) did not require the entire tank farm surface inside the fence be covered. Therefore, some of the areas outside of the tank farm fence were not covered, as surface water infiltration will not be diverted to those areas. Also, some of these areas are small and do not impact the overall reduction of infiltration or are problematic and cannot be covered.

It was agreed that the RAOs of the TFIA would not be impacted by these modifications and the cover installed will accomplish the 80% reduction in surface water infiltration as required by the OU 3-13 ROD (DOE-ID 1999a).

In the Agreement to Resolve Dispute (DOE 2003), DOE-ID agreed to meet the intent of the TFIA by completing the action in two phases. Phase I of the interim action was completed before September 30, 2003, and included the following:

- Grading and lining with concrete all existing storm water collection ditches around the tank farm and out to the discharge point.
- Replacing existing culverts around the tank farm and out to the discharge point with larger culverts to accommodate the expected increase in storm water flow.
- Constructing a lift station at the intersection of Beech Street and Olive Avenue to pump storm water to a location where the water will drain freely to the discharge point.
- Constructing concrete headwalls and endwalls as necessary throughout the lined drainage system.
- Constructing a lined evaporation pond to collect storm water run-off from the tank farm and other INTEC areas. All drainage ditches within the scope of this project were routed to this basin.
- Constructing two concrete-lined ditches within the tank farm to collect and direct precipitation run-off to the surrounding storm water collection system.
- Constructing a new fence around the evaporation pond.

Phase II of the TFIA was completed by September 30, 2004, and required DOE-ID to place an infiltration barrier (asphalt) over the affected areas of the three principal soil contamination sites (CPP-28, CPP-31, and CPP-79). The purpose of Phase II was to meet the intent of the interim action, which is to reduce precipitation infiltration.

The details of the Agreement to Resolve Dispute and the description of Phase I and Phase II were included in a revised RD/RA Work Plan, which was completed and distributed in September 2003 (DOE-ID 2003b).

In the Agreement to Resolve Dispute, DOE-ID also agreed to revise the data quality objectives as a modification to the existing OU 3-14 Phase 1 Remedial Investigation/Feasibility Study Work Plan (DOE-ID 2000d). The revised Remedial Investigation/Feasibility Study Work Plan (DOE-ID 2004c) superseded the December 2000 Work Plan and the 1999 RD/RA Scope of Work (DOE-ID 1999b). In the Agreement to Resolve Dispute, the Agencies agreed to a planned date of December 31, 2006, for completion of an early OU 3-14 ROD. Appendix E of the Work Plan evaluated the feasibility of accelerating the ROD for tank farm soils and expediting a phased implementation of the permanent remedy. The Agencies agreed to refine the planned date for the OU 3-14 ROD after the revised data quality objectives were established (Section 3.3.1 of the Agreement to Resolve Dispute [DOE 2003]).

DOE-ID also agreed in the Agreement to Resolve Dispute to separate the nontank-farm soil components from the OU 3-14 Remedial Investigation/Feasibility Study (the former INTEC injection well [CPP-23] and three no action sites [CPP-61, -81, and -82]) and prepare a draft Explanation of

Significant Differences to the OU 3-13 ROD to address these components. The Explanation of Significant Differences, which was signed by the Agencies in 2004 (DOE-ID 2004a), transferred the injection well and three no action sites back to OU 3-13 and finalized the no action decision for the three sites [CPP-61, CPP-81, and CPP-82].

The Agreement to Resolve Dispute also states:

The Agencies agree to work collaboratively to expedite a phased implementation of the tank farm soil permanent remedy. The sequencing of tank closures and the schedule for tank farm soil remediation will be integrated to occur in stages. (DOE 2003)

Information from RCRA tank closures; INTEC waste operations; and decommissioning of tank farm infrastructure was included in the revised OU 3-13, Group 1 RD/RA Work Plan and was used to prepare the OU 3-14 RD/RA Work Plan in June 2008 (DOE-ID 2008a) to integrate the OU 3-14 remedy selection and implementation with these other tank farm activities.

4.4.2 Remedial Action

4.4.2.1 Remedy Selection

4.4.2.1.1 Remedial Action Objectives—The RAOs as defined in the OU 3-13 ROD for the TFIA are:

- Prevent exposure to contaminated surface soils
- Control surface water run-off
- Reduce surface water infiltration
- Implement ICs.

The following requirements were established for WAG 3, Group 1 in the OU 3-13 ROD:

- Restrict access to soils to control exposure to workers and prevent exposure to the public
- Reduce precipitation infiltration by 80% of the average annual precipitation at the site by grading and surface-sealing the tank farm soils
- Use surface water run-on diversion channels to accommodate a one-in-25-year, 24-hour storm event
- Improve exterior building drainage to direct water away from the contaminated areas
- Implement ICs to limit access and exposure duration at each source area.

However, the remedial action requirements were modified by the Agreement to Resolve Dispute. The requirement to reduce precipitation infiltration by 80% through the tank farm soils was modified to minimizing precipitation infiltration at selected areas (i.e., CPP-28, -31, and -79) sufficient to divert 80% of the average annual precipitation falling on these areas. The Agreement to Resolve Dispute also scaled back the initial RAO for Group 1 by dropping the requirement to collect roof run-off and reducing the area over the tank farm from which surface water was to be collected. The intent of the Agreement to Resolve Dispute was to complete Group 1 component installations and maintain them until a decision was reached on OU 3-14. The OU 3-14 remedial decision re-implemented all of the original Group 1 RAOs and added requirements (e.g., increased the 80% capture requirement to capture all precipitation, pave an entire recharge control zone, and install an evapotranspiration cap with capillary biobarrier over the tank farm).

4.4.2.2 Remedy Implementation. As of October 1, 2004, all remedy components were installed and operational. These components included:

- Storm water collection system
- Evaporation pond
- Grading and paving outside the tank farm
- Paving soil contamination sites CPP-28, CPP-31, and CPP-79 inside the tank farm and installing a drainage system from the pavement to the lined ditches along the perimeter of the tank farm.

The previous 5-Year Review discussed completion of the remedy component installations (DOE-ID 2007a). Component installation is documented in the Remedial Action Report for the OU 3-13 Group 1 TFIA (DOE-ID 2005b).

With the interim remedy components installed, the remedial actions include operation, maintenance, inspections, and reporting. For this 5-year review time period, the following notable remedial actions have been completed:

- August 2005 – The hatch cover over the storm water drainage system’s lift station was replaced due to the discovery of broken welds within the door’s support framing. A precast reinforced concrete lid was fabricated and installed that incorporated a new double-leaf aluminum access cover and was designed to meet American Association of State Highway and Transportation Officials H-20 loading requirements.
- March 2006 – The leak detection control panel at the evaporation pond was rewired to prevent the hour meter from recording a false pump-demand condition if the pump fuse was blown.
- June 2006 – Approximately 68 ft of concrete lining a drainage ditch west of the tank farm (along Beech Street) was replaced due to surface spalling. The remedial action’s original design for concrete ditch installation was followed for the replacement work. One expansion joint was repaired.
- June 2006 – A concrete header wall in the storm water drainage system north of the tank farm was repaired after being hit by a vehicle.
- August 2006 – The asphalt over a 130-ft² area east of CPP-630, within the remedy’s 150-ft control zone was removed during a facility-directed excavation to repair a fire water main. The asphalt was replaced upon completion of the repair work.
- July 2006 – A spare pump for the lift station was added to the remedy’s parts inventory as required by the project O&M plan.
- October 2006 – Water in the evaporation pond was found to be leaking between the pond’s corrugated metal pipe inlet and the liner boot, allowing the water to flow between the two liners and enter the sump where it was pumped back into the evaporation pond. The failed seal between the corrugated metal pipe and the high-density polyethylene boot was disassembled, a coating of neoprene material was applied, and the seal reassembled.
- Annual system checks were performed to test the operability of the lift station beneath Olive Avenue and the leak detection system at the evaporation pond as required by the O&M plan.
- Quarterly remedy component inspections were performed as required by the O&M plan.

4.4.2.3 Operations and Maintenance. The O&M of the components installed under the TFIA were transferred to the OU 3-14 selected remedy upon finalization of the OU 3-14 Tank Farm Soil and INTEC Groundwater RD/RA Work Plan in June 2008 (DOE-ID 2008a). This transfer closed out Group 1. Remedial actions are currently being performed under OU 3-14.

4.4.3 Progress Since the Last Review

No issues pertaining to OU 3-13 Group 1 were identified in the previous 5-year review.

4.4.4 Data Review and Evaluation

The following subsections summarize monitoring results and site inspections.

4.4.4.1 Groundwater Monitoring. Refer to Sections 4.9 and 4.12.4.1 for discussion of groundwater monitoring at INTEC.

4.4.4.2 Vadose Zone Monitoring. Refer to Sections 4.8 and 4.12.4.4 for discussion of perched water monitoring at INTEC.

4.4.4.3 Site Inspections. Inspections of the installed interim remedy components were performed quarterly as required in the OU 3-13 O&M Plan (DOE-ID 2006f). Results of the inspection were reported in annual operations reports listed in Table 4-2.

Table 4-2. Inspection time periods and reference documents.

Time Period	Document Containing Inspection Results
October–December 2005	<i>2005 Annual Operations Report for INTEC Operable Unit 3-13, Group 1, Tank Farm Interim Action, Rev. 1 (DOE-ID 2006c)</i>
January–December 2006	<i>2006 Annual Operations Report for INTEC Operable Unit 3-13, Group 1, Tank Farm Interim Action, Rev. 0 (DOE-ID 2007c)</i>
January–December 2007	<i>2007 Annual Operations Report for INTEC Operable Unit 3-13, Group 1, Tank Farm Interim Action, Rev. 0 (DOE-ID 2008c)</i>
January–September 2008	<i>2008 Annual Report for Operable Unit 3-14, Tank Farm Soil and INTEC Groundwater, Rev. 0 (DOE-ID 2009a)</i>

Items of significance were noted during the inspections. In general, the inspection results helped ensure the installed remedy components functioned as designed.

Monitoring data were collected during quarterly inspections to evaluate the performance of the leak detection system at the evaporation pond. The following data were recorded:

- Hour meter reading (records the amount of time the sump pump operated)
- Water-level reading (displays the level of water in the leak detection sump during the inspection)
- Totalizer readings (records cumulative gallons of water pumped from the leak detection sump and into the evaporation pond) on both the day of the inspection and the following day
- Estimated surface area of pond bottom covered with water.

The evaporation pond consists of two high-density polyethylene liners with a collection sump between the liners. The leak detection system is used to evaluate the integrity of the top liner by measuring the amount of water that seeps through the top liner and enters the sump. Water that enters the sump is pumped out and returned to the pond. Data are collected to measure a leak rate (gallons per day). In accordance with the TFIA O&M Plan, no action is required for leak rates lower than 6,018 gal/day. The collected and calculated data to determine the evaporation leak rate are contained in Table 4-3. As shown, the highest leak rate calculated during the reporting time period was 38 gal/day on March 24, 2008.

Table 4-3. Summary of monitoring data collected and calculated during remedy component inspections at the evaporation pond.

Inspection Date	Hour Meter (hour)	Water Level in Sump (in.)	Totalizer Day 1 ^a (gal)	Totalizer Day 2 ^a (gal)	Totalizer Difference (gal)	Estimated Surface Area of Water (ft ²)	Pond Bottom Covered ^b %	Leak Rate ^c (gal/day)
3/31/05	5.3	10.7	3,947.1	3,947.1	0	77,760	100	0
4/22/05	722.5	16.5	4,079.2	4,079.2	0	77,760	100	0
9/07/05	2,571.3	17.5	4,079.2	4,079.2	0	25,661	33	0
10/05/05	3,243.1	17.4	4,079.2	4,079.2	0	38,880	50	0
3/22/06	5,379.8	11.5	6,166.5	6,166.5	0	(Snow-covered)	NA ^d	0
5/17/06	5,422.1	13.7	34,630.7	34,630.7	0	76,989	100	0
9/6/06	5,422.3	13.9	34,783.8	34,783.8	0	66,980	87	0
10/16/06	5,422.3	14.1	34,783.8	34,783.8	0	70,830	92	0
2/6/07	5,422.5	14.2	34,925.7	34,925.7	0	71,600	93	0
5/9/07	5,422.5	13.7	34,926.0	34,926.0	0	73,140	95	0
8/29/07	5,422.7	9.8	35,068.7	35,068.7	0	20,790	27	0
11/15/07	5,422.7	9.9	35,068.8	35,068.8	0	50,040	65	0
3/24/08	5,423.4	11.3	35,567.2	35,601.2	34	69,290	90	38
6/2/08	5,424.1	9.7	35,994.4	35,994.4	0	65,441	85	0
8/26/08	5,424.2	9.3	36,020.6	36,020.6	0	6,159	8	0
11/06/08	5,424.2	9.3	36,020.6	36,020.6	0	28,486	37	0
3/24/09	5,426.7	12.6	37,650.0	37,650.0	0	76,989	100	0
6/09/09	5,426.7	14.8	37,650.0	37,650.0	0	76,989	100	0
9/03/09	5,426.9	13.1	37,794.3	37,794.3	0	65,441	85	0
a. The leak rate calculation requires the inspector to record totalizer readings once per day over two consecutive days. "Day 1" is the first day of the inspection visit, and "Day 2" is the second. b. Bottom surface area of the evaporation pond is 76,989 ft². c. Leak rate = (totalizer reading Day 2 – totalizer reading Day 1)/percent of pond bottom covered by water. d. Not applicable.								

4.4.5 Technical Assessment

The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. The remedy is functioning as intended. The asphalt cover and drainage improvements have been installed to reduce infiltration of precipitation. O&M procedures are in place to routinely inspect the cover and implement repairs as necessary. The ICs and the Notice of Soil Disturbance process are effectively preventing unauthorized intrusion into the tank farm soil. It should be noted that the interim action established in the OU 3-13 ROD has now been superseded by the final remedy for tank farm soils, as specified in the OU 3-14 ROD.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Yes. The OU 3-13 Group 1 ROD determination is an interim action. Subsequently, the OU 3-14 Remedial Investigation/Feasibility Study evaluated alternatives for a final action for tank farm soils. RAOs used for selecting the interim action remedy did not change.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

Technical Assessment Summary

The TFIA remedy for Group 1 installed and operated improvements to control surface water infiltration in and around the INTEC tank farm. In addition, ICs were maintained, and inspections and required maintenance were performed until June 2008 when the OU 3-14 RD/RA Work Plan was finalized and the TFIA components were incorporated into the OU 3-14 selected remedy.

4.4.6 Issues

None.

4.4.7 Recommendations and Follow-Up Actions

Because no issues were identified, recommendations and follow-up actions are not required.

4.4.8 Protectiveness Statement for Operable Unit 3-13, Group 1

The remedy at OU 3-13 Group 1 is expected to be protective of human health and the environment upon completion of the OU 3-14 response. All of the OU 3-13, Group 1 interim remedial actions have been completed.

4.5 Operable Unit 3-13, Group 2 – Soils Under Buildings and Structures

4.5.1 Background

Group 2 – Soil under Buildings and Structures, comprises release sites where contaminated soil is present under existing buildings or structures. From the OU 3-13 ROD, the original Group 2 sites

included CPP-02, CPP-41a, CPP-60, CPP-68, CPP-80, CPP-85, CPP-86, CPP-87, and CPP-89. These sites consist of soil contamination that resulted from past hazardous or radioactive liquid spills, leaks, and plant operations. The selected remedy for Group 2 was ICs and soil excavation or capping. Because the buildings and structures tend to limit infiltration, soil excavation and capping activities have been deferred until the buildings and structures are closed, decontaminated, and dismantled. ICs have been established and maintained in the interim.

In September 2009, the potential new site CPP-135 was identified. This site consists of radionuclide-contaminated soil adjacent to the east side of Building CPP-603. During CERCLA cleanup activities conducted in 2008 at Sites CPP-01, CPP-09, and CPP-10, soil contamination was found adjacent to the east side of Building CPP-603. Site remediation activities removed contaminated soil from Sites CPP-09 and CPP-10, which were north and east of Building CPP-603, and Site CPP-01, which was east of Building CPP-603; however, the soil next to the building was left in place at a slope of 1:1.5 (rise over run) to avoid compromising the integrity of the foundation and to avoid an active 8-in.-diameter fire water line running parallel to the building. The potential new site was documented in NSI-25258 (Fulton 2009) with the recommendation that remedial action be performed under the existing OU 3-13 ROD, Group 2, and that ICs be established.

4.5.2 Remedial Action

4.5.2.1 Remedy Selection

4.5.2.1.1 Remedial Action Objectives—Remediation goals for OU 3-13 Group 2 soils under buildings and structures, for the period before decommissioning, are to prevent exposure to current workers and nonworkers and to minimize possible leaching and transport of contaminants to the underlying SRPA. The remediation goals for the post-decommissioning period are to prevent exposure to future workers and residents and to minimize possible leaching and transport of contaminants to the underlying SRPA.

The OU 3-13 ROD specified the following RAOs for Soils under Buildings and Structures (Group 2):

- Prevent exposure to contaminated surface soils at each release site such that for all surface exposure pathways, a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1 are not exceeded at each release site. These RAOs also address no further action sites where the current radiological contaminant levels will meet the residential risk-based concentration on or before the year 2095.

4.5.2.1.2 Cleanup Levels—The selected remedy for Group 2 sites is:

- Implement ICs to limit access and exposure duration at each source area to achieve a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1.
- Remove contaminated soil at each source area sufficient to achieve a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1 to a future residential user or cap in place contaminated soil or debris areas presenting a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1.
- Maintain caps for contaminated soil areas that are contained in place to prevent exposure of the public to a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1.

4.5.2.2 Remedy Implementation. Group 2 is not and will not be an active remedial action project. Instead, it relies on actions by other projects to implement the group's selected remedy for the Group 2 sites.

CPP-41A—This site was transferred to Group 3 as described in the OU 3-13, Group 3, Other Surface Soils, Prioritization, and Site Grouping Report (DOE-ID 2002b) in July 2002. Site CPP-41A, located northwest of Building CPP-663, measures approximately 12 × 10.7 m (40 × 35 ft). Here, oils and organic materials were placed in metal drip pans and ignited for fire brigade members to practice extinguishing the blaze. The site is currently covered by asphalt and is sufficiently close to Building CPP-663 that it is suspected the location of CPP-41A was completely excavated during the construction of Building CPP-663 in 1980. In the OU 3-13, Group 3, Other Surface Soils Remediation Phase II RD/RA Action Work Plan (DOE-ID 2006d), this site was re-evaluated and determined to not contain any COCs above remediation goals and was not a threat to human health. The document also determined that no remediation/excavation was required and that Site CPP-41A was to become a no action site.

CPP-60—CPP-60 was located where a small cinder block building (CPP-615) once stood on a concrete pad. The building was the Chemical and Hazardous Material Storage Building where grease, solvents, and paints were stored. The building was constructed in 1953–1954 and demolished in 1976 in preparation for the construction of the new quality assurance building (CPP-645). The construction area of CPP-645 completely engulfed the footprint of CPP-615.

Site CPP-60 was listed as a Group 2 site in the OU 3-13 ROD (DOE-ID 1999a) due to its existence under Building CPP-645. However, Building CPP-645 was scheduled for decommissioning during the same timeframe as the Group 3, Phase II, soil sites remediation schedule. Therefore, it was included in the WAG 3, Group 3, Phase II, Work Plan. The OU 3-13 ROD established remediation goals to be accomplished for Group 2 sites, divided between pre-decommissioning and post-decommissioning. Pre-decommissioning goals were met (e.g., maintaining the building to minimize moisture infiltration and unacceptable exposure to current workers). Building CPP-645 was removed in 2008. Post-decommissioning remediation goals for this site were met by addressing this site under the CERCLA remedial action pathway (i.e., including it in this Work Plan) as allowed under the direction of OU 3-13 Group 2 Closure Evaluation Criteria and Checklist (DOE-ID 2000e).

Upon removal of the building, the former location of CPP-60 was examined. Information from DOE-ID (2009c) stated:

No evidence of contamination was found, providing confirmation of the earlier records that no physical evidence, no documentation, and no interviews with site workers provided any indication that a release ever occurred at this site beyond suggesting that the possibility may have existed.

Based on the lack of evidence of contamination, no action was required.

CPP-68—Site CPP-68 is the abandoned gasoline tank area located northwest of Building CPP-606. The 1,893-L (500-gal) underground tank (CPP VES-UTI-652) was taken out of service in June 1983 and removed in September 1986. During the exhumation of the tank, there was no visual evidence that the tank had leaked and there are no operating records prior to 1983 or records of spills associated with the operation of the tank. Soil was collected at the site for analysis in 1986 and sample results indicated only trace amounts of gasoline constituents at concentrations within acceptable levels (low concentrations of decane, benzene, toluene, and 3-methyl 2-pentanone). The remedial action decision for CPP-68 was to be documented in a RD/RA Work Plan per the OU 3-13 ROD. Since a Group 2 RD/RA Work Plan was not to be written, this site was added to the list of Group 3, Phase II, sites to be discussed in the Group 3 RD/RA Work Plan (DOE-ID 2006d). Under this Work Plan it was determined

that the tank did not appear to have leaked and no Group 3 contaminants of potential concern were detected or suspected of being present at this site; therefore, remedial action was not required for the site and it was deemed a no action site. This decision was documented in the OU 3-13, Group 3, Phase II Remedial Action Report (DOE-ID 2009c).

CPP-80—Site CPP-80 is located in the lowest-level, southeast corner of Building CPP-601 and was the result of a hazardous radioactive liquid condensate leak from the building's vent tunnel drain. This site was capped during the grouting of the CPP-601 basement, meeting the remedial action requirements for this Group 2 site. ICs remain in place for this site.

CPP-85—CERCLA site CPP-85 is the Waste Calcining Facility blower corridor that runs along the outside of the former Waste Calcining Facility. The Agencies agreed that the blower corridor would be closed in place by grouting along with the Waste Calcining Facility closure project. The post-closure monitoring and maintenance requirements were addressed in the OU 3-13 ROD (DOE-ID 1999a), which required that the Waste Calcining Facility be included in the 5-year review. DEQ has since required that post-closure care of the Waste Calcining Facility be conducted under the Hazardous Waste Management Act/RCRA program (HWMA 1983; 42 USC § 6901 et seq.) rather than CERCLA. Subsequently, DOE-ID submitted a Hazardous Waste Management Act/RCRA post-closure permit application that was approved by the State of Idaho (DEQ 2003). The post-closure permit requires periodic inspection and monitoring of the Waste Calcining Facility cap and routine monitoring of the groundwater. As an OU 3-13 Group 2 site, this action is consistent with the remediation goals for the post-decommissioning period to prevent exposure to future workers and residents and to minimize possible leaching and transport of contaminants to the underlying SRPA. ICs remain in place for this site.

CPP-117—The CPP-602 waste collection system resulted in contamination from liquid leaks falling onto the CPP-602 basement floor (pipe leakage, careless cleaning, fire sprinkler water, and rainwater infiltration into the building). CPP-117 included these leaks and any other releases that would have been associated with the CPP-602 laboratory process equipment waste collection piping that drained into the CPP-602 waste trench. The effects of the releases were discovered in 1989, some time after the releases occurred. Estimates indicated release of approximately 1.39 Ci of radionuclides at CPP-117, with Cs-137 and Sr-90 making up most of the activity (ICP 2006a). The CPP-602 waste trench sump was previously designated CPP-86. Soil samples collected beneath the sump floor were found to contain detectable concentrations of metals but were below regulatory action levels. Samples for radiological analyses were not collected. While the CPP-86 site originally focused on the LC-107 sump, the CPP-117 site encompassed the entire CPP-602 waste trench and the buried lines that fed into it. Additional details regarding this CERCLA site are summarized in ICP (2006a).

It was determined that no remediation or excavation was required. This site will be capped during the grouting of the CPP-602 basement trench, meeting the remedial action requirements for this Group 2 site. ICs remain in place for this site.

CPP-118—The CPP-118 site is located at the south end of CPP-601 near the building centerline, near the bottom of the process equipment waste tank vaults. CPP-118 was contaminated at some time during the early 1980s, when the process equipment waste tank vaults were twice flooded with solution deep enough so that liquid entered the unlined concrete ventilation ducts serving the tank vaults. Some amount of liquid probably entered the soil, because the ducts, which are cast onto the outside of the south wall of the tank vaults with cold concrete joins, were not designed to contain liquid. Applying the typical deep tank process equipment waste composition for the early 1980s to the liquid released at CPP-118 results in a loss of 0.152 Ci (Cs-137, Sr-90, H-3, Tc-99, and I-129) (ICP 2006a).

It was determined that no remediation or excavation was required. This site was capped during the grouting of the CPP-601 basement, meeting the remedial action requirements for this Group 2 site. ICs remain in place for this site.

CPP-119—The CPP-119 release site is located in the CPP-602 building under the P-cell floor at approximately 32 ft below ground level. Condensate from a second-cycle product evaporator (P-110) located in the P-cell was discharged to a 2-in. stainless steel drain line (2”P-1138C) that directed the waste to the WH/WG deep process equipment waste tanks in CPP-601. Examination of the vertical run portion of the drain line with a borescope camera found that the weld roots were corroded, and one weld appeared not to have been completed, showing evidence of three tack welds, but no circumferential welding. Solutions, primarily condensate from the evaporator, were directed down the line, a portion of which was released to the soil surrounding the unfinished weld. Approximately 17.2 μ Ci was estimated to have been released, principally Cs-137, Sr-90, Tc-99, and I-129 (ICP 2006a). ICs remain in place for this site.

CPP-120—The CPP-120 site is located under the CPP-601 West Vent Tunnel (WJ) from just north of the junction with the CPP-640 Vent Tunnel (HV) to the junction with the South Vent Tunnel (VT). The CPP-120 site had a series of potential releases from failed waste piping under the vent tunnel. Valve and piping failures in the West Vent Tunnel released contaminated liquids to the vent tunnel floor that could reach the soil via cold joints at the edges of the floor slab. The total radioactivity of the liquids released amounts to 148 Ci, primarily Cs-137 and Sr-90 (ICP 2006a). ICs remain in place for this site.

CPP-121—The CPP-121 site is located under M-cell of the CPP-601 building. A small hole in the M-cell floor liner approximately 3 in. above the floor was identified when the floor was flooded with water during performance of criticality safety tests prior to the first use of M cell in 1983. While there are no events identified that would have subsequently flooded M-cell to this level, during cell decontamination activities, small amounts of radioactive materials could have been forced into this hole. The volume of process solution that entered the subliner space was conservatively estimated at 0.25 gal. ICs remain in place for this site.

CPP-122—The CPP-122 site is located under E-cell of the CPP-601 building. During the 1980–1981 zirconium and coprocessing fuel dissolution campaigns, a release of dissolver product created pinhole leaks in the floor liner. Attempts were made in May 1986 to decontaminate the liner using heated nitric acid on the cell floor (depth of 6 to 12 in. for a period of 2 weeks). This effort would have also released these materials to the concrete under the liner, where they could reach the soil via cold joints at the edges of the slab. The total radioactivity of the liquids released was 77 Ci, primarily Cs-137 and Sr-90 (ICP 2006a). ICs remain in place for this site.

CPP-123—The CPP-123 site is located under F-cell of the CPP-601 building. During the 1980–1981 zirconium and coprocessing fuel dissolution campaigns, a release of highly contaminated E-DOG scrubber solution occurred from the E-DOG scrubber pumps located in F-cell. The leak caused very high beta radiation fields in F-cell that were controlled by flooding the cell floor with water. Some of this water leaked under the stainless steel floor liner through an unsealed hole for a bolt that secured the cell ladder to the floor, carrying some of the highly radioactive waste with it. The liquid under the liner resulted in a 5-R/hour gamma field in the lower portions of the cell near the sump. Some of this liquid might have been released to the soil at cold joints around the edges of the floor slab. An attempt to flush the subliner space during 1991 might have forced additional waste into the soil. Conservative estimates place the volume of the leak at 310 gal and the radionuclides at 200 Ci (Cs-137 plus Sr-90) (ICP 2006a). ICs remain in place for this site.

4.5.2.3 Operations and Maintenance. ICs are currently in place for Group 2 sites under the requirements of the IC/O&M Plan (DOE-ID 2010a). The OU 3-14 ROD states that the OU 3-13, Group 2 sites within the industrial land use area will be addressed under OU 3-13 in accordance with the process identified in the OU 3-13 Group 2 Closure Evaluation Criteria and Checklist (DOE-ID 2000e) using the OU 3-14 remediation goals for soil in the industrial use area. This includes those sites under Buildings CPP-601 and CPP-602 (CPP-80, -117, -118, -119, -120, -121, -122, and -123). The OU 3-13 ROD states that Group 2 soils are remedial action sites where the remedial action is delayed until the building is removed. Both CPP-601 and CPP-602 are presently undergoing decommissioning, with parts of the buildings being removed. All of the contaminated soils beneath those two buildings are greater than 3 m (10 ft) below surrounding grade. The contaminants have been assessed and have been determined to not present an unacceptable threat to groundwater (EDF-8293). Therefore, upon completion of these decommissioning activities, the OU 3-13 Group 2 sites beneath these buildings should be transitioned from Group 2 remedial action sites to no further action sites. This should be documented in the applicable removal action report or completion report.

Pending building removal, the drainage from buildings on or near Group 2 sites was evaluated in accordance with the Drainage Evaluation Plan for Group 2—Soils under Buildings and Structures for OU 3-13 (DOE-ID 2000f). The Drainage Observation Report for OU 3-13 (DOE-ID 2000g) and the Drainage Inspection Report/Long-Term Drainage Maintenance Plan for OU 3-13 (DOE-ID 2001a) identified corrective measures for the CPP-80, CPP-87, and CPP-89 sites. At CPP-80, a deteriorated seal in a foundation expansion joint was repaired in June 2001. Paving for CPP-87 and CPP-89 was deferred, as agreed upon by the Agencies in accordance with the Final Original Agreement to Resolve Dispute for OU 3-13 (Bowhan 2003) and ensuing RD/RA Work Plan (DOE-ID 2003b).

4.5.3 Progress Since the Last Review

No issues pertaining to OU 3-13 Group 2 were identified in the previous 5-year review.

4.5.4 Data Review and Evaluation

The following subsections summarize monitoring results and site inspections.

4.5.4.1 Groundwater Monitoring. Refer to Sections 4.9 and 4.12.4.1 for discussion of groundwater monitoring at INTEC.

4.5.4.2 Vadose Zone Monitoring. Refer to Sections 4.8 and 4.12.4.4 for discussion of perched water monitoring at INTEC.

4.5.4.3 Site Inspections. Inspections for Group 2 sites (including signage) are performed under the requirements of the IC/O&M Plan (DOE-ID 2010a), and results are reported in the annual IC report (e.g., RPT-544). No other actions are performed for Group 2 sites.

4.5.5 Technical Assessment

The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. The remedy consists of ICs with containment. The ICs have restricted access to the contaminated soils. The annual IC inspections have revealed no significant deficiencies that would impact human health or the environment.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Yes. The exposure assumptions, toxicity data, cleanup levels, and RAOs are still valid.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No. There is no new information that would call the protectiveness of the remedy into question.

Technical Assessment Summary

Final remedial actions for Group 2 Sites CPP-41A, -60, -68, and -80 are complete. Final remedial actions for the remaining Group 2 sites are deferred until the buildings and structures are closed and decommissioning has been completed. ICs and the soil disturbance process are in place and prevent inadvertent intrusion into the Group 2 sites.

4.5.6 Issues

No issues were identified for Group 2 sites.

4.5.7 Recommendations and Follow-Up Actions

Because no issues were identified, recommendations and follow-up actions are not required.

4.5.8 Protectiveness Statement for Operable Unit 3-13, Group 2

The remedy at OU 3-13 Group 2 is expected to be protective of human health and the environment upon completion, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled. Group 2 sites compose a deferred action that consists of implementing ICs and soil excavation and capping. The remedy associated with these sites is functioning as intended in the decision document.

4.6 Operable Unit 3-13, Group 3 – Other Surface Soils (Phase I)

Sets 1, 2, and 3 for Phase 1 are given below (DOE-ID 2002b)::

Remediation Set 1

- CPP-92, soil boxes west of CPP-1617 (boxes of soil and debris in the Storage and Staging Annex)
- CPP-97, soil stockpiles
- CPP-98, tank farm shoring boxes (boxes of debris in the Storage and Staging Annex)
- CPP-99, boxed soil (boxes of soil and soil and debris in the Storage and Staging Annex).

Remediation Set 2

- CPP-37B, gravel pit and debris landfill inside INTEC fence (Gravel Pit #2)
- CPP-37C, contamination discovered southeast of CERCLA Site CPP-37B (new site adjacent to Gravel Pit #2)

Remediation Set 3

- CPP-03, temporary storage area southeast of CPP-603

- CPP-34A/34B, soil storage areas (disposal trenches) in the northeast corner of INTEC
- CPP-37A, gravel pit—outside INTEC fence (Gravel Pit #1)
- CPP-67, percolation ponds 1 and 2.

4.6.1 Background

4.6.1.1 Remediation Set 1. The information below describes Remediation Set 1.

Site CPP-92, Soil Boxes West of CPP-1617—Site CPP-92 comprised containerized waste located in the southwest portion of INTEC. This site consisted of 648 boxes containing soil (i.e., 567 boxes) and soil and debris (i.e., 81 boxes) that were generated from various INTEC plant projects, including:

- Tank farm upgrade
- Various CERCLA remediation projects
- Building CPP-603 cleanup
- Construction of the emergency fire exit tunnel for Building CPP-604/605 (Site CPP-89); excavated soil was part of the tunnel excavation just south of and under CPP-604
- Miscellaneous soil excavations at INTEC where soil contamination was encountered
- Cleanup of soil and debris at Site CPP-17. Site CPP-17 was divided into CPP-17A and CPP-17B. These sites were used for storing piles of soil and debris that reportedly came from various construction and maintenance activities within INTEC.

CPP-97, Tank Farm Soil Stockpile—Site CPP-97, located in the northeast portion of INTEC, included two tarp-covered soil stockpiles and the contaminated surface soil surrounding those piles. The piles were generated from waste soil that originated from the Tank Farm Upgrade Project conducted in 1993, 1994, and 1995. One pile contained approximately 1,093 m³ (1,430 yd³) of radionuclide-contaminated soil. The second soil stockpile contained approximately 53 m³ (70 yd³) of radionuclide-contaminated soil. This upgrade project was divided into five areas within the INTEC tank farm. Areas 1, 2, and 3 are located on the north end of the tank farm. Area 4 is located on the west side, with Area 5 on the south side. Process knowledge indicated no known leaks of radioactive contamination from process lines and no environmentally controlled areas within Areas 1–4. Any potential contamination would have resulted from the tank farm; therefore, I-129 was not expected to be present at detectable concentrations. Soil from these areas went to the larger, lower-level contamination stockpile. Contamination in Area 5 was attributed to leaks from process lines identified as environmentally controlled areas and from releases associated with Waste Calcining Facility condensate. Soil from Area 5 could potentially contain I-129. Soil from this area was placed in the second, smaller stockpile.

Physical boundaries of Site CPP-97 were well defined. Radiological surveys defined the lateral extent of radiological contamination in the area surrounding the piles.

CPP-98, Tank Farm Shoring Boxes—Site CPP-98 comprised containerized waste consisting of 119 boxes of debris located in the southwest portion of INTEC, west of CPP-1617. These boxes contained wooden shoring used during the Tank Farm Upgrade Project. The OU 3-13 ROD identified that CPP-98 had 118 boxes (DOE-ID 1999a). However, Waste Generator Services used the Integrated Waste Tracking System and a physical inventory and identified 119 boxes. Because the tank farm soil was contaminated, the shoring also became contaminated and was placed into 0.6- × 1.2- × 1.2-m (2- × 4- × 8-ft) and 1.2- × 1.2- × 2.4-m (4- × 4- × 8-ft) wooden waste boxes lined with a polyethylene membrane.

CPP-99, Boxes Soil—Site CPP-99 comprised a group of boxes located in the southwest portion of INTEC, west of CPP-1617, in the Staging and Storage Annex. This site consisted of 58 boxes containing radionuclide-contaminated soil (i.e., 14 boxes), soil and debris (i.e., 43 boxes), and unknown contents (i.e., 1 box) generated from the Tank Farm Upgrade Project and CPP-604/605 Emergency Fire Tunnel Excavation Project. The OU 3-13 ROD (DOE-ID 1999a) identified 59 boxes; however, Waste Generator Services used the Integrated Waste Tracking System and a physical inventory and identified only 58 boxes. The boxes were wooden waste boxes lined with a polyethylene membrane.

Soil data from Sites CPP-97 and CPP-92 were assumed to be representative of Site CPP-99. Data also were available for excavated soil from the excavation for the fire exit from Building CPP-604/605 (Site CPP-92) and were assumed to be representative of Site CPP-99, as well.

4.6.1.2 Remediation Set 2. The information below describes Remediation Set 2.

CPP-37B, Gravel Pit and Debris Landfill Inside INTEC Fence—Site CPP-37B consisted of Gravel Pit #2, located in the northeast corner inside the INTEC security fence. Before being backfilled, Gravel Pit #2 was approximately 79 m (260 ft) wide, 116 m (380 ft) long, and 7.9 m (26 ft) deep. Before 1982, this pit was often used to dispose of water released from the sludge dewatering pit of the old Sewage Treatment Plant (CPP-715). The exact volume of water effluent discharged to this gravel pit is unknown, but the volume is believed to be low. Sludge from the dewatering pit was known to be radioactively contaminated, indicating that water discharged to the pit likely contained radionuclides.

After 1982, the pit was used to dispose of construction debris, some of which may have been radioactively contaminated. Anecdotal information suggests that Gravel Pit #2 may also have been used for disposal of chemical waste. Additionally, the pit was open in 1964 when the release of radioactive steam associated with Site CPP-26 occurred. Radioactive steam containing Cs-137 was released from a decontamination header in the high-level liquid waste tank farm. The specific date this pit was backfilled is unknown, but it was probably backfilled to grade shortly after its use as a construction debris landfill was discontinued.

The physical boundary of Gravel Pit #2, shown in the OU 3-13 ROD (DOE-ID 1999a), was based on historical knowledge, the 1980 topographical survey (GAI 1992), and the 1991 geophysical survey. However, a review of CERCLA documents and aerial photos related to Site CPP-37C determined that the CPP-37B boundary identified in the OU 3-13 ROD does not accurately reflect the full extent of the excavation pit used for disposal. Thus, the boundary of Site CPP-37B was expanded to include outer limits of the pit area.

CPP-37C, Contamination Discovered Southeast of CERCLA Site 37B—Site CPP-37C was not identified in the ROD (DOE-ID 1999a). It was established in 2002 after contamination was discovered in November 2000, southeast of and adjacent to Site CPP-37B while digging a trench along the fence near the east perimeter road (ICP 2002). This contamination included construction debris (mostly lava rock, gravel, soil, and minor amounts of concrete, plywood, pipe, and plastic) located approximately 1.5 to 1.8 m (5 to 6 ft) bgs to below the bottom of the excavation (approximately 4.3 m [14 ft]) and appeared to be most prevalent on the west edge of the trench.

Physical boundaries for Site CPP-37C were defined using aerial photos and topographical surveys. The INL Site aerial photographs indicated that the CPP-37C site is bounded on the east by the east perimeter road, on the south by the internal INTEC access roadway system, on the west by Site CPP-37B, and on the north by CPP-37B northern limits.

4.6.1.3 Remediation Set 3. The information below describes Remediation Set 3.

CPP-03, Temporary Storage Area Southeast of CPP-603—Site CPP-03 is located in the south-central portion of INTEC within the facility security fence boundaries. Current physical boundaries of Site CPP-03 are defined by corner markers on the west side (approximately 10 m [33 ft] east of Building CPP-603), Willow Avenue to the south, Evergreen Street to the east, and the railroad tracks to the north. Dimensions of Site CPP-03 are approximately 45.7 m (150 ft) (north to south) × 152.4 m (500 ft) (east to west).

Site CPP-03 is the location of a former temporary storage area southeast of Building CPP-603, the Fuel Receiving and Storage Facility. The area was used to store old and abandoned radioactively contaminated equipment (e.g., tanks, valves, and fuel casks). Recently discovered records from 1974 indicate that the eastern third of the site was used previously as a construction landfill and that a pit existed in the southeast-central area of the site, running east to west. The storage area was decommissioned in the mid-1970s, and contaminated equipment and soil were packed into standard wooden radioactive waste boxes and taken to RWMC. The top several inches of underlying soil was contaminated by storage of contaminated equipment in the area. Most of the contaminated soil was removed, boxed, and sent to RWMC for disposal. Approximately 29 cm (11 in.) of uncontaminated soil was placed over the area south of the railroad tracks and then graded to a level surface.

CPP-37A, Gravel Pit Outside INTEC Fence—Site CPP-37A consisted of Gravel Pit #1, which is located outside the INTEC security fence in the northeast corner and measures approximately 43 m (140 ft) wide, 64 m (210 ft) long, and 4.3 m (14 ft) deep. The date of the pit's first use was not available; however, Pit #1 was used for decontamination of radiologically contaminated construction equipment during July and October 1983. In addition, during 1982 and 1983, Pit #1 was used as a percolation pond for INTEC service wastewater while the injection well was being refitted. This pit received storm water run-off from INTEC until August 2003. The extent of Site CPP-37A is known because physical boundaries of the pit are well defined, and use and disposal practices at this site are well documented.

In 1991, soil samples were collected from several boreholes in Pit #1 (GAI 1992; INEL 1995). One deeper borehole was drilled in the center of Pit #1 from which soil samples were collected at 1.5-m (5-ft) intervals to the soil and basalt interface (i.e., approximately 9 m [30 ft]). Samples were analyzed for inorganics, VOCs, semivolatile organic compounds, pesticides and herbicides, polychlorinated biphenyls, and radionuclides. The data, summarized in Appendix A of the RD/RA Work Plan (DOE-ID 2004b), indicate that arsenic was detected above background values (Rood, Harris, and White 1996) in several samples. However, the maximum arsenic concentration was only 8.7 mg/kg, relative to the background value for arsenic of 5.8 mg/kg. Radionuclides detected above background in soil samples collected in Pit #1 were Am-241, Cs-137, Np-237, Pu-238, and Sr-90. I-129 was analyzed for but not detected in any sample. Other radionuclides that do not have a background value were detected at low concentrations, including Co-60 and U-235. Radionuclides were not detected in the 0 to 0.3-m (0 to 0.5-ft) samples, except for Sr-90 at 0.69 ± 0.12 pCi/g in the southwestern portion of the pit. Radionuclides were not detected above background in the deep borehole below 4.6 m (15 ft).

No sample exceeded remediation goals at CPP-37A. Eu-152, Eu-154, and Pu-241 are COCs that were not analyzed for during past sampling. Using Cs-137 as a scaling factor, as described in Section 3.3 of the Engineering Design File for the ICDF Design Inventory (EDF-ER-264), 95% UCL estimates for these values were developed. Table 3-1 of the RD/RA Work Plan compares the estimated 95% UCL values to remediation goals for Group 3 COCs, including Eu-152, Eu-154, and Pu-241. This comparison illustrates that, even if concentration estimates were significantly higher than reasonably expected (several orders of magnitude), values would still fall below remediation goals.

CPP-34A/34B, Soil Storage Areas (Disposal Trenches) in the Northeast Corner of INTEC—Site CPP-34 comprised the soil storage area in the northeast corner of INTEC. In summer 1983, approximately 9,180 m³ (12,000 yd³) of contaminated soil was excavated from around Tank WL-102, in the tank farm area northeast of Building CPP-604, and stockpiled at Site CPP-03, to the east of Building CPP-603. In August and September 1984, the pile of contaminated soil was removed from CPP-03 and buried in three trenches in the northeastern corner of INTEC, situated between the animal (outer) and security (inner) fences.

Trenches were 13.7 m (45 ft) wide at the top, 7.6 m (25 ft) wide at the bottom, and approximately 4.3 to 4.9 m (14 to 16 ft) deep, and trenches were 126 m (413 ft), 122 m (400 ft), and 74 m (242 ft) long. The Track 1 document (WINCO 1993) reported that, at the time of disposal, contaminated soil in the trenches was covered with approximately 0.6 m (2 ft) of clean soil.

The extent of Site CPP-34A/34B was known because boundaries of the trenches were well defined, based on documented process knowledge and analytical data. Previous sampling results of contaminated soil at CPP-34A/34B were detailed in the Group 3 RD/RA Work Plan (DOE-ID 2004b). Soil contamination exceeded remediation goals for Cs-137 and Sr-90 for at least one depth at all four sample locations. Existing data were sufficient to complete a waste profile. I-129 was not detected in any characterization samples, and process knowledge from FY 2004 sampling of tank farm alluvium (collected every 4 ft to basalt in Sites CPP-15, CPP-27, CPP-28, CPP-31, and CPP-79 [DOE-ID 2006a]) indicated no detectable presence of I-129. Consequently, only verification sampling was performed, per the Characterization Plan (DOE-ID 2004h), as part of the waste disposal process.

CPP-67, Percolation Ponds 1 and 2—Site CPP-67 consisted of two unlined service wastewater (percolation) ponds that received service wastewater consisting primarily of cooling water and condensed steam generated by various INTEC operations. The ponds were located just outside the INTEC fenced perimeter on the south side. INTEC wastewater, containing only traces of radioactivity (or none at all), passed through the service wastewater system. Waste was monitored for radioactivity before being discharged to Service Wastewater Pond 1 or Service Wastewater Pond 2. Three main service wastewater systems at INTEC discharged to the ponds: east-side system, west-side system, and CPP-604 condensate monitoring and shutdown system. Under normal conditions, radioactivity was not present in service wastewater streams except condensate from the process equipment evaporator, which routinely contained trace quantities of radionuclides (e.g., I-129).

Service Wastewater Pond 1 (POND-YGD-326) was established in 1984 and is approximately 125 m (410 ft) x 146.3 m (480 ft), and 5.5 m (18 ft) deep. The pond was excavated into gravelly alluvium that is approximately 7.6 to 9.1 m (25 to 30 ft) thick and is underlain by basalt.

Service Wastewater Pond 2 (POND-YGD-327) was established in 1985 when it became apparent that the infiltration capacity of Service Wastewater Pond 1 had decreased, and water levels began to rise. The pond bottom is approximately 152 m (500 ft) square and 3.7 to 4.3 m (12 to 14 ft) deep. The pond was excavated in gravelly alluvium approximately 6 to 11 m (20 to 35 ft) thick and is underlain by basalt. The pond was designed to accommodate continuous disposal of approximately 11.4 million L (3 million gal) of water per day.

4.6.1.4 OU 3-13 New Sites. No new sites were identified under OU 3-13, Group 3, Phase I.

4.6.1.5 OU 3-13, Group 3 (Phase I), No Action and No Further Action Sites. Remedial action was not necessary to meet RAOs and remediation goals. The no action and no further action sites are:

- CPP-37A, Gravel Pit 1 outside INTEC fence (no further action)

- CPP-37B, Gravel Pit 2 and debris landfill inside INTEC fence (no further action)
- CPP-37C, new site contamination area (construction debris) southeast of CPP-37B (no further action).

4.6.2 Remedial Action – Operable Unit 3-13, Group 3 Phase II

4.6.2.1 Remedy Selection. The ROD-selected remedy for the Group 3, Phase II, Other Surface Soils, is soil removal and onsite disposal at ICDF. The OU 3-13 ROD provides the option to cap Group 3 sites under unique circumstances; however, this option was not exercised. The Group 3, Phase I remedial action requirements to implement the ROD remedy are summarized below:

- Implement ICs as specified in Table 11-1 of the OU 3-13 ROD.
- Sample and analyze Group 3 new sites using direct push probes and grab samples techniques to determine location, nature, and extent of potential soil contamination.
- Excavate soil according to remedial design requirements.
- Record real-time spectroscopy results during and following excavation activities.
- Perform confirmation sampling (for Sr-90).
- Dispose of contaminated soil at ICDF.
- Backfill excavated areas with clean soil. Contour with additional gravel and grade the areas to provide appropriate site drainage.

4.6.2.1.1 Remedial Action Objectives—The following are the RAOs for the Group 3 soils, as developed in the OU 3-13 ROD, Section 8 (2a) (DOE-ID 1999a):

- Prevent exposure to contaminated surface soils at each release site such that for all surface exposure pathways, a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1 are not exceeded at each release site. These RAOs also address no further action sites where the current radiological contaminant levels will meet residential risk-based concentration on or before 2095. The RAOs will be achieved as follows:
 - DOE Operational Phase, expected until year 2045:
 - Implement ICs to limit access and exposure duration at each source area to achieve a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1
 - Remove contaminated soil at each source area, sufficient to achieve a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1 to a future residential user; or cap in place contaminated soil or debris areas presenting a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1

- Government Control Phase, expected between year 2045 and 2095:
 - Implement ICs to limit the duration and frequency of exposure to non-capped contaminated soil areas by the public to achieve a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1
 - Maintain caps for contaminated soil areas, which are contained in place, to prevent exposure of the public to a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1
 - Maintain the closed and capped ICDF Complex to prevent exposure of the public to a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1
- Post-government control, beyond 2095:
 - Continue ICs at all capped areas to prevent disturbance of capped areas to achieve a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1.

The terms “DOE Operational Phase” and “Government Control Phase” were developed in the OU 3-13 ROD to delineate the time period when active DOE operation as an industrial facility at INTEC was expected to end as opposed to that time period from 2045 to 2095 when the U.S. Government would control the area to protect human health and the environment. The OU 3-14 ROD subsequently revised the projected date for INTEC facility closure as 2035.

4.6.2.1.2 Cleanup Levels—To meet the RAOs, remediation goals were established in the OU 3-13 ROD (DOE-ID 1999a) to ensure a risk-based protectiveness of human health and the environment. These contaminant-specific goals, summarized in Table 4-4, are quantitative cleanup levels based primarily on ARARs and risk-based concentrations.

Table 4-4. Risk-based remediation goals for Operable Unit 3-13 soils.

Contaminant of Concern	Soil Risk-Based Remediation Goal or Single Contaminant of Concern (pCi/g or mg/kg)
Radionuclides	
Am-241	290
Cs-137	23
Eu-152	270
Eu-154	5,200
Pu-238	670
Pu-239/240	250
Pu-241	56,000
Sr-90	223
Nonradionuclides	
Mercury (human health)	23

Section 8.1.3 of the OU 3-13 ROD states the following:

The primary threat posed by the Group 3, Other Surface Soils is external exposure to contaminated soils (DOE-ID 1999a). The remediation goal for the Other Surface Soils sites is to prevent external exposure to current workers and nonworkers and future workers and residents. This remediation goal will be accomplished by:

- Implementing the ICs described in Table 11-1 [of the OU 3-13 ROD]
- Minimizing future residential exposure to surface soils in 2095 and beyond by excavating the contaminated soils exceeding the remediation goals in Table [2-1], to a minimum depth of 3 m (10 ft) and subsequent disposal and management of the excavated soils in the ICDF
- Capping the contaminated areas that are not excavated with an engineered barrier in accordance with the substantive requirements of the hazardous waste landfill closure standards (IDAPA 16.01.05.008; 40 CFR 264.310).

In addition to the threat posed by the Group 3 soils of external exposure, the OU 3-13 ROD also discussed the possible threat to underlying groundwater. Since finalization of the ROD, the OU 3-14 Remedial Investigation/Baseline Risk Assessment, through extensive modeling of the alluvium and groundwater, has concluded that Group 3 soils do not pose a risk to groundwater.

Table 11-1 in the OU 3-13 ROD stipulates that ICs will apply to Group 3, Other Surface Soils, sites following soil remediation when contamination is left in place at depths greater than 3 m (10 ft) bgs.

4.6.2.2 Remedy Implementation

CPP-03 (Temporary Storage Area Southwest of CPP-603)—The original remedial design for CPP-03 from the Phase I RD/RA Work Plan (DOE-ID 2004b) called for excavating the entire site and removing all structures included in that footprint. This also required rebuilding of the removed fences and roads. Careful review of historical aerial photographs verified that contaminated soil and equipment staged at CPP-03 were in a smaller footprint. Based on this, the Agencies approved an OU 3-13 Phase I Field Sampling Plan (DOE-ID 2004i) to further refine the footprint of the areas to be remediated.

The cleanup goal for CPP-03 was to remove contamination to meet risk-based remediation goals identified in Table 4-4.

Major components of the selected remedy for CPP-03 included:

- Remove contaminated soil and debris from CPP-03 using conventional excavation methods
- Dispose of contaminated soils and debris in ICDF
- Survey and record contamination left in place at depths below 3 m (10 ft) for future ICs, as necessary
- Replace excavated soil with clean backfill and regrade.

NOTE: *The remedy specified backfilling the excavation to the surrounding elevation; however, discussions with INTEC facility management determined that no future use was expected for the excavation area. Therefore, clean soil cover was placed over the excavation to a nominal depth of 15.2 cm (6 in.), leaving the excavated depressions with gradual side slopes. This was discussed during a weekly Agency conference call and again during the prefinal inspection.*

The remedy also specified that eight random soil samples would be collected from locations identified in the Phase I Field Sampling Plan. This was modified and expanded to include nine additional biased samples, as discussed below:

- The eight random samples were collected within the excavation.
- Seven of the nine biased samples were collected within the excavation in the ditch area.
- The eighth biased sample was collected from outside the original excavation, in an extension of the excavation, to remediate a hot spot.
- The ninth biased sample was collected from an area that required additional excavation to remove a hot spot.

Hot spot locations were identified using a NaI or LaBr₃ gamma detector.

In August 2006, a geophysical land survey was conducted to mark and record excavation boundaries. The southeastern boundary of the site (and excavation) also was remapped at that time to follow the curvature of the two roads adjacent to site boundaries. This survey was conducted to avoid excavating the asphalt roads.

Also in August 2006, earthwork equipment was mobilized to the site, and the area directly associated with the remedial action was cleared of vegetation. Fencing and temporary boundary ropes were removed or installed, as necessary.

A culvert was placed in the ditch along the south-central boundary of the site (between the two excavation areas) and was backfilled to provide a ramp over which haul vehicles could enter and exit the site. A tarping station was erected just north of the installed ramp (within the site and between the two excavation areas), which provided access to the haul equipment for transporting the soil to ICDF and also to complete radiologic surveys prior to exiting the site.

Excavation of the site began on August 28, 2006, and continued through December 11, 2006. Soil was transported using articulated trucks and roll-on/roll-off containers. Trucks removed 162 loads from the site, for a total deposit of 2,620 tons of soil in ICDF. Roll-on/roll-off containers removed 223 loads from the site, for a total deposit of 2,077 tons of soil in ICDF. The combined was a total of 4,698 tons. The soil was wetted during excavation for dust suppression and estimated at 1.7 tons/yd³. This brings the estimated volume of the excavated material to 2,113 m³ (2,764 yd³).

The excavation encroached on Willow Avenue to the south and Evergreen Street to the east, such that storm water drainage ditches adjacent to the roads were compromised (i.e., sections of the ditches were excavated). Confirmation sampling was completed in the excavated ditch areas; whereafter, the ditches were backfilled with clean soil and contoured so they would be functional.

Site sampling was an ongoing activity throughout the excavation phase. The OU 3-13 CPP-03 Field Sampling Plan (DOE-ID 2005e) called for collecting eight random confirmation samples from the excavation in areas having the highest residual activity based on wide-area gamma scans collected using a high-purity germanium detector. An alternate approach was adopted. The approach incorporated using a portable gamma detector to scan the excavation floor shortly after it was uncovered and before the excavator moved out of reach. In this way, the radiologically hot spots were identified quickly and further remediated without having to build a land bridge to them or having equipment contaminated upon entering the excavation to remediate the hot spot. A 1.5- × 1.5-m (5- × 5-ft) grid was established over the excavation, and eight confirmatory sampling sites were then randomly selected, from which soil samples were collected in the region 0 to 15.2 cm (0 to 6 in.) deep. Figure 4-2 shows the confirmation sampling locations. The eight randomly selected locations correspond to the grids labeled as 121, 146, 187, and 402 in the western excavation and 63, 265, 368, and 174 in the eastern excavation.



Figure 4-2. Confirmation sample locations for Site CPP-03.

An additional nine biased sampling locations were selected, as shown in Figure 4-2. The six locations designated by Grids 406, 409, 479, 457, 424, and 279 were collected in the ditch area, which needed to be backfilled and contoured to avoid disrupting the storm water drainage system for that region of INTEC. The polygon-shaped areas outlined by dashed lines represent hot spots located with the gamma detector. These areas were excavated further, and three biased soil samples were collected to demonstrate that soil above the remediation goal was removed. Two of the three biased samples were from Grid Area 227 in the western excavation and Grid Area 487 in the eastern excavation. The third biased sample location was in the hot spot in the eastern excavation, which extended beyond the excavation boundary. The excavation then proceeded outside the boundary and encompassed the portion of contaminated soil shown on the map and bounded by the dashed line, but outside the boundary lines. A biased sample then was collected from the Grid 491 area to confirm that the contaminated soil was removed.

Data were validated in accordance with a Level B validation, as defined in GDE-7003, "Levels of Analytical Method Data Validation." All the samples are below the 23-pCi/g remediation goal for the COC for this site (i.e., Cs-137) (see Table 4-5). Data are summarized in Table 4-6.

Table 4-5. Comparison between risk-based remediation goals and performance levels achieved for CPP-03 soils.

Contaminant of Concern	Soil Risk-Based Remediation Goal for Single Contaminants of Concern (pCi/g)	Performance Level Achieved 95% UCL (pCi/)
Cs-137	23	1.95
UCL	upper confidence limit	

The excavation was partially backfilled with clean soil after getting results of the confirmation sample analyses. Backfill soil was placed along banks of the excavation to allow contouring (1:2, rise:run) from the surrounding surface to the bottom of the excavation. In addition, soil was placed in the bottom of the excavation to provide a nominal 15.2-cm (6-in.) cover. Repeated movement of the haul and contouring equipment over the backfill area packed the soil and resulted in a stable smooth surface. Radiological control technicians then surveyed the entire base of the excavation with portable beta-gamma friskers and free-released the site. A grader then contoured fill areas along the ditches to restore drainage capability. Ditches were contoured over their full length, but freezing soil conditions precluded cutting them to the final grade. Grading contours were to be completed in summer 2007. The prefinal inspection was completed in January 2007. Establishing requirements for final grading for the site was transferred to remedial actions performed for Site CPP-130, which was created in November 2006 within the boundaries of CPP-03.

CPP-34A/34B (Soil Storage Area in the Northeast Corner of INTEC)—The selected remedy for Site CPP-34A/34B addressed removal of contaminated soil and disposal in ICDF (DOE-ID 1999a). No planned future land use or O&M requirements have been identified for these sites.

This section outlines activities designed for excavation of contaminated soil associated with Site CPP-34A/34B. To implement the RAO strategy, the remedial design called for excavation to 6.1 m (20 ft) below grade, based on process knowledge of the elevation where the soils were buried.

Grid ^a	Sample Result (pCi/g)	Sample Error (pCi/g)	Validation Flag ^b	Date Sample Collected	Minimum Detectable Activity	Limitations and Validation Report Number	Field Sample Number	Lab Sample Number
279	3.22E+00	6.93E-02		11/06/2006	6.43E-02	BAM-061-06	E0790600801R4	176447001
424	2.10E+00	1.07E-01		11/06/2006	2.78E-02	BAM-061-06	E0790600901R4	176447002
457	6.28E+00	2.37E-01		11/14/2006	4.32E-02	BAM-061-06	E0790601001R4	176447003
121	1.40E-01	3.49E-02		11/29/2006	7.09E-02	SOS-TL022-07	E0790600001R4	177148001
146	6.06E-01	6.10E-02		11/29/2006	9.13E-02	SOS-TL022-07	E0790600101R4	177148002
146	3.28E-01	4.90E-02		11/29/2006	1.02E-01	SOS-TL022-07	E0790600102R4	177148003
187	2.37E-01	3.91E-02		11/29/2006	8.49E-02	SOS-TL022-07	E0790600201R4	177148004
402A	7.20E-02	2.53E-02	UJ	11/29/2006	8.18E-02	SOS-TL022-07	E0790600301R4	177148005
402B	2.91E-01	4.32E-02		11/29/2006	7.96E-02	SOS-TL022-07	E0790601101R4	177148006
402C	4.54E-01	6.05E-02		11/29/2006	8.83E-02	SOS-TL022-07	E0790601201R4	177148007
63	1.88E-01	2.08E-02		12/12/2006	2.51E-02	SOS-TL026-07	E0790600401R4	178020001
256	1.95E-01	7.17E-02	J	12/12/2006	5.81E-02	SOS-TL026-07	E0790600501R4	178020002
368	7.95E-01	6.29E-02		12/12/2006	7.68E-02	SOS-TL026-07	E0790600601R4	178020003
174	2.42E+00	6.82E-02		12/12/2006	6.83E-02	SOS-TL026-07	E0790600701R4	178020004
479	1.01E+00	7.03E-02		12/12/2006	3.43E-02	SOS-TL026-07	E0790601301R4	178020005
487	6.80E-02	1.73E-02		12/12/2006	2.21E-02	SOS-TL026-07	E0790601401R4	178020006
491	1.03E+00	7.64E-02		12/12/2006	4.34E-02	SOS-TL026-07	E0790601501R4	178020007
227	1.29E+00	4.79E-02		12/12/2006	5.97E-02	SOS-TL026-07	E0790601601R4	178020008
Summary Information								
Average activity					1.19			
Maximum activity					6.28			
Standard deviation					1.60			
95% UCL					1.95			

Remedial design called for the following:

- Rerouting existing roads and surface features. Activities will be limited primarily to protecting utilities while modifying surface features.
- Excavating contaminated soil in CPP-34A/34B to a depth of 6.1 m (20 ft) for a total estimated volume of 46,599 m³ (60,949 yd³).
- Importing backfill for the CPP-34A/34B area.
- Revegetating the laydown area at CPP-34A/34B.

The Field Sampling Plan described the confirmation soil sampling strategy in detail (DOE-ID 2004i). Following remediation of the site, an initial radiological survey was performed for Cs-137 using a high-purity germanium detector, followed by hot-spot removal, as necessary, and a resurvey, in accordance with the RD/RA Work Plan. The final high-purity germanium survey of the excavated surface is provided in Appendix B (high-purity germanium data results for CPP-34A/34B) (DOE-ID 2007e).

Excavation activities at CPP-34A/34B began in May 2005. Excavation began first in CPP-34A. Work took place May 4 through November 7, 2005; soil was removed to a depth of approximately 6.4 m (21 ft) from the soil contamination area. About 46,090 m³ (60,283 yd³) was removed and transported from CPP-34A/34B to ICDF.

Field gamma gross radiation was measured at the CPP-34A/34B areas during excavation. Figure 4-3 contains a diagram of the site showing plotted measurement locations. A Trimble Global Positioning System with survey-grade positioning was used to establish a grid.

The system used for data collection consisted of a 42% efficient (relative to 3 × 3 sodium iodide) high-purity germanium detector mounted on a tripod with the detector face positioned 1 m (3.3 ft) above ground. This arrangement yielded an optical field of view of about 15.2 m (50 ft) in diameter at each measurement point. The detector was quality-control-checked daily using a multinuclide point source traceable to the National Institute of Standards and Technology. Results from these checks were control-charted daily, and all values were within control limits for the duration of the project. Count times were for 20 to 30 minutes, which gave precisions on the reported Cs-137 concentration values that are less than 10% at the 2σ confidence level. Spectral data were analyzed.

Results of the activity showed that nine locations exceeded the Cs-137 remediation goal of 23 pCi/g. These areas were excavated, and radiation measurements were repeated. The pin flags were destroyed during this remediation, so the subsequent gamma scans were performed as physically close as possible to the initial measurement location. Tables B-1 and B-2 in Appendix B of the OU 3-13, Group 3, Phase I Remedial Action Report provide high-purity germanium data and location differences (DOE-ID 2007e). These measurements were all below the remediation goal for Cs-137 (23 pCi/g), meaning that remediation was complete and confirmation samples could be collected to verify the condition.

The design drawings called for approximately 35,187 m³ (46,023 yd³) of backfill for CPP-34A and approximately 11,412 m³ (14,926 yd³) of backfill for CPP-34B. Revegetation was required outside the area of contamination in the subcontractor laydown yard. Additionally, the temporary perimeter road installed to route emergency traffic around INTEC was reconstructed and revegetated, as necessary, and delivered back to its original state.

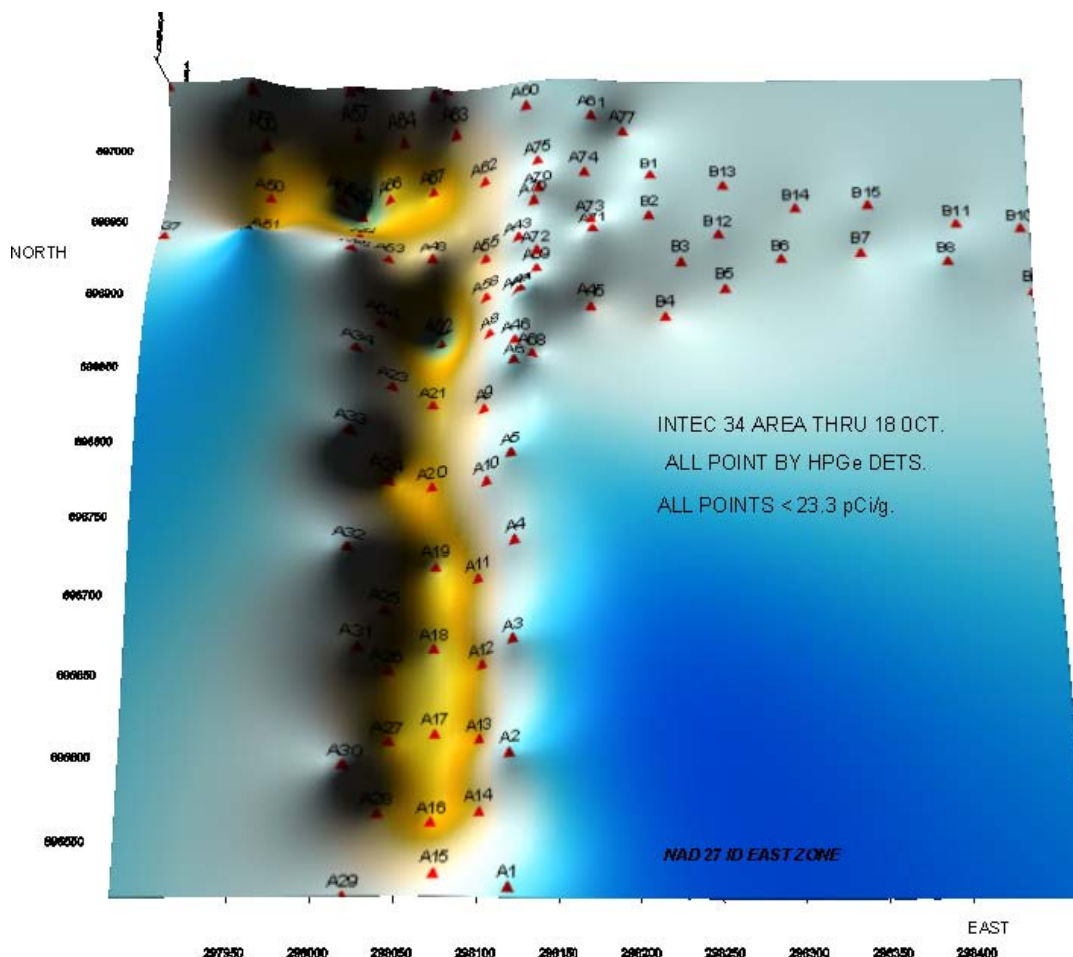


Figure 4-3. CPP-34A/34B high-purity germanium scans showing final excavation topography. Post-excavation locations are shown, all of which are below the remediation goal of 23 pCi/g. Colors were used only to emphasize the contours and do not constitute radiological differences.

The RAO for the CPP-34A/34B site, as stated in the RD/RA Work Plan (DOE-ID 2004b), was to prevent exposure to contaminated surface soil such that for all surface exposure pathways, a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1 was not exceeded. To meet this RAO, remediation goals were established in the OU 3-13 ROD (DOE-ID 1999a, p. 8-4) to ensure a risk-based protectiveness of human health and the environment. Table 4-7 compares project performance results from confirmation sampling to remediation goals and shows that the RAO was achieved.

Table 4-7. Comparison between risk-based remediation goals and performance levels achieved for CPP-34A/34B soils.

Contaminant of Concern	Soil Risk-Based Remediation Goal for Single Contaminants of Concern (pCi/g)	Performance Level Achieved ^a 95% UCL (pCi/g)
Cs-137	23	1.5
Sr-90	223	1.5

a. Performance level results are from confirmation sampling data presented in Kirchner (2005a).

UCL upper confidence level

Sampling Activities and Results for CPP-34A/34B—Soil sampling was performed during two activities. Verification and confirmation soil sampling were performed by the Environmental Services project under ESP-014-05 (Kirchner 2005b) and ESP-050-05 (Kirchner 2005a), respectively. Verification sampling results were compared to the ICDF landfill waste acceptance criteria, as described in the Characterization Plan (DOE-ID 2004h). Confirmation sampling was compared to remediation goals to assess remedial action performance, as described in the OU 3-13 Phase I Field Sampling Plan (DOE-ID 2004i). Between these activities, during excavation, field surveys were used to locate hot spots and guide excavation.

ESP-014-05 Sampling Activity (Verification Sampling)—Initial verification soil samples were collected from CPP-34A/34B following PLN-1901. These samples were collected for I-129 characterization and inorganic verification sampling for material profile 4529q—CPP-34A/34B trenches (ESP-014-05) (Kirchner 2005b). In March 2005, soil samples were taken from CPP-34A/34B, at depths ranging from 0.3 to 6.1 m (1 to 20 ft). Verification sample results validated the original characterization data for CPP-34A/34B.

ESP-050-05 Sampling Activity (Confirmation Sampling)—Samples were collected in August through September 2005. These samples were collected to confirm the Cs-137 and Sr-90 remediation goals were met. The data presented in ESP-050-05 (Kirchner 2005a) are reproduced below in Tables 4-8 and 4-9.

Table 4-8. Confirmation sampling data summary of Cs-137 for Site CPP-34A/34B.

Sample	Cs-137 Activity ^a (pCi/g)	Cs-137 Activity ^b (pCi/g)	Validation Flag ^c	Sample Uncertainty	MDA (pCi/g)
VS34A-1	5.11E-01	5.11E-01		6.60E-02	1.10E-01
VS34A-2	1.22E-01	1.22E-01		3.50E-02	1.00E-01
VS34A-3	-6.00E-04	0.00E-01	U	2.60E-02	9.40E-02
VS34A-4	2.16E+00	2.16E+00		1.70E-01	1.20E-01
VS34A-5	2.06E+00	2.06E+00		1.50E-01	1.10E-01
VS34A-6	1.44E+00	1.44E+00		1.10E-01	9.00E-02
VS34B-1	1.33E-01	2.35E-01		2.50E-02	6.30E-02
VS34B-1 Dup	3.37E-01			3.80E-01	5.70E-02
VS34B-2	6.40E-02	6.40E-02		2.10E-02	8.10E-02
Data Summary					
	Maximum value		2.16		
	Average		0.82		
	Standard deviation		0.92		
	Confidence interval		0.68		
	95% upper confidence level		1.50		

a. Column contains the complete data set.

b. Data used for the statistical evaluation. VS34B-1 and the duplicate were averaged. VS34A-3 was not used.

c. No flag = The analysis was performed and radioactivity was detected (statistically positive at the 95% confidence interval and is above the minimum detectable activity). The radionuclide is considered to be present in the sample.

U flag = Material analyzed for and not detected.

MDA minimum detectable activity

Table 4-9. Confirmation sampling data summary of total strontium for Site CPP-34A/34B.

Sample	Total Strontium Activity ^a (pCi/g)	Total Strontium Activity ^b (pCi/g)	Validation Flag ^c	Sample Uncertainty	MDA (pCi/g)
VS34A-1	2.85E+00	2.85E+00	J	1.60E-01	1.80E-01
VS34A-2	4.78E-01	4.78E-01	J	6.80E-02	2.00E-01
VS34A-3	2.02E-01	2.02E-01		6.50E-02	2.00E-01
VS34A-4	8.46E-01	8.46E-01		8.90E-02	2.10E-01
VS34A-5	8.27E-01	8.27E-01		8.60E-02	2.00E-01
VS34A-6	9.80E-01	9.80E-01		1.00E-01	2.40E-01
VS34B-1	1.60E-01	0.00E+00	U	2.50E-01	4.10E-01
VS34B-1 Dup	3.60E-01		U	2.60E-01	4.10E-01
VS34B-2	2.00E-02	0.00E+00	U	2.50E-01	4.20E-01
Data Summary					
	Maximum value		2.85		
	Average		0.77		
	Standard deviation		0.92		
	Confidence interval		0.68		
	95% UCL		1.45		

a. Column contains the complete data set.

b. Data used for the statistical evaluation. VS34B-1 and the duplicate were averaged. VS34A-3 was not used.

c. No flag = The analysis was performed and radioactivity was detected (statistically positive at the 95% confidence interval and is above the minimum detectable activity). The radionuclide is considered to be present in the sample.
J flag = The analysis was performed and the analyte was detected. Result is statistically positive at the 95% confidence interval and is less than the minimum detectable activity. Result is questionable. The analyte is considered to be in the sample; however, the result may not be accurate.
U flag = Material analyzed for and not detected.

MDA minimum detectable activity.
UCL upper confidence limit

Confirmation samples collected at Site CPP-34A/34B after remediation showed the 95% UCL for the average residual concentration for Cs-137 to be 1.5 pCi/g. This value is substantially lower than the remediation goal of 23 pCi/g.

Confirmation samples collected at Site CPP-34A/34B after remediation showed the 95% UCL for the average residual concentration for total strontium to be 1.5 pCi/g. This value is also substantially lower than the remediation goal of 223 pCi/g.

Based on the above results, remediation of Site CPP-34A/34B is complete.

Site 37A – Gravel Pit – Outside INTEC Fence (Gravel Pit #1)—Section 13.2 of the OU 3-13 ROD (DOE-ID 1999a), “Sites Included in Other Programs or Other OUs,” identified that for Site CPP-37A, “A presumptive remedy of excavate and dispose at the ICDF will be implemented.” This decision was based on available data at the time of development of the OU 3-13 ROD. Data at that time were not complete because they did not include Eu-152, Eu-154, and Pu-241 COCs. Using a Cs-137 scaling factor, information can now be provided on these COCs. In review of this new information, COCs

at Site CPP-37A do not exceed OU 3-13 remediation goals. The presumptive remedy of excavate and manage at ICDF is not needed because the cleanup levels are currently met.

No remediation was conducted on Site CPP-37A. Hazardous constituents identified through sampling do not exist in sufficient concentration or activity to warrant remediation. This site is now considered a no further action site.

Site 37B – Gravel Pit and Debris Landfill Inside INTEC Fence—The selected remedy for Site CPP-37B, as developed in the OU 3-13 ROD, was to further characterize the site and determine whether remediation is required, and, if so, to develop a path forward.

Previous investigations of contamination at Site CPP-37B included a geophysical survey and samples collected from four boreholes (i.e., CPP-37-1, -2, -3, and -4) in Gravel Pit 2 in 1991 (GAI 1992; INEL 1995). Samples were analyzed for inorganics, VOCs, semivolatile organic compounds, pesticides and herbicides, polychlorinated biphenyls, and radionuclides. Data, summarized in Appendix A of the Phase I RD/RA Work Plan (DOE-ID 2004b), indicate that arsenic, barium, chromium, mercury, and silver were detected above background concentrations (Rood, Harris, and White 1996) in one sample from Borehole CPP-37-4. Silver also was detected above background concentrations in one sample from Borehole CPP-37-3. Analyses were performed for a limited number of organics; of those detected, none exceeded the ICDF waste acceptance criteria (DOE-ID 2005f). Radionuclides detected above background in soil samples collected in Pit 2 were Am-241, Cs-137, Pu-238, Sr-90, and U-238. Other radionuclides that have no background value were detected, including I-129, Np-237, and U-235. Cesium-137, Np-237, and Sr-90 were detected most frequently in the samples from the four boreholes. Concentrations of Cs-137 and Sr-90 typically decrease with depth below the base of the fill (i.e., 6.4 to 7.9 m [21 to 26 ft]). Cesium-137 was not detected above background values below 6.1 m (20 ft) bgs, while Sr-90 was detected in several samples below 6.1 m (20 ft) bgs. The presence of Sr-90 and not Cs-137 in deeper samples is likely due to the increased mobility of Sr-90 relative to Cs-137. In two of the four borings at Pit 2, Sr-90 was the only radionuclide detected between a depth of 6.1 m (20 ft) and the top of basalt. No radionuclides were detected in the sample from the 33-m (109-ft) interbed beneath Gravel Pit 2.

Based on these investigations, no remediation goals were exceeded for any sample result at CPP-37B; however, existing CPP-37B data were insufficient to determine, with statistical confidence, whether remediation goals were exceeded at this site. Also, previous sampling did not analyze for Eu-152 and Eu-154. Therefore, additional characterization data were needed to determine whether remediation of this site is necessary. Also, the suspected presence of contaminated debris at Site CPP-37B was unconfirmed.

In 2006, the final three-phase characterization effort for Site CPP-37B was designed to determine whether remediation was required and, if so, develop a path forward (DOE-ID 2005e). The first phase was a geophysical survey using a time-domain metal detector to (1) determine boundaries of the site, (2) determine extent and locations of debris and utilities, and (3) confirm the pit edges. The second phase comprised characterization sampling of six biased locations, designed to supplement previous sampling and to avoid boring into debris and utilities (using the results of Phase I). The third phase was excavating pits and trenches to extract buried debris (located in the first phase) for radiological field screening. Two pit locations were dug at Site CPP-37B. A high-purity germanium detector was used during the excavation to monitor real-time radiation fields in the pit area and to characterize excavated soil and debris for Cs-137 contamination.

Results of the three-phase effort indicated that Site CPP-37B did not require remedial action (ICP 2006b). Geophysical survey information was used to verify physical boundaries and determine locations of debris and utilities. Based on this information, samples were collected and analyzed. Sample

results were significantly below remediation goals for all COCs. Evaluation of excavated debris showed Cs-137 contamination to be at least one order of magnitude less than the remediation goal. The COCs contained in Site CPP-37B are well below action levels, supporting a determination that these sites be considered no further action sites.

Site 37C, Contamination Discovered Southeast of CERCLA Site CPP-37B (New Site Adjacent to Gravel Pit 2)—Data and process knowledge for Site CPP-37C were insufficient to define the extent of contamination or to determine whether remediation goals were exceeded. Therefore, characterization data were needed to determine if remediation of this site was necessary. Also, the suspected presence of contaminated debris at Site CPP-37C was unconfirmed.

The final three-phase characterization effort for Site CPP-37C in 2006 (DOE-ID 2005e) was designed to determine whether remediation was required, and, if so, to develop a path forward. The first phase was a geophysical survey using a time-domain metal detector to (1) determine boundaries of the site, (2) determine extent and locations of debris and utilities, and (3) confirm the pit edges. The second phase comprised characterization sampling of 11 biased locations, based on results of the geophysical survey, historical photos, and historical survey data. The third phase comprised excavation of pits and trenches to extract buried debris (located in Phase I) for radiological field screening. One pit location was dug at Site CPP-37C. A high-purity germanium detector was used during the excavation to monitor real-time radiation fields in the pit area and to characterize excavated soil and debris for Cs-137 contamination.

Results of this three-phase effort document that CPP-37C did not require remedial action (ICP 2006b). Geophysical survey information was used to verify physical boundaries and to determine locations of debris and utilities. Based on this, samples were collected and analyzed. Sample results were significantly below remediation goals for all COCs. Evaluation of excavated debris showed Cs-137 contamination to be at least one order of magnitude less than the remediation goal.

No remediation was conducted on Site CPP-37C. Hazardous constituents identified through sampling, and remediation goals imposed thereon in the ROD for Group 3 sites, do not exist in sufficient concentration or activity to warrant remediation. This site is now considered a no action site.

CPP-67 (Percolation Ponds)—Remediation activities for CPP-67 were reported complete in the previous 5-year review document (DOE-ID 2007a), and *Site Completion Report for Area CPP-67, WAG 3, OU 3-13, Group 3, Other Surface Soils* discusses remediation activities fully (DOE-ID 2005g). The two ponds were excavated as per the remedial design; however, the requirements to backfill and reshape the slopes, add top soil, reseed, and remove the fence were not performed (as agreed to by the Agencies) to allow for the site to be available for future use.

Section 7.2.4 of the OU 3-13 Group 3 Phase 1 Remedial Action Report stated that, rather than backfill the CPP-67 site after remediation, the CPP-67 site should be used to dispose of construction and demolition waste (nonhazardous, nonradiological) generated by general decommissioning activities at the INL Site performed as CERCLA NTRCAs. Operation and closure of this landfill would be performed in accordance with applicable or relevant and appropriate requirements for a landfill. On November 19, 2007, DOE requested EPA and DEQ concurrence in operating the INTEC CERCLA Demolition Waste Landfill at the CPP-67 site. DEQ concurred on November 28, 2007, and EPA concurred on November 29, 2007. The first waste was received on February 5, 2008. As of September 30, 2009, the INTEC CERCLA Demolition Waste Landfill had received and disposed of 27,177 yd³ (20,778 m³) of CERCLA-generated construction and demolition waste. (Koch 2007; Jensen 2007; Ceto 2007)

CPP-92 (Soil Boxes West of CPP-1617)—CPP-92 and CPP-99 soil boxes were characterized using a stratified approach, based on radiation measurements performed on the boxes and recorded in IWTS (DOE-ID 2004b; DOE-ID 2004j). Soil boxes were divided into three levels, based on radiation measurements. A total of 16 composite samples were analyzed for RCRA Appendix IX VOCs (40 CFR 264, Appendix IX), Appendix IX semivolatile organic compounds, Universal Treatment Standard metals, total metals, polychlorinated biphenyls, and radiochemistry. In total, 59 samples were analyzed for I-129.

Sampling results are detailed in the Characterization Results Report (ICP 2005) and summarized here. The results were compared to Table UTS of 40 CFR 268.48 and to the ICDF landfill waste acceptance criteria, as applicable. All concentrations of applicable and positively detected VOCs, semivolatile organic compounds, and polychlorinated biphenyls are less than the standards, with over 95% of organic results either nondetect (i.e., U-flagged) or estimated nondetect (i.e., UJ-flagged). All positively detected toxicity characteristic leaching procedure inorganic concentrations are less than the standards, with 80% of toxicity characteristic leaching procedure results either nondetects or estimated nondetects. All positively identified radiochemical results were less than the standards. Analysis and reanalysis results provide evidence that I-129 is not present.

The remedial operation for Site CPP-92 consisted of transporting boxed waste from the staging and Storage Annex to ICDF. This was a routine waste-handling operation.

The general sequencing of operations performed for this remedial action are outlined below:

- Pre-sort boxes before collecting additional characterization samples.
- Collect and analyze additional characterization samples in accordance with the Characterization Plan (DOE-ID 2004h).
- Develop waste profiles and determine ICDF waste acceptance criteria acceptability and applicability for stabilization to meet land disposal restrictions.
- Transfer soil and debris waste boxes to ICDF for direct disposal or to the Staging, Storage, Sizing, and Treatment Facility within the ICDF Complex for treatment, as necessary. The specific sequencing of operations associated with transferring soil and debris waste boxes to ICDF from the Staging and Storage Annex is outlined below:
 - Establish a site boundary of sufficient size to allow staging and loading of a transport trailer and tractor unit at the Staging and Storage Annex.
 - Use a forklift with sufficient capacity to move boxes from the Staging and Storage Annex and load them onto the tractor-trailer unit. Loading will be limited by weight-loading restriction on the tractor-trailer unit.
 - Tie down the load, secure it to the trailer unit, and perform a final radiological survey for release.
 - Drive the tractor-trailer unit from the Staging and Storage Annex to ICDF, where it will be weighed and directed to the staging area to drop off the trailer and boxes.

Soil and debris waste boxes were transported to ICDF for disposal (Curnutt 2005a). Box numbers were confirmed as having been placed at ICDF. No spills or releases were associated with the transfer of the CPP-92 waste to ICDF for disposal, based on a review of spill team records. Butler (2006) documented these final actions on October 4, 2006.

CPP-97 (Soil Stockpiles)—Characterization of Site CPP-97 followed the Characterization Plan (DOE-ID 2004h), with results reported in the Characterization Results Report (ICP 2005). Based on these results, concentrations of all COCs meet the ICDF landfill waste acceptance criteria for disposal (DOE-ID 2004j).

The selected remedy for Site CPP-97 comprised removal of contaminated soil and onsite disposal into ICDF (DOE-ID 1999a). No planned future land uses or O&M requirements have been identified for these sites.

After removal of the site boundary fence, excavation of Site CPP-97 involved removal of the two soil stockpiles (including liners) and excavation of the contaminated surface soil within the boundary to a depth of 15.2 cm (6 in.). The estimated volume of soil from stockpiles was 1,127 m³ (1,474 yd³). The estimated volume of contaminated surface soil was 730 m³ (955 yd³).

The remedial design also called for (1) Title II drawings containing demolition and configuration of fencing and roadways, estimated quantities of debris, plot plans, contours, quantities, sections, and excavation profiles and (2) rerouting of existing roads and surface features.

The confirmation soil sampling strategy is described in detail in the OU 3-13 Phase I Field Sampling Plan (DOE-ID 2004i). Following remediation, the site was initially surveyed for Cs-137 using a gamma spectrometer, followed by hot-spot removal, as necessary, and a resurvey and final confirmation sampling of the excavated surface to ensure compliance with RAOs.

The site was backfilled with pit-run gravel. The estimated volume was 730 m³ (955 yd³). To backfill the excavation, the site was contoured and graded either to maintain existing surface water patterns or as designated in design drawings.

Remediation and demolition activities followed the scope of work provided to ICDF project management. This scope was based on excavation of the OU 3-13 site areas (in accordance with the general sequencing plan) as outlined in the RD/RA Phase I Work Plan (DOE-ID 2004b).

Subcontractor mobilization began in May 2005. Work on improving the infrastructure was started first and included the following activities:

- Constructed a controlled-access haul road between INTEC and ICDF
- Installed a dust-control system that used water
- Identified fencing around the northeast corner of INTEC for removal and protection prior to excavation activities.

Site CPP-97 was excavated from October 5, 2004, through November 17, 2004. Total volume removed and transported to ICDF was approximately 1,858 m³ (2,430 yd³).

A high-purity germanium scan was performed in November 2005. All values for Cs-137 were less than 23 pCi/g, meaning that the excavation was complete. Appendix E of the Phase I Remedial Action Report (DOE-ID 2007e) contains the high-purity germanium data.

CPP-98 (Tank Farm Shoring Boxes)—Sampling was not required for CPP-98 container debris because CPP-97 soil data were determined to be representative of the debris contamination. The OU 3-13 Phase I Field Sampling Plan was developed to guide sampling for Group 3 sites (DOE-ID 2004i). The Field Sampling Plan was implemented with the latest revision of the Quality Assurance Project Plan, which provides guidance for sampling, quality assurance, quality control,

analytical procedures, and data management. Together, the Quality Assurance Project Plan and the Field Sampling Plan constitute the remedial action sampling and analysis plan. In accordance with the Field Sampling Plan, no confirmation sampling was necessary for Site CPP-92 because it did not require excavation.

The remedial operation for Site CPP-98 consisted of transporting boxed waste from the Staging and Storage Annex to ICDF. This was a routine waste-handling operation. Shipments began on October 27, 2005, and were completed on January 10, 2006.

The general sequencing of operations for this remedial action is outlined below:

- Presort boxes before collecting additional characterization samples.
- Collect and analyze additional characterization samples in accordance with the Characterization Plan (DOE-ID 2004h).
- Develop waste profiles and determine ICDF waste acceptance criteria acceptability and applicability for stabilization to meet land disposal restrictions.
- Transfer soil and debris waste boxes to ICDF for direct disposal or to the Staging, Storage, Sizing, and Treatment Facility within the ICDF Complex for treatment, as necessary. The specific sequencing of operations associated with transferring soil and debris waste boxes to ICDF from the Staging and Storage Annex is outlined below:
 - Establish a site boundary of sufficient size to allow staging and loading of a transport trailer and tractor unit at the Staging and Storage Annex.
 - Use a forklift with sufficient capacity to move boxes from the Staging and Storage Annex and load them onto the tractor-trailer unit. Loading will be limited by weight-loading restriction on the tractor-trailer unit.
 - Tie down the load, secure it to the trailer unit, and perform a final radiological survey for release.
 - Drive the tractor-trailer unit from the Staging and Storage Annex to ICDF, where it will be weighed and directed to the staging area to drop off the trailer and boxes.

A total of 119 wooden soil and debris waste boxes were transported to ICDF for disposal (Curnutt 2005b).

No spills or releases were associated with the transfer of Site CPP-98 CERCLA waste to ICDF for disposal, based on a review of spill team records (Butler 2006).

CPP-99 (Boxed Soil)—CPP-92 and CPP-99 soil boxes were characterized using a stratified approach based on radiation measurements performed on the boxes and recorded in the Integrated Waste Tracking System (DOE-ID 2004b; DOE-ID 2004j). The soil boxes were divided into three levels, based on radiation measurements. A total of 16 composite samples were analyzed for RCRA Appendix IX VOCs (40 CFR 264, Appendix IX), Appendix IX semivolatile organic compounds, Universal Treatment Standard metals, total metals, polychlorinated biphenyls, and radiochemistry. A total of 59 samples were analyzed for I-129.

Results of the sampling are detailed in the Characterization Results Report (ICP 2005). The results were compared to Table UTS of 40 CFR 268.48 and to the ICDF landfill waste acceptance criteria, as applicable. All applicable and positively detected concentrations of VOCs, semivolatile organic compounds, and polychlorinated biphenyls were less than the standards, with over 95% of organic results

either nondetect (i.e., U-flagged) or estimated nondetect (i.e., UJ-flagged). All positively detected toxicity characteristic leaching procedure inorganic concentrations were less than the standards, with 80% of toxicity characteristic leaching procedure concentrations either nondetect or estimated nondetect. All positively identified radiochemical concentrations were less than the standards. Analysis and reanalysis results provide evidence that I-129 was not present.

The remedial operation for Site CPP-99 consisted of transporting boxed waste from the Staging and Storage Annex to ICDF. This was a routine waste-handling operation. Shipments began on October 27, 2005, and were completed on January 10, 2006

The general sequencing of operations performed for this remedial action is outlined below:

- Presort boxes before collecting additional characterization samples.
- Collect and analyze additional characterization samples in accordance with the Characterization Plan (DOE-ID 2004h).
- Develop waste profiles and determine ICDF waste acceptance criteria acceptability and applicability for stabilization to meet land disposal restrictions.
- Transfer soil and debris waste boxes to ICDF for direct disposal or to the Staging, Storage, Sizing, and Treatment Facility within the ICDF Complex for treatment, as necessary. The specific sequencing of operations associated with transferring soil and debris waste boxes to ICDF from the Staging and Storage Annex is outlined below:
 - Establish a site boundary of sufficient size to allow staging and loading of a transport trailer and tractor unit at Staging and Storage Annex.
 - Use a forklift with sufficient capacity to move boxes from the Staging and Storage Annex and load them onto the tractor-trailer unit. Loading will be limited by weight-loading restriction on the tractor-trailer unit.
 - Tie down the load, secure it to the trailer unit, and perform a final radiological survey for release.
 - Drive the tractor-trailer unit from the Staging and Storage Annex to ICDF, where it will be weighed and directed to the staging area to drop off the trailer and boxes.

A total of 58 wooden soil and debris waste boxes were transported from Site CPP-99 to ICDF for disposal (Curnutt 2005b). No spills or releases were associated with the transfer of CPP-99 waste to ICDF for disposal, based on a review of spill team records (Butler 2006).

4.6.2.3 Operations and Maintenance. None. Remedial actions have been completed.

4.6.3 Progress Since the Last Review

No issues pertaining to OU 3-13 Group 3 were identified in the previous 5-year review.

4.6.4 Inspections Performed

The following prefinal/final inspections were performed:

CPP-03—The Prefinal/Final Inspection Report (Butler 2007) was sent to the Agencies on February 15, 2007. The report noted two deficiencies from the original prefinal inspection checklist:

1. Submittal of the final results from confirmation sampling

2. Final contouring of the storm water drainage ditches, which were modified during remediation and not recontoured because of freezing conditions.

Two copies of closure reports for the confirmation sampling were attached to the transmittal, thus completing the first deficiency. A note on the second deficiency indicated that it was a primary task and would be completed when conditions permitted and would be tracked through completion in FY 2007. Establishing requirements for final contouring was transferred to the remedial actions performed for Site CPP-130, which were completed in September 2008.

CPP-34A/34B—The Prefinal Inspection Report (Butler 2007) was sent to the Agencies on December 7, 2005.

CPP-92—The Pre-Final/Final Inspection Closure Report (Butler 2006) was sent to the Agencies on October 4, 2006.

CPP-97—The Pre-Final/Final Inspection Report (Butler 2005) was sent to the Agencies on December 7, 2005.

CPP-98—The Pre-Final/Final Inspection Closure Report (Butler 2006) was sent to the Agencies on October 4, 2006.

CPP-99—The Final Inspection Closure Report (Butler 2006) was sent to the Agencies on October 4, 2006.

For CPP-99, the prefinal inspection report (Butler 2005) identified two action items for Site CPP-99: (1) submit waste tracking database information documenting transfer of all waste boxes from storage at the Staging and Storage Annex to ICDF for disposal and (2) identify and status any spills or releases associated with transfer of the waste boxes. Documentation of waste tracking and no spills or releases was transmitted in the final inspection report on October 4, 2006 (Butler 2006).

4.6.5 Technical Assessment

The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. The contaminated soil was excavated at all of the OU 3-13, Group 3, Phase I sites that required remediation.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?

Yes.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

Technical Assessment Summary

The Phase I Sets 1, 2, and 3 remediation sites were completed in accordance with the requirements established in the OU 3-13 ROD (DOE-ID 1999a) and are protective of human health and the environment. No changes to the remedy or assumptions have come to light that would call into question the effectiveness of the selected remedy.

4.6.6 Issues

No issues are identified for Group 3 that would have any effect on the selected remedy or that would require immediate attention.

4.6.7 Recommendations and Follow-Up Actions

Because no issues are identified, recommendations or follow-up actions are not required.

4.6.8 Protectiveness Statement for Operable Unit 3-13, Group 3, Phase I (Sets 1, 2, and 3)

The remedy at OU 3-13 Group 3 Phase I (Sets 1, 2, and 3) is protective of human health and the environment. These remedial actions have been completed. The Group 3 Phase I Remedial Action Report (DOE-ID 2007e) has been approved. No changes in the physical conditions of these sites have occurred that would affect the protectiveness of the remedy.

4.7 Operable Unit 3-13, Group 3 - Other Surface Soils (Phase II)

As given in OU 3-13, Group 3, Other Surface Soils, Prioritization and Site Grouping Report (DOE-ID 2002b), below is the list of WAG 3, Group 3, Other Surface Soils, Phase II, Sets 4, 5, and 6 and other soil contamination sites at INTEC:

Remediation Set 4

- CPP-01 – Concrete settling basins and dry wells east of CPP-603
- CPP-04/05 – Contaminated soil area around CPP-603 settling tanks and settling basin
- CPP-08/09 – Basin filter system line failure and soil contamination at northeast corner of CPP-603 south basin
- CPP-10 – CPP-603 plastic line leak
- CPP-11 – CPP-603 sludge and water release
- CPP-19 – CPP-603 to CPP-604 line leak

Remediation Set 5

- CPP-13 – Pressurization of solid storage cyclone release northeast of CPP-633
- CPP-35 – CPP-633 decontamination spill
- CPP-36 – Transfer line leak from CPP-633
- CPP-48 – French drain south of CPP-633
- CPP-91 – CPP-633 blower pit drain
- CPP-93 – Simulated calcine disposal trench

Remediation Set 6

- CPP-14 – Old sewage treatment plant west of CPP-664
- CPP-41A – Fire training pits between CPP-666 and CPP-633, under asphalt
- CPP-44 – Grease pit south of CPP-608
- CPP-55 – Mercury contamination area south of CPP T-15
- CPP-68 – Abandoned gasoline tank CPP-VES-UTI-652.

4.7.1 Background

4.7.1.1 Set 4 Sites – Located near CPP-603. Set 4 Sites CPP-01 through CPP-11 were all collocated on the east side of the CPP-603 facility and were also adjacent to the facilities associated with SFE-20, -106, and -126, which also required remediation and removal. Consequently, the OU 3-13 project team promoted and developed a comprehensive remediation plan that integrated all the related projects into one continuous excavation and remediation campaign, which aided joint project goals. Although the specifics of individual sites are described separately below, their remediation, demolition, and confirmatory sampling activities were addressed collectively, since they were assimilated into one continuous excavation on the east side of CPP-603 facility.

4.7.1.1.1 Site CPP-01, Concrete Settling Basins and Dry Wells East of CPP-603—Site CPP-01 was a 47-m² (500-ft²) site that was a portion of the fuel storage basin cleanup support system and was located east of Building CPP-603 (Figure 4-4). The original system, built in 1951 and operated until 1962, consisted of a 1.5- × 1.5- × 5.8-m (5- × 5- × 19-ft) vertical settling vault (CPP-301) that received the backwash slurry of filter aid material (diatomaceous earth) from the filter system associated with the Fuel Receiving and Storage Facility activities. When the slurry in the vault settled, the supernatant was drained from the vault to a deep dry well (CPP-303), where the effluent percolated into the surrounding soil. CPP-303 is located approximately 30 m (100 ft) south of CPP-301 and connected by a 15-cm (6-in.) -diameter stainless steel pipe. While the area surrounding the CPP-303 dry well is sometimes referenced as CPP-01S, this area is not a separate CERCLA site, but part of CPP-01. In 1962, a horizontal settling system, consisting of horizontal settling basin CPP-740 and dry well SW-048, was constructed to expedite the slow settling rate of the original system, and CPP-301 was valved out of service at this time.

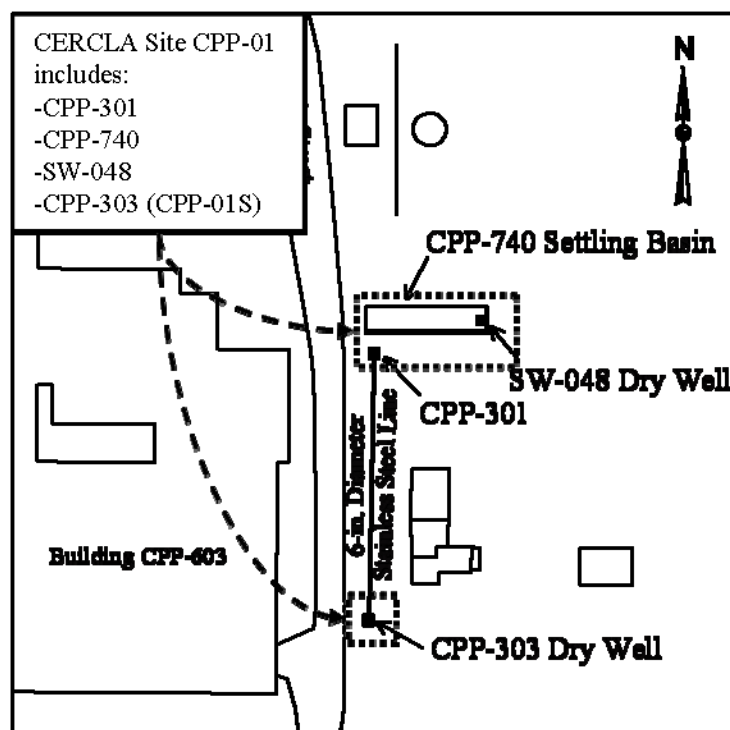


Figure 4-4. Location of CPP-01 site structures.

CPP-740 included a 1.2- × 1.6- × 9.1-m (4- × 5.3- × 30-ft) horizontal settling system of weir compartments and an access manhole. This system was used to settle slurry solids and drain the supernatant to dry well SW-048, which directed it to the surrounding soils (see Figure 4-4). Use of the CPP-740 settling facilities was terminated in 1977 when the filter system was replaced by a system of pressurized sand filters (INEL 1995).

The total volume (18,925 L [5,000 gal]) of sludge and liquid in the horizontal settling basin CPP-740 and the vertical settling pit CPP-301 was removed in fall 1993 under a removal action. The liquid removed was sent to the process equipment waste evaporator facility and the sludge was dried and sent to RWMC (DOE-ID 1997a).

4.7.1.1.2 CPP-04/05, Contaminated Soil Area Around CPP-603 Settling Tanks and Settling Basin—Site CPP-04 was a 10.0- × 20.4-m (33- × 67-ft) area of contaminated soil above the horizontal settling basin CPP-740, and Site CPP-05 was a site (with the same dimensions) of contaminated soil above the vertical settling pit CPP-301 (see Figure 4-5). These two sites reportedly became contaminated from unintentional releases during sludge removal activities from the two structures in 1978 (DOE-ID 1999a). These sites, located east of CPP-603, were combined because they were determined to have resulted from the same release. The releases of the contaminated sludge had left the area contaminated to such an extent it was later covered with 0.6 m (2 ft) of soil.

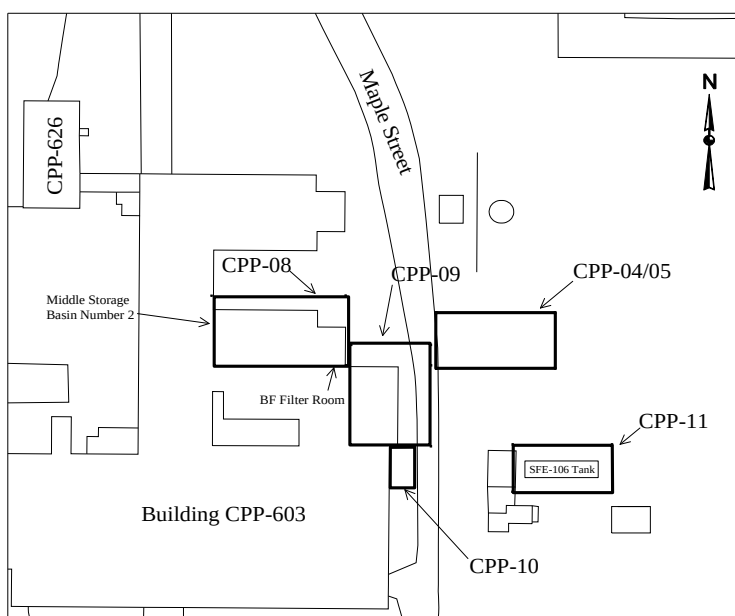


Figure 4-5. Location of Sites CPP-04/05, -08, -09, -10, and -11.

4.7.1.1.3 CPP-08/09, Basin Filter System Line Failure and Soil Contamination at Northeast Corner of CPP-603 South Basin—Sites CPP-08 and CPP-09 (see Figure 4-5) consisted of soil contaminated by a leak of radiologically contaminated liquid from a recirculation line in the CPP-603 basin. In 1973, the water level in the CPP-603 basin was observed to be decreasing much faster than could be accounted for by operations in progress or evaporation. Additional observations revealed excessive leakage occurred only during basin filter operations. It was concluded that an underground carbon steel line in the filter system most likely failed due to corrosion. The basin water circulation and filter system was taken out of service when the leak was traced to the circulation line. A blind flange was placed on the recirculation line on the south side of Building CPP-603 after the

leak was discovered, and the line was replaced with an aboveground line. During the 7-day period of the investigation, the rate of leakage averaged approximately 11,350 L/day (3,000 gal/day) (DOE-ID 1997a) for an estimated total discharge of 79,450 L (21,000 gal).

The exact location of the leak in the recirculation line was never determined. However, contaminated soil was encountered on the east side of CPP-603 while construction crews were replacing a leaking fire water line where a section of the recirculation line was located. The contaminated soil on the east side of Building CPP-603 was identified in the FFA/CO as Site CPP-09. Based on the circumstantial evidence discovered during the Track 2 investigation, the contaminated soil was believed to be associated with the release from the filter system line failure that has been identified as Site CPP-08. The location of contamination associated with CPP-08 was arbitrarily chosen beneath the Middle Storage Basin Number 2 and BF Filter Room in CPP-603, because the exact location of the leak in the recirculation line was never determined. The extent of Sites CPP-08 and CPP-09 was not known.

4.7.1.1.4 CPP-10, CPP-603 Plastic Line Leak—Site CPP-10 resulted from the release of radionuclide-contaminated basin water that drained onto the Building CPP-603 shielded area floor from a break in a polyvinylchloride line (DOE-ID 1997b). The release occurred in December 1976 when the CPP-603 fuel storage basin water filter system was started up. After approximately 5 minutes of operation, the system shut down automatically due to standing water in the sump. A search discovered that the water was coming from behind the shielding wall where a 1.90-cm (3/4-in.) polyvinylchloride line had broken. Approximately 3,000 L (800 gal) of basin water drained onto the shield area floor and a small quantity of this drained through a personnel access door and contaminated a small area of an asphalt road and dirt area adjacent to CPP-603 (DOE-ID 1997a). Filter effluent and block valves were manually closed to minimize drainage. No documentation of any remedial actions at the site occurred other than the placement of several inches of clean soil over the contaminated area.

4.7.1.1.5 CPP-11, CPP-603 Sludge and Water Release—Site CPP-11 was the result of a surface spill of CPP-603 fuel storage basin sludge and liquids. The release covered an area of 8.5×17.1 m (28×56 ft) and was directly over the VES-SFE-106 tank that was housed in a concrete vault (DOE-ID 1997b). The top of the vault lid was approximately 1.2 m (4 ft) bgs. It was reported in February 1978 that between 1,136 to 1,893 L (300 to 500 gal) of waste-containing sludge and basin water was released to the ground during basin cleanup activities. Reports of the spill indicated that localized areas having radiation levels of 1 R/hour or greater were removed immediately. The remainder of the area was reportedly cleaned up at a later time. The contamination in the soils above the VES-SFE-106 tank was suspected to be present from small spills associated with sludge removal activities in recent years (DOE-ID 1997a).

4.7.1.1.6 CPP-19, CPP-603 to CPP-604 Line Leak—Site CPP-19 is the result of a leak in a waste transfer line to the north of Building CPP-603 (see Figure 4-6). During the graveyard shift on March 9, 1978, a leak was discovered in the waste transfer line from the Basin Liquid Waste Tank (VES-SFE-106) near Building CPP-603 to the Waste Evaporator Feed Tank (WL-102) in Building CPP-604. The leak began at approximately 5:30 a.m. when the transfer pump was started to transfer 13,250 L (3,500 gal) of waste fluid. After the transfer was complete, the waste management operator notified the fuel storage operator that no liquid reached the storage tank (WL-102). The line was inspected during the day shift on March 9, 1978, by filling it with water and performing a hydrostatic test, which forced water out the breach in the transfer line and up to the ground surface where it pooled. The water transfer line was constructed of 304 stainless steel that reduced from 1-1/2- to 1-1/4-in. diameter and ran for 530 m (0.33 miles) at a depth of approximately 1.5 m (5 ft) bgs. The area of contamination was estimated at the time to be approximately 10 m^2 (108 ft^2) on the surface. The waste transfer line was abandoned in place after the leak was discovered. Cs-137 was the most widely distributed radiological contaminant at Site CPP-19.

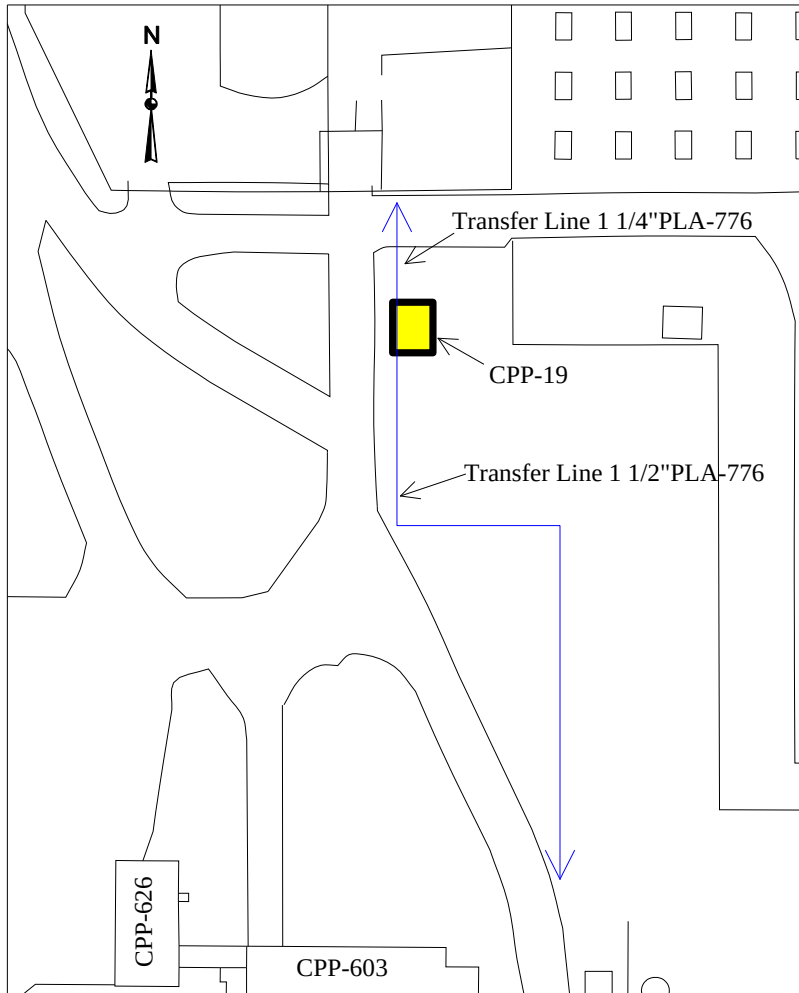


Figure 4-6. Location of Site CPP-19.

4.7.1.2 Set 5 Sites – Balance of INTEC Facility

4.7.1.2.1 CPP-13, Pressurization of Solid Storage Cyclone Release

Northeast of CPP-633—Site CPP-13 resulted from the pressurization of the solid storage cyclone northeast of Building CPP-633 where calcined, high-level waste was released to the air in 1976. While attempting to clear the solid storage cyclone (WC-912) of a restriction, the cyclone became overpressurized and blew contaminated granular solids into the air. The release contaminated the roof of Building CPP-747, located on the top of the concrete vaulted storage bin, and the berm area to the northeast of CPP-747. The contamination encompassed a 28-m² (300-ft²) area on the northeast berm covering Bin Sets 1 through 3. The bin sets contain high-level waste and, as a result, contamination in the area was masked by the high levels of radiation in the area. Subsequent cleanup efforts were successful in decontaminating the top of Building CPP-747. However, the contamination over the berm area was left in place and covered with approximately 0.15 m (0.5 ft) of soil (DOE-ID 1997b). As a result of sampling to support the Remedial Investigation/Baseline Risk Assessment (DOE-ID 1997a), the location of the area contaminated by the calcine was found to be more northerly as opposed to generally northeast (see Figure 4-7).

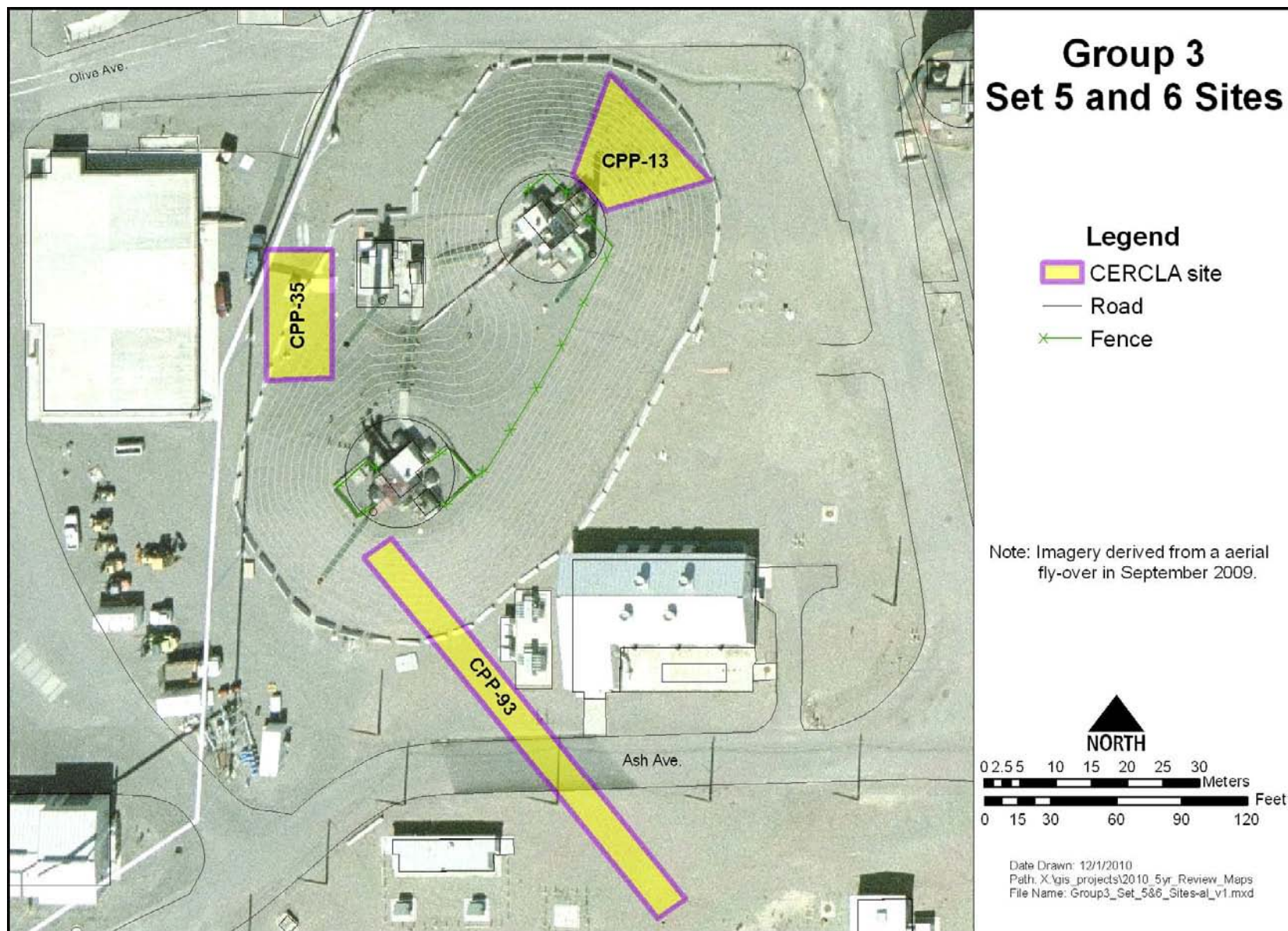


Figure 4-7. Location of Sites CPP-13, -35, and -93.

Based on the investigative results, Cs-137 and Sr-90 were considered the primary COCs at CPP-13. Numerous other radionuclides were detected at activities above background; however, these detections were low levels and all below remediation goals.

4.7.1.2.2 CPP-35, CPP-633 to CPP-604 Line Leak—Site CPP-35 (see Figure 4-7) is the result of a release of decontamination solution through the air transport system during the decontamination operation of calcine vessel WC-102 on May 16, 1972. The release, estimated at approximately 38 L (10 gal) of solution, contained nitric acid, mercuric nitrate, heavy metals, fluoride, nitrates, and up to 10 Ci of radioactivity. This solution contaminated approximately 111 m² (1,200 ft²) of soil just east of the Waste Calcining Facility cap (DOE-ID 1997b).

The cleanup undertaken after the spill involved the removal of approximately 7.5 Ci of activity in approximately 9 metric tons (10 tons) of gravel that was disposed of at RWMC. During the removal operation, the highest concentration of activity was located approximately 1.2 to 1.8 m (4 to 6 ft) from the end of the pipe (air transport system) and had penetrated greater than 0.6 m (2 ft) into the gravel. Following cleanup, the residual radiation levels in the soil were generally in the range of 5 to 25 mR/hour with highs of 100 to 200 mR/hour. It was estimated that approximately 2.5 Ci of radioactivity remained at the site (DOE-ID 1997a).

4.7.1.2.3 CPP-81, Abandoned CPP-637/ CPP-601 Vessel Off-Gas Line—Site CPP-81 was an abandoned underground 3-in.-diameter vessel off-gas line. The line ran east/west at a depth of 2 to 3 ft below ground (area formerly occupied by Building CPP-620) toward Birch Street. The line became plugged in October 1986 with simulated, nonradioactive calcine during Test Run 15 of the Calcine Pilot Plant (DOE-ID 2004a). In response, a new vessel off-gas line was rerouted around the partially plugged portion of the vessel off-gas line and activities continued. The line was cleaned out in September 1993 as a NTCRA and, after removal of the simulated calcine solids, the line was flushed with five nitric acid washes and 14 water rinses. No leaks were observed during the removal action, indicating that no previous release to the environment had occurred during the 1986 Run 15 or during the flushing operation. Calculations using data collected during the removal estimated approximately 52 kg of simulated calcine was removed by dissolution. The complete removal of this plugged material was believed to have been confirmed when no solids were observed in the vessel off-gas line during the post-removal inspection (partial in-line video inspection). The upstream end of the abandoned vessel off-gas line was then capped and the downstream end of the line remained connected to the plant vessel off-gas system (DOE-ID 2001b).

In 2001, the condition and status of CPP-81 were evaluated and a recommendation made that the site be a no further action site. All evidence indicated that no release had occurred at this site and that the potential threat of contamination in the pipe had been removed. This recommendation was presented in the Explanation of Significant Differences for the Final ROD for the INTEC, OU 3-13 (DOE-ID 2004a). The remedy for this site was changed from “requiring additional information for making a final determination” to “further evaluation has been completed. Retain in the OU 3-13 ROD as a no action site.”

In 2005, the line was cut as part of the decommissioning activities at CPP-637. The cut was approximately 10.9 m (3 ft) outside the footprint of CPP-637 in a location that previously had been inaccessible. Soon after the cut was made, a laydown of moist material was discovered next to the cut, which came from the cut pipe. A sample was collected and results indicated hazardous levels of cadmium and chromium. Based on these new findings, CPP-81 was assigned to OU 3-13, Group 3, for remediation.

4.7.1.2.4 CPP-93, Simulated Calcine Disposal Trench—Site CPP-93 was the Simulated Calcine Disposal Trench and was located just southeast of the Waste Calcining Facility closure cap (Figure 4-7). This trench was excavated in the early 1960s and used to dispose of simulated calcine

test batches before hot startup of the Waste Calcining Facility. Historical operator log entries and photographs indicated that several tons of simulated calcine material was disposed of in the trench, which was approximately 61 m (200 ft) long and 2.4 m (8 ft) wide at the bottom, sloping to 4.9 m (16 ft) wide at the top with a depth of 1.2 m (8 ft). The simulated nonradioactive calcine material reached a height of 1.1 to 1.2 m (3.5 to 4 ft) before the trench was backfilled to grade with approximately 1.2 m (4 ft) of soil (DOE-ID 1997a).

Samples of the simulated calcine contained elevated concentrations of mercury, aluminum, nitrate/nitrite, and sodium. Concentrations of sodium, nitrate/nitrite, and aluminum appear to decrease with depth in the borings to background levels, but mercury concentrations were still above background at the deepest samples (2–2.1 m [6.5–7 ft] bgs) in the borings. The full extent of mercury above background was not defined, but the analytical data suggest that mercury concentrations would continue to decrease with depth below 3 m (10 ft). The results of additional borings drilled outside the area of the trench indicated that no lateral migration of mercury from the buried simulated calcine occurred.

4.7.1.3 OU 3-13 New Sites

4.7.1.3.1 CPP-130, Soil and Buried Debris—Excavation of CPP-03 began on August 28, 2006. On September 11, 2006, while excavating the eastern portion of the site, an empty drum was uncovered at a shallow depth (~2 ft bgs). No debris of this nature or size was expected, and excavation halted temporarily to evaluate the need for additional subsurface investigation. The drum and the soil surrounding it were analyzed for radiological constituents. Results showed the surface inside the drum to be radiologically contaminated with alpha nuclides. Soil samples taken around the drum site did not contain alpha nuclide activity and were below the remediation goals for known COCs.

A series of subsurface investigations were then conducted over the entire CPP-03 site using a time-domain electromagnetic induction survey instrument. The survey was conducted over the site to assess the area for conductive subsurface anomalies. The time-domain electromagnetic induction survey was conducted with high sensitivity to objects located within 3 m (10 ft) of the surface. A map was produced identifying the location of 38 anomalies of potentially significant size. Whether the remaining anomalies were construction debris or container-type vessels was unclear. Small-sized construction debris was expected to be present on the site and uncovered during the dig, but large debris and drums were not. All of the anomalies were investigated and excavated.

The complexity and hazards associated with what was assumed to be a simple excavation increased substantially. Areas where the anomaly density was high or where anomalies were known to be of a small size remained part of Site CPP-03 and were excavated. Conductive (metal) mass corresponding to an object the size of a small cylinder or larger was grouped into a new site designated as a new Site CPP-130.

New Site CPP-130 is discussed in Section 4.7.2.2.7; Figure 4-8 shows the site plus any areas inside Site CPP-03 not previously excavated and found to have contamination above the remediation goal.

4.7.1.3.2 CPP-132, Soil Contamination Beneath Olive Avenue—Site CPP-132 was a new site consisting of radionuclide-contaminated soil in the Olive Avenue area of INTEC (also see Section 4.7.2.2.8). The site was identified during excavation activities in support of the Integrated Waste Treatment Unit construction; soils contaminated with radionuclides were discovered in the area of Olive Avenue at the INTEC facility. On August 29, 2007, while digging a utility trench under Olive Avenue near the west end of CPP-659, an area of widespread contamination was identified by the radiation control technician monitoring the dig. Although background radiation readings in the area are elevated (range from 300 to 500 counts/minute) due to the close proximity of the bin sets, radiation surveys of the

soil in the excavation were 200 to 300 counts/minute above background. Consequently, the site was barricaded and identified as a contamination area by the Radiological Controls program. Contaminated soils were managed as CERCLA waste, using the soil waste profile that was developed for the OU 3-13, Group 3, Phase II remediation activities. This waste profile was developed to represent the waste resulting from releases at the Phase II INTEC sites, including sites in proximity to Olive Avenue.

4.7.1.4 OU 3-13, Group 3, (Phase II) Sites Where Remedial Actions Were Not Required.

No remedial actions were necessary for the OU 3-13 no action or no further action sites to meet the applicable RAOs and remediation goals. There are a total of six no action sites (CPP-41A, -44, -55, -60, -68, and -129) and seven no further action sites (CPP-14, 36, -37B, -37C, -48, -91, and -124). These sites are:

- CPP-14 – Old sewage treatment plant west of CPP-664 (no further action)
- CPP-36 – Transfer line leak from CPP-633 (no further action)
- CPP-41A – Fire training pits between CPP-666 and CPP-633, under asphalt (no action)
- CPP-44 – Grease pit south of CPP-608 (no action)
- CPP-48 – French drain south of CPP-633 (no further action)
- CPP-55 – Mercury contamination area south of CPP T-15 (no action)
- CPP-60 – Paint shop (storage building) at present location of CPP-645 (no action)
- CPP-68 – Abandoned gasoline tank CPP-VES-UTI-652 (no action)
- CPP-91 – CPP-633 blower pit drain (no further action)
- CPP-124 – Leak east of CPP-601 (no further action)
- CPP-129 – Soils under the CPP-637 and CPP-620 facilities (no action).

4.7.2 Remedial Action – Operable Unit 3-13, Group 3 Phase II

4.7.2.1 Remedy Selection. The ROD-selected remedy for the Group 3, Phase II Other Surface Soils is soil removal and onsite disposal at ICDF. The OU 3-13 ROD provides the option to cap Group 3 sites under unique circumstances; however, this option was not exercised. The Group 3, Phase II remedial action requirements to implement the ROD remedy are summarized as follows:

- Implement ICs as specified in Table 11-1 of the OU 3-13 ROD.
- Sample and analyze Group 3 new sites using direct push probes and grab samples techniques to determine location, nature, and extent of potential soil contamination.
- Excavate soil according to remedial design requirements.
- Record real-time spectroscopy results during and following excavation activities.
- Perform confirmation sampling (for Sr-90 and mercury).
- Dispose of contaminated soil at ICDF.
- Backfill excavated areas with clean soil. Contour with additional gravel and grade the areas to provide appropriate site drainage.

Group 3 Phase II contaminated soil is to be disposed of at ICDF under a single waste profile prepared using the existing soil sampling and analysis data summarized in Appendix A of DOE-ID (2006d). Excavation plot plans (see Appendix B of DOE-ID [2006d]) have been prepared for each site to be remediated.

At the completion of the remedial action, the real-time field spectroscopy data were reviewed, summarized, and included in the Group 3 Phase II Remedial Action Report.

4.7.2.1.1 Remedial Action Objectives—The following are the RAOs for the Group 3 soils, as developed in the OU 3-13 ROD, Section 8 (2a) (DOE-ID 1999a):

- Prevent exposure to contaminated surface soils at each release site such that for all surface exposure pathways, a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1 is not exceeded at each release site. These RAOs also address no further action sites where the current radiological contaminant levels will meet residential risk-based concentration on or before the year 2095. The RAOs will be achieved as follows:
 - DOE Operational Phase, expected until year 2045:
 - Implement ICs to limit access and exposure duration at each source area to achieve a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1.
 - Remove contaminated soil at each source area, sufficient to achieve a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1 to a future residential user; or cap in place contaminated soil or debris areas presenting a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1.
 - Government Control Phase, expected between year 2045 and 2095:
 - Implement ICs to limit the duration and frequency of exposure to non-capped contaminated soil areas by the public to achieve a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1.
 - Maintain caps for contaminated soil areas, which are contained in place, to prevent exposure of the public to a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1.
 - Maintain the closed and capped ICDF Complex to prevent exposure of the public to a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1.
 - Post-government control, beyond 2095:
 - Continue ICs at all capped areas to prevent disturbance of capped areas to achieve a cumulative carcinogenic risk of 1×10^{-4} and a total hazard index of 1.

The terms “DOE Operational Phase” and “Government Control Phase” were developed in the OU 3-13 ROD to delineate the time period when active DOE operation as an industrial facility at INTEC was expected to end as opposed to that time period after 2045 where the U.S. Government would control the area as necessary to protect human health and the environment. The OU 3-14 ROD subsequently revised the projected date for INTEC facility closure as 2035.

4.7.2.1.2 Cleanup Levels—To meet the RAOs, remediation goals were established in the OU 3-13 ROD (DOE-ID 1999a) to ensure a risk-based protectiveness of human health and the environment. These contaminant-specific goals, summarized in Table 4-10, are quantitative cleanup levels based primarily on ARARs and risk-based doses.

Table 4-10. Risk-based remediation goals for Operable Unit 3-13 soils.

Contaminant of Concern	Soil Risk-Based Remediation Goal or Single Contaminant of Concern (pCi/g or mg/kg)
Radionuclides	
Am-241	290
Cs-137	23
Eu-152	270
Eu-154	5,200
Pu-238	670
Pu-239/240	250
Pu-241	56,000
Sr-90	223
Nonradionuclides	
Mercury (human health)	23

Section 8.1.3 of the OU 3-13 ROD states the following:

The primary threat posed by the Group 3, Other Surface Soils is external exposure to contaminated soils (DOE-ID 1999a). The remediation goal for the Other Surface Soils sites is to prevent external exposure to current workers and nonworkers and future workers and residents. This remediation goal will be accomplished by:

- Implementing the ICs described in Table 11-1 [of the OU 3-13 ROD]
- Minimizing future residential exposure to surface soils in 2095 and beyond by excavating the contaminated soils exceeding the remediation goals in Table 8-1 [of the OU 3-13 ROD], to a minimum depth of 3 m (10 ft) and subsequent disposal and management of the excavated soils in the ICDF
- Capping the contaminated areas that are not excavated with an engineered barrier in accordance with the substantive requirements of the hazardous waste landfill closure standards (IDAPA 16.01.05.008; 40 CFR 264.310).

In addition to the threat posed by the Group 3 soils of external exposure, the OU 3-13 ROD also discussed the possible threat to underlying groundwater. Since finalization of the ROD, the OU 3-14 Remedial Investigation/Baseline Risk Assessment, through extensive modeling of the alluvium and groundwater, has concluded that Group 3 soils do not pose a risk to groundwater.

Table 11-1 in the OU 3-13 ROD stipulates that ICs will apply to Group 3, Other Surface Soils, sites following soil remediation when contamination is left in place at depths greater than 3 m (10 ft) bgs.

4.7.2.2 Remedy Implementation

4.7.2.2.1 Set 4 Sites Adjacent to CPP-603 (CPP-01 through CPP-11)—Set 4 Sites CPP-01 through CPP-11 were all collocated on the east side of the CPP-603 facility and were adjacent to the facilities associated with SFE-120, SFE-106, and SFE-126, which also required remediation and removal. Consequently, the OU 3-13 project team promoted and developed a comprehensive remediation plan that integrated all the related projects into one continuous excavation

and remediation campaign, which aided joint project goals. Although the specifics of individual sites are described separately below, their remediation, demolition, and confirmatory sampling activities were addressed collectively, since they were assimilated into one continuous excavation on the east side of CPP-603 facility.

The Set 4 Phase II sites adjacent to CPP-603 included CPP-01, -04/05, -08/09, -10, and -11. Remediation began with the CPP-08 excavation on December 12, 2007, and continued through December 11, 2008. The initial excavations, which progressed from north to south along the CPP-603 facility eastern side, were performed first to ensure the disconnection of utility lines, which serviced the abandoned waste systems to the east. All abandoned lines and contaminated structures were cut and capped or plugged, sized, and removed as they were excavated. This included the removal of all concrete structures associated with CPP-01 and CPP-04/05 down to the 3-m (10-ft) level bgs. Soils and debris were transported to ICDF using articulated trucks and roll-on/roll-off containers. The minimum depth of excavation for all the sites adjacent to CPP-603 was generally 3 m (10 ft) bgs. There was one exception to meeting all of the related soil sites' remediation goals: some contaminated soils above 3 m (10 ft) bgs adjacent to the CPP-603 foundation were left in place to avoid undermining an active fire water line and the CPP-603 foundation. Therefore, Section 1.3.2 of the Phase II RD/RA Work Plan required a New Site Identification form^a to identify the contaminated soils above the 3-m (10-ft) level bgs remaining adjacent to CPP-603 and potentially extending beneath the building.

All contaminated soil from the ground level down to at least 3 m (10 ft) bgs was removed over the entirety of the site. A line was surveyed at 3 m (10 ft) bgs all the way around the excavation. This is shown as the excavation toe on the final gamma scan maps. While excavating, several areas with substantially higher radioactivity (hot spots) were encountered in the 0 to 3-m (0 to 10-ft) level bgs and deeper. Values exceeding 250,000 pCi/g of gamma-emitters (mostly Cs-137) and up to 5 R beta (mostly Sr-90) were encountered. In areas near to and under the CPP-740 settling basin, SW-048 dry well, CPP-301 vertical settling basin, the CPP-303 dry well, and SFE-20 structures where higher radioactivity was encountered, the excavation went deeper—to 4 m (13 ft) bgs under all the structures and down to 22 ft bgs under the SFE-20 structures.

The full extent of the soils removed accommodated other projects (e.g., SFE-20, -106, and -126) in the immediate area, which were integrated into the final excavation plan. This created a synergistic improvement in overall efficiency for the combined projects, which resulted in reduced costs and higher utilization of resources.

The consolidated excavation plan estimate for all sites adjacent to CPP-603 was 13,520 yd³, and the combined total amount of OU 3-13 soil and debris removed was 11,928 tons. The soil was wetted during excavation for dust suppression, yielding an estimated conversion factor of 1.73 ton/yd³. Thus, the estimated volume of the excavated material for OU 3-13 related wastes was 6,895 yd³. The sites were subsequently backfilled with clean, naturally occurring fill material taken from the Monroe Pit at the INL Site, compacted as required, and contoured to the original surface grade.

4.7.2.2.2 CPP-13 (Solid Storage Cyclone Release Northeast of CPP-633)—

Mobilization began in March 2009 with the setup of construction zone boundaries, ropes, signage, and an outage of Olive Avenue. A subsurface investigation was performed and the jersey barriers were removed, allowing the mobilization of earthmoving equipment.

Excavation activities at CPP-13 began March 11, 2009, on the easternmost edge of the berm. The excavation progressed west until a clean interface (below remediation goals) was established on the west

a. A new site identification form for Site CPP-135 was transmitted to the Agencies on November 24, 2009 (Fulton 2009).

side of the berm. The maximum excavation depth at the crest of the berm was approximately 2.1 m (7 ft) below the original grade surface, and the slope gradually feathered out to the toe of the berm near Olive Avenue. Final excavations were performed by hand at the top of the berm crest on the flat area between the crest to the Bin 3 top concrete surface. Work took place March 11 through April 13, 2009. The original estimated volume was 685 yd³ and the actual yardage removed and transported from CPP-13 to ICDF was approximately 362 yd³. The berm was rebuilt using clean local pit run backfill material from the Monroe Pit, and original contours were reestablished to provide appropriate storm water drainage and berm stability.

All contaminated soil from the ground level down to approximately 2.1 m (7 ft) bgs near the top of the berm next to the bin set, tapering to approximately 0.3 m (1 ft) bgs near the bottom of the berm, was removed over the entirety of the site. The surrounding area was tapered from ground level to the toe of the excavation. Hot spots with up to approximately 200 pCi/g Cs-137 were found while excavating, but nothing below the 1.2-m (4-ft) level bgs.

The CPP-13 site was subsequently backfilled with clean, naturally occurring fill material taken from the Monroe Pit at the INL Site and contoured to the original surface grade. The storm water drainage ditch running to the east along the southern side of Olive Avenue was contoured to improve drainage in the general area. The concrete barricades were repositioned to protect the berm and other infrastructure from traffic impact.

4.7.2.2.3 CPP-19 (CPP-603 to CPP-604 Line Leak)—Remediation activities followed the scope of work as outlined in the Phase II RD/RA Work Plan (DOE-ID 2006d). The extent of contamination required the excavation boundaries to expand northward into CPP-1619 storage facility. No changes in scope were encountered regarding the original Work Plan.

Mobilization began in May 2007 with the setup of construction zone boundaries, ropes, and signage and staging of earthmoving equipment. The subsurface was investigated to locate underground utilities in the area.

Excavation activities at CPP-19 began July 12, 2007. The excavation expanded in all directions until clean interfaces (above remediation goals) were established. The excavation floor was at least 3 m (10 ft) below the original grade surface. Abandoned piping and other miscellaneous structures were removed and disposed of as the excavation progressed. The extent of excavation expanded due to the waste having a preferential flow pathway through the steam piping bedding media. The original design was 570 yd³ in the Work Plan, and the actual yardage removed and transported to ICDF was approximately 2,563 yd³.

All contaminated soil from the ground level down to at least 3 m (10 ft) bgs was removed over the entirety of the site. A line was surveyed at 3 m (10 ft) bgs all the way around the excavation. This is shown as the excavation toe on the final gamma scan maps. High levels of radioactivity were encountered while excavating along the steam line, between approximately 1.8 to 3.7 m (6 to 12 ft) bgs. Field readings of 800 mrem gamma (mostly from Cs-137) and up to 9 R beta (mostly Sr-90) were encountered. The actual activities were not measured as these levels swamped the detector. The excavation went deeper (i.e., to 4 m [13 ft] bgs under the length of pipe exhibiting the high radiation levels).

The release and subsequent abandonment of piping within what was to become CPP-19 occurred in 1978 prior to the promulgation of RCRA regulations. As a result of the hydrostatic testing to find the point of release, the piping was well flushed. Upon removal of the section of piping within CPP-19, the interior of the piping was confirmed to be void of any liquid or solid materials. This information was used

to support a RCRA hazardous waste determination that the empty piping could go to ICDF for disposal as CERCLA waste.

The CPP-19 site was subsequently backfilled in January 2008 with clean fill material taken from the Monroe Pit at the INL Site and contoured to the original surface grade. The asphalt areas were repaved and the original facility fence lines were reinstalled.

4.7.2.2.4 CPP-35 (CPP-633 to CPP-604 Line Leak)—The remedial action approach for CPP-35, as depicted in the Work Plan, was modified in accordance with the OU 3-14 ROD (DOE-ID 2007d), which stated that the OU 3-13 sites within the industrial use area will be cleaned up under the OU 3-13, Group 3, Phase II RD/RA Work Plan, but to the OU 3-14 remediation goals. The OU 3-14 ROD industrial use area limited risk evaluation to the future occupational scenario (0–1.2 m [0–4 ft] below grade). The OU 3-13 ROD, Table 7-7, documented that Cs-137 is the only COC that exceeded acceptable levels for that scenario. Consequently, the required depth for remediation was 1.2 m (4 ft) below existing grade and only Cs-137 remained a COC. This reduced the total quantities removed due to the industrial use area and increased the remediation goal for Cs-137 (from 23 pCi/g to 82 pCi/g) imposed by the OU 3-14 ROD.

No changes in scope occurred regarding the original remediation Work Plan other than the land use and remediation goal revisions noted above.

Mobilization began in early April 2009 with the setup of construction zone boundaries, ropes, and signage and staging of earthmoving equipment. A subsurface investigation was performed to locate underground utilities in the area.

Excavation activities at CPP-35 began April 7, 2009. The extent of contamination required the excavation boundaries to expand outside of the original boundaries indicated in Figure 4-7, since the excavation expanded in all directions until clean interfaces (above remediation goals) were established. Consistent with Section 1.3.2 of the Work Plan, soils adjacent to the Waste Calcining Facility apron and cap were left in place to avoid undermining the apron, which is attached to the cap. A New Site Identification form for CPP-136 was submitted to the Agencies to identify the contamination remaining in the proximity to Waste Calcining Facility that may extend beneath the apron. The final excavation boundaries were completely within the OU 3-14 established industrial use zone.

All contaminated soil from the ground level down to 1.2 m (4 ft) bgs was removed over the entirety of the site. The excavation depth was greater on the east side (1.5 to 1.8 m [5 to 6 ft] bgs), in part to remove additional contamination, but also to create a higher bank, which provided shielding for the Backpack Spectroscopy Identification System and reduced radiation “shine” from the bin set and aboveground calcine transfer ducts. Hot spots with up to approximately 500 pCi/g Cs-137 were found while excavating and were removed down to the 1.2-m (4-ft) level bgs.

The maximum excavation depth was 1.2 m (4 ft) below the original grade surface. The original design was 1,405 yd³ in the Work Plan and the actual yardage removed and transported to ICDF was approximately 400 yd³.

The CPP-35 site was subsequently backfilled in May 2009 with clean fill material taken from the Monroe Pit at the INL Site and contoured to the original surface grade. The asphalt pathways were repaved and the original facility barriers were reinstalled.

4.7.2.2.5 CPP-81 (Abandoned CPP-637/CPP-601 Vessel Off-Gas Line)—

Remediation and demolition activities for CPP-81 followed the scope of work as outlined in the RD/RA Work Plan (DOE-ID 2006d). There were no scope changes regarding the actual remediation of CPP-81.

Mobilization for CPP-81 began April 23, 2009, with the setup of construction zone boundaries, ropes, and signage and staging of earthmoving equipment. A subsurface investigation was performed to locate underground utilities in the area. This site had no contaminated soil or external exposure risk. Soil was removed to approximately 1 m (3 ft) bgs, sufficient to expose the pipe and cut it.

Excavation and piping removal activities at CPP-81 began May 11, 2009. The CPP-81 vessel off-gas line was initially located with the cutting of slot trenches and then excavated by hand with mechanical assistance until the entire length of pipe was uncovered. The line was then removed from the excavation and sized for disposal at ICDF. No liquids were encountered and the pipe sections were sealed at each end for transport. There were no indications of leakage or breaching related to the length of the pipe removed. The section of pipe removed was approximately 8.5 m (28 ft) long and only ran east to west; no remnant was found angling to the north.

The CPP-81 site was subsequently backfilled on May 14, 2009, with the reuse of the excavated soil (less than 2.3 pCi/g Cs-137) and clean pit run gravel taken from the Monroe Pit at the INL Site, and contoured to the original surface grade. The incidental asphalt that was excavated during the remediation was boxed and disposed of at ICDF.

4.7.2.2.6 CPP-93 (Simulated Calcine Disposal Trench)—

The remedial action approach for CPP-93 as depicted in the Work Plan was modified in accordance with the OU 3-14 ROD (DOE-ID 2007d), which stated that the OU 3-13 sites within the industrial use area will be cleaned up under the OU 3-13, Group 3, Phase II RD/RA Work Plan (DOE-ID 2006d), but to the OU 3-14 remediation goals. The OU 3-14 ROD industrial use area limited risk evaluation to the future occupational scenario (0–4 ft below grade). The OU 3-13 ROD, Table 7-7, documented that mercury was the only COC that exceeded acceptable levels for that scenario. Consequently, the required depth for remediation for that portion of CPP-93 within the industrial use area was 4 ft below existing grade. This reduced the quantities excavated (~1,300 yd³) in the affected northern end of the excavation due to the industrial use area. There were no changes in scope regarding the original remediation Work Plan other than the land use noted above.

Mobilization for CPP-93 began November 13, 2008, with the movement of equipment and supplies to the area east of Bin Sets 1–3. Preparation activities continued for 2 weeks and included setup of construction zone boundaries, ropes, and signage; staging of earthmoving equipment; arrangement of a road outage; and relocation of the crew warming hut. A subsurface investigation also located underground utilities in the area.

Excavation activities at CPP-93 began December 1, 2008, with digging commencing at the south end of the site and hand excavation work to locate utility piping, which ran under Ash Avenue. As excavation progressed, the lateral extent of the contamination grew larger than expected since it appeared the prototype calcine was deposited in thin layers and then backfilled with clean layers of local pit run soil. This calcine deposition process required more chasing and sampling than anticipated. Excavation continued from December 2008 to early March 2009 with the aid of ground-thawing equipment. The original remedial design estimate for excavation was 3,945 yd³, and the final excavated amount was approximately 2,651 yd³.

All contaminated soil from the ground level down to at least 3 m (10 ft) bgs was removed over the entire portion of the site located within the residential use area and to 1.2 m (4 ft) bgs in the industrial use

area. A line was surveyed at 3 m (10 ft) bgs all the way around the excavation (residential use area only), and the depth was measured with a tape measure in the industrial use area. This is shown as the excavation toe on the final sampling maps. Calcine deposits were evident as the excavation progressed and appeared as white, gray, or rust-colored blotches in the dig face. Samples were collected in many of these areas to evaluate how high the mercuric oxide concentration might be. The highest value observed was 135 mg/kg mercury. The south end of the excavation was dug to approximately 4 m (13 ft) and backfilled with 1.5 m (5 ft) of clean soil to elevate the excavation floor so the excavator could approach the south wall and dig it vertical to remove simulated calcine near a high-voltage duct bank.

CPP-93 was backfilled on March 5, 2009, using clean pit run gravel taken from the Monroe Pit at the INL Site and contoured to the original surface grade. Utility poles, protective structures, and the concrete storm water piping beneath Ash Avenue were all returned to their original condition. The removed section of the Ash Avenue asphalt road was repaved in early June 2009.

4.7.2.2.7 CPP-130 (Subsurface Anomalies)—The CPP-130 site (Figure 4-8) consisted of two unique remediation areas. The western portion of the site consisted of subsurface anomalies and no associated or detected radionuclide contamination as identified during the CPP-03 characterization effort (DOE-ID 2007e). The eastern area consisted of subsurface anomalies and known Cs-137 contamination. Crews and equipment were mobilized to CPP-130 on July 22, 2008, in preparation for anomaly investigation, excavation, and disposal.

A Schonstedt Magnetometer Model GA-52 Cx was used during excavation activities to locate specific anomalies in the soil column. The approach to excavating anomalies consisted of, first, pot-holing down using hand excavation techniques to avoid risks of damaging an anomaly, identifying ferrous readings using the magnetometer, and then excavating in approximately 0.3-m (1-ft) lifts until an item was found or there were no more readings from the magnetometer. After each anomaly was removed, another magnetometer scan using the same instrument was performed to verify the absence of stacked debris. The subsurface anomalies in the western portion of the site consisted of two distinct features: an L-shaped region and a southwestern rectangular region of numerous small subsurface features. A total of 14 concrete fence posts were exhumed in the northwestern portion of the site. The southwest area was excavated down 1 m (3 ft) bgs and guided by the use of the magnetometer, and only small pieces of debris were uncovered. The debris consisted of numerous nails, t-post pieces, and nut/bolts strewn across the area. The subsurface investigation also identified an anomaly between an aboveground manway and the railcar puller. The excavation uncovered the top of a pull-box in this area.

Following the anomaly investigation effort, the project began excavating “islands” left over from the original CPP-03 remediation activities. The excavation of the western portion of CPP-130 began in July 2008 with the westernmost “island” and progressed eastward. After completing the removal of islands, the project began excavating the northeast area of the CPP-130 site, where the CPP-03 alpha-laced drum was first uncovered. Small pieces of debris continued to be uncovered during this excavation. This area was excavated to 1.2 m (4 ft) bgs to remove radionuclide-contaminated soils. Subsurface items found consisted of common construction debris (e.g., a small section of hose, iron plates, and other small pieces of metal, such as rebar). Excavation of the soil up to the south side of the railroad tracks was necessary to achieve remediation goals and resulted in a final excavation slope of 1:1 in this area. The original estimated volume was approximately 1,200 yd³, and the actual yardage removed and transported from CPP-130 to ICDF was approximately 1,658 yd³. All contaminated soil from the ground level down to at least 1 m (3 ft) bgs was removed over the entire site. Hot spots of a mild nature (above remediation goals, but below the considerably higher radiation levels encountered in other sites) were encountered, with Cs-137 activities less than approximately 200 pCi/g. These areas were excavated laterally and deeper until the remaining soil was below remediation goals. At no time was it necessary to excavate deeper than 1.5 m (5 ft) bgs.

Excavation Sketch for CPP-130 Remediation

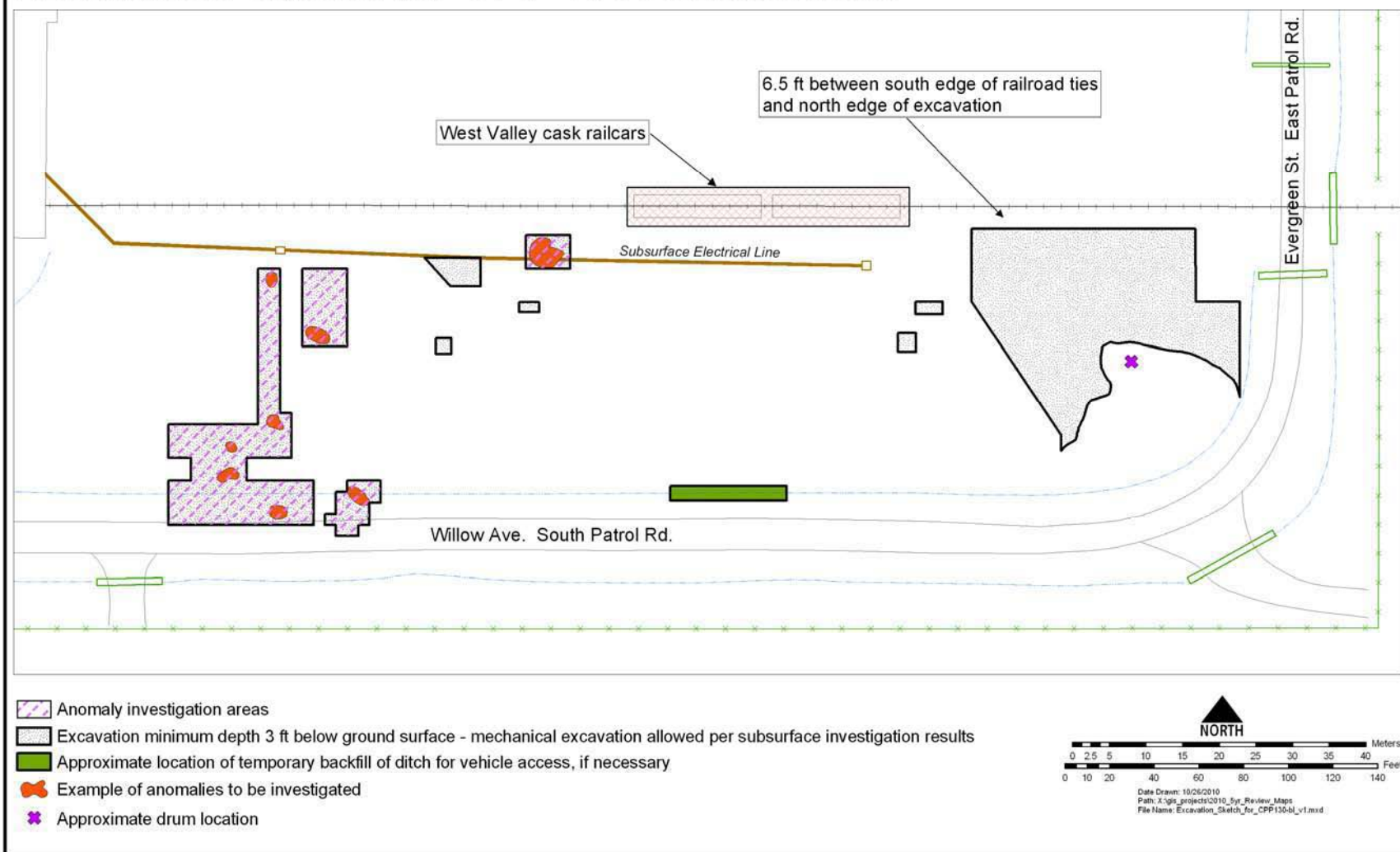


Figure 4-8. Excavation sketch for CPP-130.

Following the excavation of contaminated areas, Backpack Spectroscopy Identification System gamma scans confirmed the removal of Cs-137-contaminated soil above remediation goals. All soil and debris removed during the excavation of CPP-130 were disposed of in ICDF. Backfilling was completed by the end of September 2008.

4.7.2.2.8 CPP-132 (Soil Contamination Beneath Olive Avenue)—Remediation activities were performed by the Integrated Waste Treatment Unit project subcontract resources incidental to the installation of Integrated Waste Treatment Unit utilities in the area. The Integrated Waste Treatment Unit crew was guided by the OU 3-13 project support personnel who were using the Backpack Spectroscopy Identification System to direct removal of contaminated soils from the excavation.

Excavation and disposal activities at CPP-132 related to the contaminated soils followed the same cleanup processes used by the OU 3-13 Phase II construction crew. Work performance adhered to the Phase II RD/RA Work Plan and the related remediation goals for Cs-137, utilizing the same confirmation sampling techniques and approved waste profiles for ICDF disposal.

CPP-132 was subsequently backfilled with clean pit run gravel taken from the Monroe Pit at the INL Site and contoured to the original surface grade.

4.7.2.3 Operations and Maintenance. None. Remedial actions have been completed.

4.7.3 Progress Since the Last Review

No issues pertaining to OU 3-13 Group 3 were identified in the previous 5-year review.

4.7.4 Data Review and Evaluation

This section gives information on inspections and sampling. See Sections 4.9 and 4.12.4.1 for discussion of groundwater monitoring at INTEC. See Sections 4.8 and 4.12.4.4 for discussion of perched water monitoring at INTEC.

4.7.4.1 Inspections Performed and Results. Eight prefinal/final inspections were performed with none resulting in outstanding action items. The inspections were:

- The CPP-08 Prefinal/Final Inspection Report (Dieter 2008) was sent to the Agencies on May 29, 2008, and there were no outstanding action items.
- The CPP-01, -04/05, -09/10, and -11 Prefinal/Final Inspection Report (Dieter 2009a) was sent to the Agencies on January 23, 2009, and there were no outstanding action items.
- The CPP-13 Prefinal/Final Inspection Report (Dieter 2009b) was sent to the Agencies on June 4, 2009, and there were no outstanding actions items. Because there were no outstanding items, the report also served as the final inspection for Site CPP-13.
- The CPP-19 Prefinal/Final Inspection Report (Dieter 2008) was sent to the Agencies on May 29, 2008, and there were no outstanding action items. Because there were no outstanding items, the report also served as the final inspection for Site CPP-19.
- The CPP-35 Prefinal/Final Inspection Report (Dieter 2009b) was sent to the Agencies on June 4, 2009, and there were no outstanding actions items. Because there were no outstanding items, the report also served as the final inspection for Site CPP-35.

- The CPP-81 Prefinal/Final Inspection Report (Dieter 2009b) was sent to the Agencies on June 4, 2009, and there were no outstanding actions items. Because there were no outstanding items, the report also served as the final inspection for Site CPP-81.
- The CPP-93 Prefinal/Final Inspection Report (Dieter 2009b) was sent to the Agencies on June 4, 2009, and there were no outstanding actions items. Because there were no outstanding items, the report also served as the final inspection for Site CPP-93.
- The CPP-130 Prefinal/Final Inspection Report (Dieter 2009a) was sent to the Agencies on January 23, 2009, and there were no outstanding action items. Because there were no outstanding items, the report also served as the final inspection for Site CPP-130.

4.7.4.2 Summary of Sample Results

4.7.4.2.1 Set 4 Sites Adjacent to CPP-603 – CPP-01 Through CPP-11 – Confirmation Sample Results—Site sampling and scanning for gamma activity with the Backpack Spectroscopy Identification System were ongoing activities throughout the excavation phase. The Backpack Spectroscopy Identification System was used routinely to guide excavation into areas having Cs-137 activity higher than the remediation goal. After the routine gamma scans revealed Cs-137 activity below the remediation goal for a given area, final Backpack Spectroscopy Identification System gamma scans were collected for Cs-137 and Eu-152/154 analyses, and soil samples were collected for offsite analyses of total strontium. The data from the individual sampling activities were later compiled for reporting purposes.

Table 4-1 of the Field Sampling Plan inappropriately identified CPP-01S as one of the CERCLA sites that was being remediated adjacent to CPP-603. CPP-01S was part of CPP-01 and not a separate site. CPP-01S was merely a commonly used field team work designation for that area of CPP-01 that contained the CPP-303 dry well. Thus, the Field Sampling Plan should only have required 40 soil samples from the excavation slopes for strontium analyses and 18 from the excavation floor (DOE-ID 2006g). The required number of samples was collected and analyzed. There were no deviations from the Field Sampling Plan or quality assurance/quality control procedures.

The 43 slope samples collected were then separated into two groups: those belonging to the current CERCLA excavation (sites adjacent to CPP-603) and those belonging to the new CERCLA site, CPP-135. Fourteen of the slope samples were assigned to new Site CPP-135, while 29 slope samples were assigned to the excavation sites adjacent to CPP-603.

Evaluation of the slope data (Cs-137 and Sr-90 activities) showed that the exposure point concentrations (the 95% UCL) for the sites adjacent to CPP-603 did not exceed the “80% of the remediation goals” level, which would otherwise have required additional sampling. Consequently, no other sampling was conducted and all of the requirements in the Field Sampling Plan were satisfied.

The specific areas for collecting strontium soil samples became somewhat obscure due to different excavation situations. Sites CPP-8, -9, and -10 were up against Building CPP-603. The building foundation extended greater than 3 m (10 ft) bgs on the north side (within CPP-08), so excavation went down 3 m (10 ft) with no slope on the building side. The building foundation did not, however, extend greater than 3 m (10 ft) bgs on the east side, so excavation along the building went only as deep as 0.3 m (1 ft) above the foundation base; whereafter, it sloped away from the building at 1:1.5 (rise:run) to a depth of 3 m (10 ft) bgs. Much of the soil slopes near the building were above remediation goals and were left in place to ensure the structural integrity of the CPP-603 building foundation. These soils became the new CERCLA Site CPP-135. Soil samples were collected in the building slopes as part of the slope sampling

requirements. These data will be used in evaluating the new Site CPP-135. Samples were collected from random locations at a depth of 0 to 6 in. bgs. The sampling locations are shown in Figure 4-9. In addition, 10 soil samples collected under the (now removed) Group 7 structures, SFE-20 vault and CPP-642 pump pit, were included in the strontium data analyses. These data were collected during the Group 7 remedial action and the results relating to soil contamination were deferred to the Phase II Remedial Action report. The ICs for the data collected are summarized in Section 13.2 of DOE-ID (2009c).

The sampling (for Sr total and Cs-137) and gamma scan, point and shoot (Cs-137) data, and ProUCL (EPA 2007) statistical derivations are in Appendix B of DOE-ID (2009c). Refer to Figure 4-10 for a graphical depiction of the salient area designations, and Table 4-11 for the area descriptions.

Data for the site are partitioned into three areas as defined in Table 4-11 and summarized in Table 4-12. The related gamma scan data collected and ProUCL (EPA 2007) statistical derivations are shown in Appendix C of DOE-ID (2009c).

4.7.4.2.2 CPP-13 – Confirmation Sampling—The OU 3-13 Phase II Field Sampling Plan (DOE-ID 2006g) called for real-time spectroscopy of the CPP-13 soils, with spectral analyses for Cs-137. The sampling method used was consistent with the OU 3-13 Field Sampling Plan. The best management practice of scanning the immediate surrounding surface soils was implemented following completion of the excavation to verify the absence of cross-contamination or spread of contamination resulting from equipment staging and to verify effectiveness of dust control methods used. These subsequent data are reported as from the “construction surface.”

The OU 3-13 Phase II Field Sampling Plan called for soil sampling for strontium and scanning for Cs-137 contamination. Sampling was not conducted for strontium, as discussed earlier relative to the industrial use area requirements associated with the OU 3-14 ROD. This was the only deviation from the OU 3-13 Field Sampling Plan. There were no deviations from the quality assurance/quality control procedures. Site scanning for gamma activity with the LaBr backpack system (discussed in (DOE-ID 2009c) was an ongoing activity throughout the excavation phase. The Backpack Spectroscopy Identification System was used routinely to guide excavation into areas having Cs-137 activity higher than the remediation goal. After the routine gamma scans revealed Cs-137 activity below the remediation goal for a given area, final Backpack Spectroscopy Identification System gamma scans were collected. The data from the individual scanning activities were later compiled for reporting purposes.

Evaluation of the slope data (Cs-137 activity) showed that the exposure point concentrations (the 95% UCL) over the slopes (and excavation floor) were less than the “80% of the remediation goals” level specified in the Field Sampling Plan, where exceeding 80% would otherwise have required additional excavation and sampling. Consequently, no other sampling was conducted and all of the requirements in the Field Sampling Plan were satisfied.

The site gamma scans are partitioned into six areas as defined in Table 4-13. The gamma scan data collected for CPP-13 and ProUCL (EPA 2007) statistical derivations are shown in Appendix E (DOE-ID 2009c) and summarized below in Table 4-14. Figure 4-11 shows the final gamma scan map for the area.

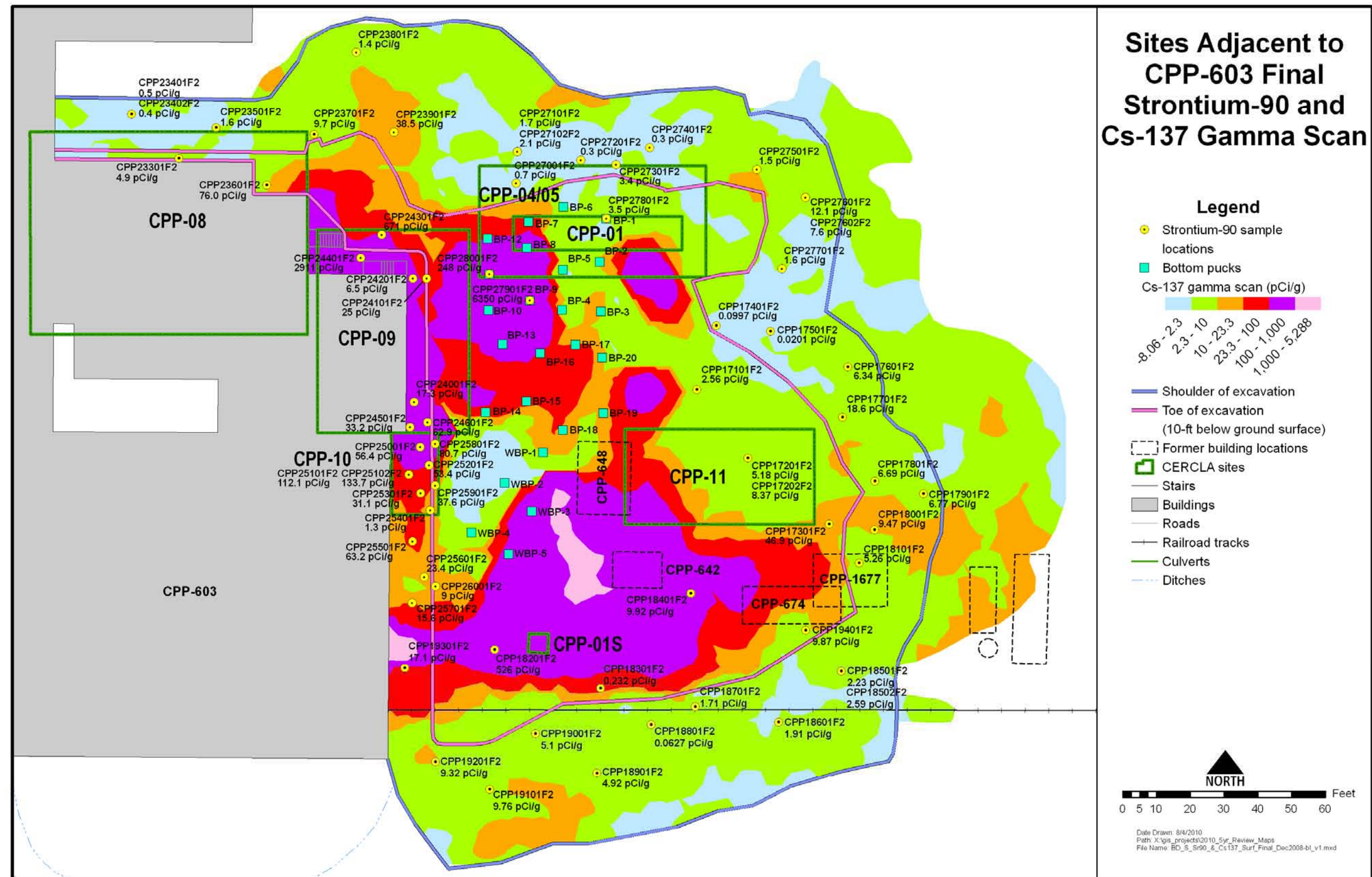


Figure 4-9. Confirmation sample locations and final gamma scan for sites adjacent to CPP-603.

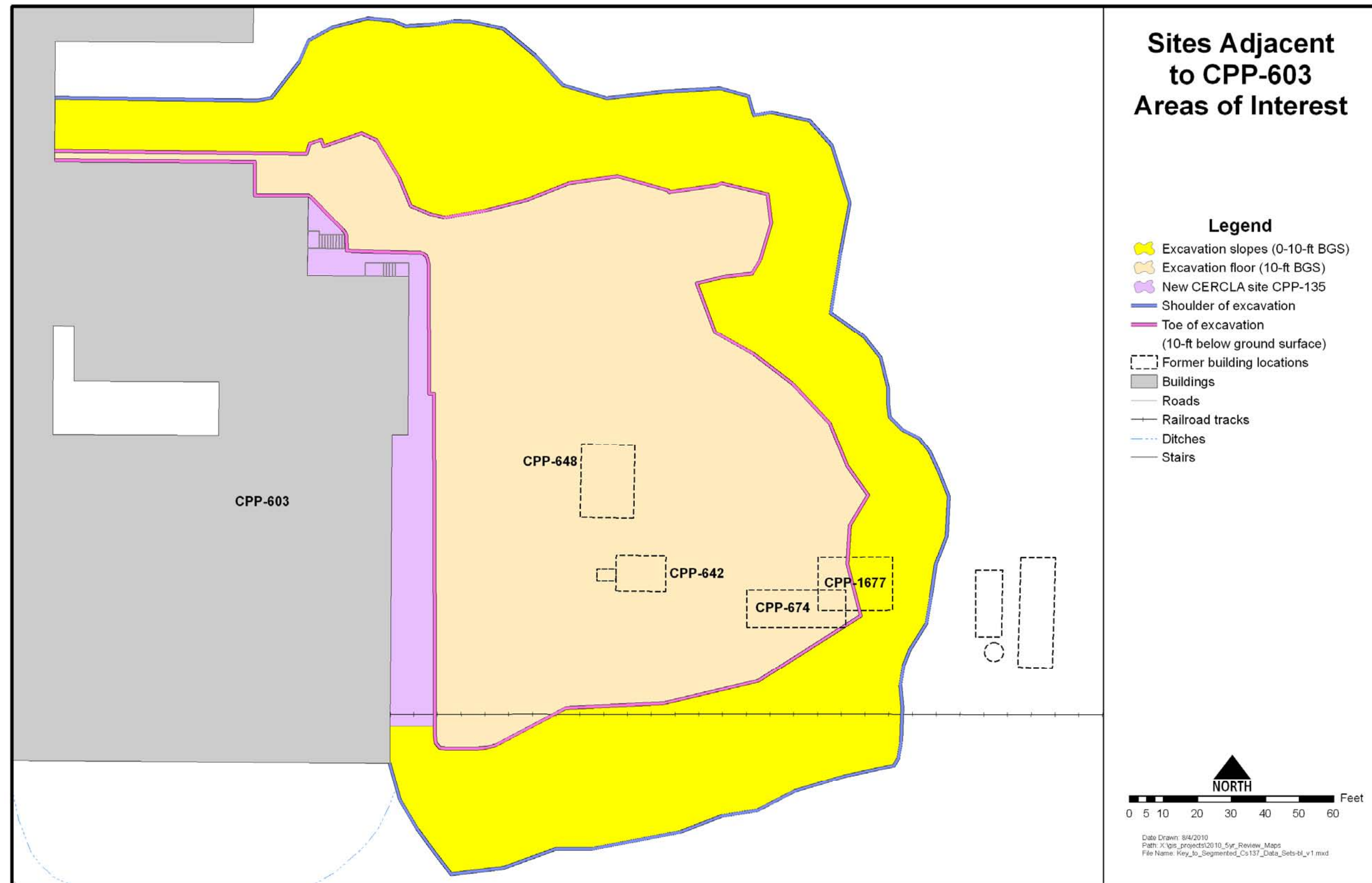


Figure 4-10. Surficial footprint of the final excavated area of CERCLA sites adjacent to CPP-603.

Table 4-11. Descriptions of the soil areas within CPP-01, -04/05, -08, -09, -10, -11.

CPP-01, -04/05, -08/09, -10, -11 Gamma-Scanned Area	Area Description
Excavation slopes	Above 10 ft excavation area (on the map). All of the sloped area (0–10 ft bgs) around the collective sites, except for that area next to Building CPP-603 designated as new Site CPP-135.
Excavation floor	Below the 10 ft excavation area (on the map). All of the excavation floor (less than 10 ft bgs) including the slopes from the floor leading to the base of the SFE-20 vault and pump pit (10–22 ft bgs), and the excavation floor under the SFE-20 vault and pump pit (22 ft bgs).
New CERCLA Site CPP-135	New CERCLA Site CPP-135 (on the map). The slope soil remaining up against the east side of CPP-603.
CERCLA Comprehensive Environmental Response, Compensation, and Liability Act	

Table 4-12. Comparison between risk-based remediation goals and performance levels achieved for CPP-01, -04/05, -08/09, -10, -11 soils.

Contaminant of Concern	Soil Risk-Based Remediation Goal, Radionuclide (pCi/g)	Performance Level Achieved, pCi/g (95% upper confidence limit)
Excavation slopes (0–10 ft bgs)		
Cs-137 (gamma scan)	23.3	5.2
Eu-152 (gamma scan)	270	0
Eu-154 (gamma scan)	5,200	8.1
Sr-90 (soil samples, slopes)	223	7.9
Excavation floor (>10 ft bgs)		
Cs-137 (gamma scan + point and shoot)	NA	165
Eu-152 (gamma scan + point and shoot)	NA	2
Eu-154 (gamma scan + point and shoot)	NA	2
Sr-90 (soil samples + CPP-69)	NA	4,000
New CERCLA Site CPP-135		
Cs-137 (gamma scan, slope)	23.3	559
Eu-152 (gamma scan, slope)	270	14.5
Eu-154 (gamma scan, slope)	5,200	3.2
Sr-90 (soil samples, slope)	223	2,289
NA not applicable UCL upper confidence limit		

Table 4-13. Descriptions of the gamma-scanned soil areas within CPP-13.

CPP-13 Gamma-Scanned Area	Area Description
Excavation floor (4 ft bgs)	Bottom of the excavation.
West slope (0–4 ft bgs)	West-side slope of the excavation.
East slope (0–4 ft bgs)	East-side slope of the excavation.
West top (0–1 ft bgs)	West side of the site on the flat level portion of the berm surrounding the storage bin, approximately 6 ft wide
East top (0–1 ft bgs)	East side of the site on the flat level portion of the berm surrounding the storage bin, approximately 6 ft wide
Construction surface	Those surfaces where equipment was staged, tracked over, or under the swing radius of excavation equipment

Table 4-14. Comparison between risk-based remediation goals and performance levels achieved for CPP-13 soils.

Contaminant of Concern	Soil Risk-Based Remediation Goal for Single Contaminant of Concern (pCi/g)	Performance Level Achieved (pCi/g) (95% upper confidence limit)
Cs-137, excavation floor	Not applicable at depths ≥ 4 ft bgs	8.5
Cs-137, west slope (0–4 ft bgs)	82	8.8
Cs-137, east slope (0–4 ft bgs)	82	5.0
Cs-137, west top (0–1 ft bgs)	82	30.8
Cs-137, east top (0–1 ft bgs)	82	14.4
Cs-137, construction surface	82	5.6

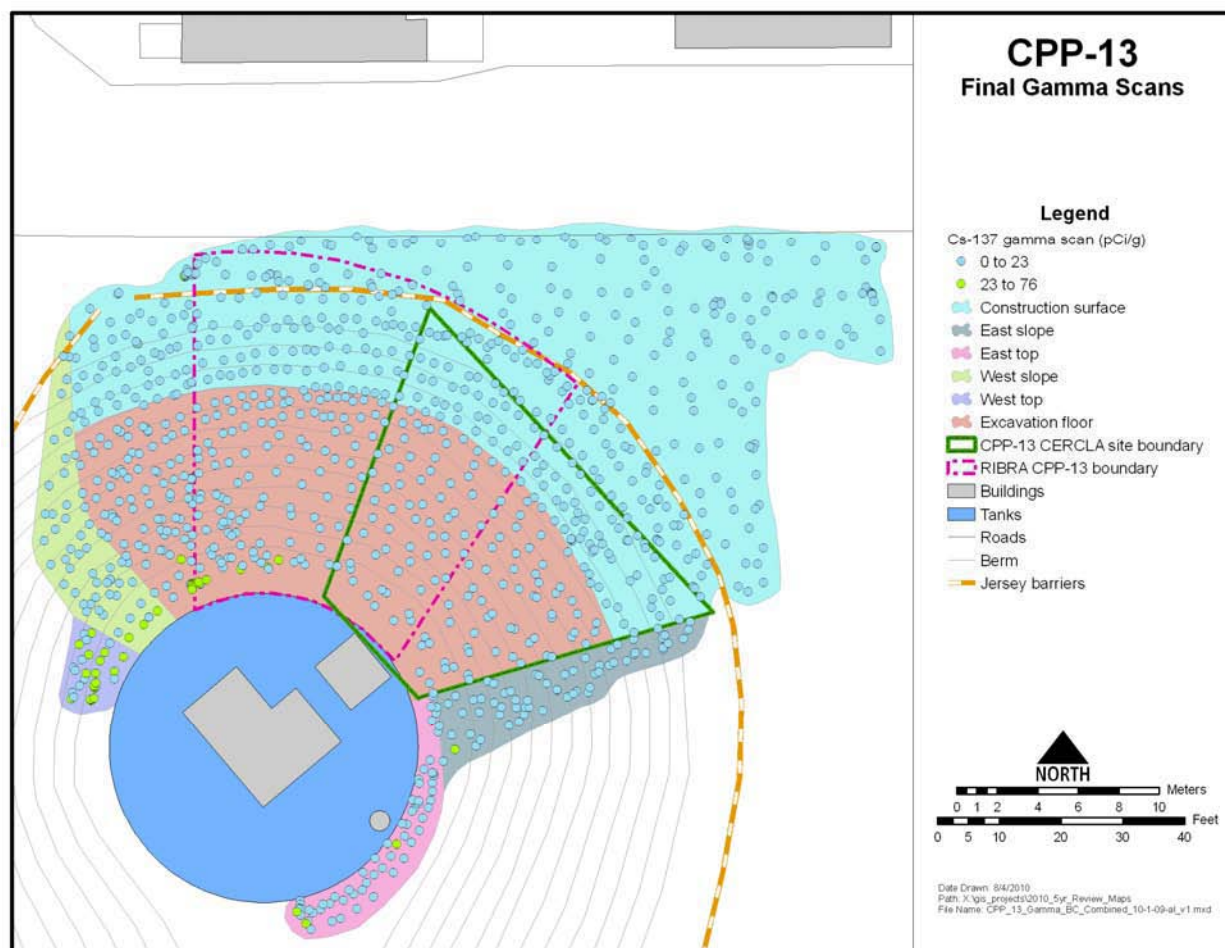


Figure 4-11. Surfacial footprint of CPP-13 excavation and construction areas, with overlay of final gamma scan data.

4.7.4.2.3 CPP-19 – Confirmation Sampling—The OU 3-13 Phase II Field Sampling Plan (DOE-ID 2006g) called for real-time spectroscopy of the CPP-19 soils, with spectral analyses specifically for Cs-137 and Eu-152/154. It also called for collecting eight soil samples from the excavation slopes (0–3 m [0–10 ft] bgs) and three soil samples from the excavation floor (below 3 m [10 ft] bgs). Although not called for in the Field Sampling Plan, a best management practice of scanning the immediate surrounding surface soils was implemented following completion of the excavation. This was performed to verify the absence of cross-contamination or spread of contamination resulting from equipment staging and to verify effectiveness of dust control methods used. These subsequent data are reported as from the “construction surface.”

Site sampling and scanning for gamma activity with the LaBr backpack system were ongoing activities throughout the excavation phase. The Backpack Spectroscopy Identification System was used routinely to guide excavation into areas having Cs-137 activity higher than the remediation goal. After the routine gamma scans revealed Cs-137 activity below the remediation goal for a given area, final Backpack Spectroscopy Identification System gamma scans were collected for Cs-137 and Eu-152/154 analyses, and soil samples were collected for offsite analyses of total strontium. The data from the individual sampling activities were later compiled for reporting purposes.

The OU 3-13 Phase II Field Sampling Plan for strontium required eight samples from the slope and three from the excavation floor. Samples were collected from 11 slope locations and seven excavation floor locations at a depth of 0 to 6 in. bgs using a grid similar to the one specified in Appendix B of the Field Sampling Plan. The sampling locations are shown in Figure 4-12. The sampling and gamma scan data and ProUCL (EPA 2007) statistical derivations are shown in Appendixes G (Sr), H (Cs-137), I (Eu-152), and J (Eu-154) of DOE-ID (2009c) and are summarized below in Table 4-15. The evaluation of the data shows that the exposure point concentrations for CPP-19 do not exceed the 80% of the remediation goals; therefore, further sampling was not required to be considered. There were no deviations from the Field Sampling Plan or the quality assurance/quality control procedures.

4.7.4.2.4 CPP-35 – Confirmation Sampling—The OU 3-13 Phase II Field Sampling Plan (DOE-ID 2006g) called for real-time spectroscopy of the CPP-35 soils, with spectral analyses for Cs-137. As mentioned in Section 4.7.2.2.4, the remediation goal for this site was established in the OU 3-14 ROD, and the sampling method used was consistent with the OU 3-13 Field Sampling Plan applied uniformly for all of the OU 3-13 sites, regardless of their location in the industrial use area or the residential use area. There were no deviations from the Field Sampling Plan or the quality assurance/quality control procedures. The best management practice of scanning the immediate surrounding surface soils was implemented following completion of the excavation to verify the absence of cross-contamination or spread of contamination resulting from equipment staging and to verify effectiveness of dust control methods used. These subsequent data are reported as from the “Excavation Pad.”

Site scanning for gamma activity with the LaBr backpack system was an ongoing activity throughout the excavation phase. The Backpack Spectroscopy Identification System was used routinely to guide excavation into areas having Cs-137 activity higher than the remediation goal. After the routine gamma scans revealed Cs-137 activity below the remediation goal for a given area, final Backpack Spectroscopy Identification System gamma scans were collected. The data from the individual scanning activities were later compiled for reporting purposes.

Evaluation of the slope data (Cs-137 activity) showed that the exposure point concentrations (the 95% UCL) over the slopes were less than the “80% of the remediation goals” level specified in the Field Sampling Plan, except on the north end of the west slope. The OU 3-13 Phase II Field Sampling Plan requires additional sampling under these conditions; however, sampling was already adequate in the area and the higher activity was due to unremoved contamination that could not be removed without compromising the adjacent structure, the Waste Calcining Facility cap. Consequently, no further excavation occurred in that area and no additional sampling was conducted. That section of the site was reclassified as new Site CPP-136. All of the requirements in the Field Sampling Plan were satisfied for the remaining portion of CPP-35.

The site gamma scans are partitioned into four areas, as defined in Table 4-16. The gamma scan data collected for CPP-35 and ProUCL (EPA 2007) statistical derivations are shown in Appendix L (DOE-ID 2009c) and summarized below in Table 4-17. Figure 4-13 shows the final gamma scan map for the site.

4.7.4.2.5 CPP-81 – Confirmation Sampling—The OU 3-13 Phase II Field Sampling Plan did not require confirmation sampling on CPP-81 since no evidence of leakage was found.

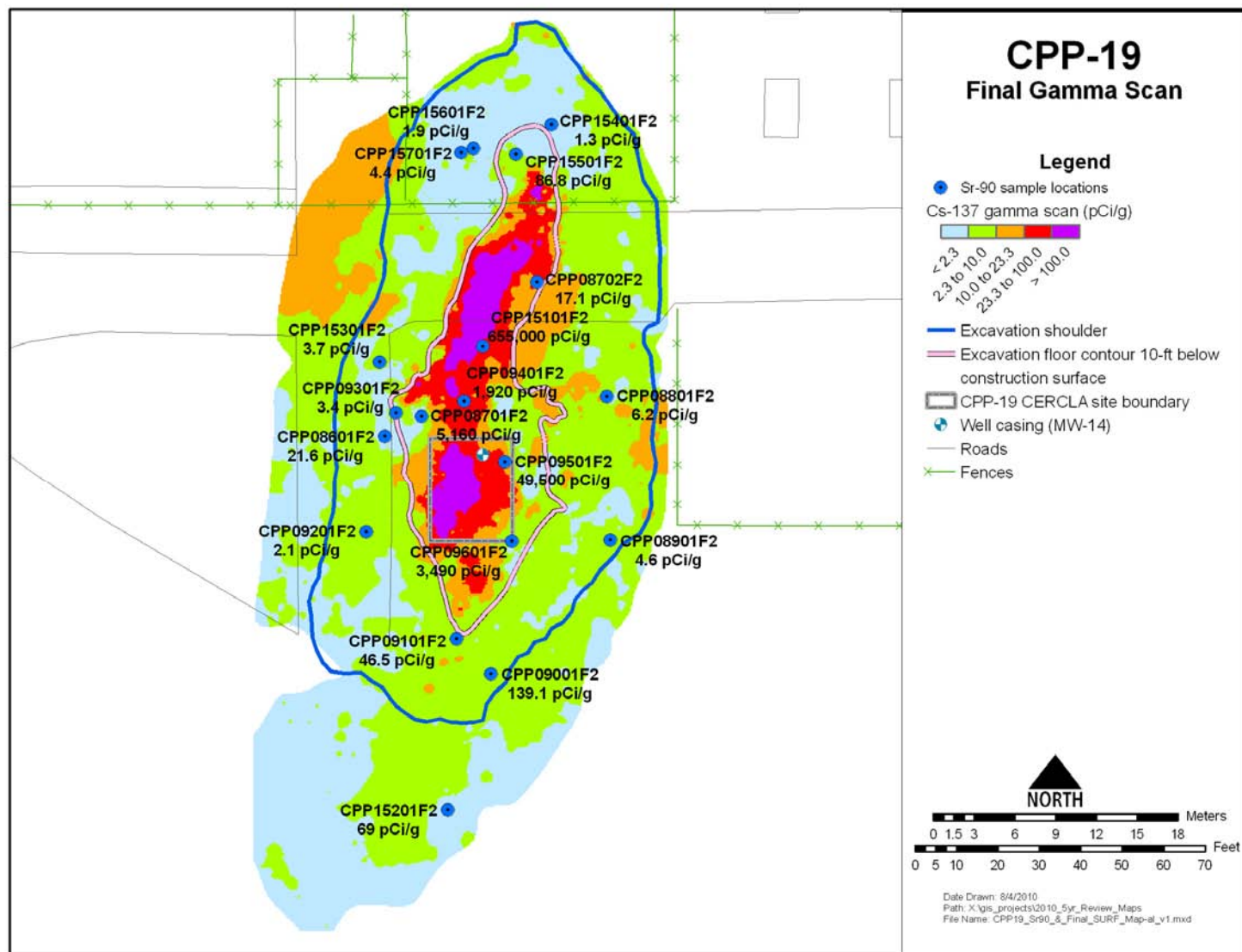


Figure 4-12. Surficial footprint of excavation and construction areas at CPP-19, with overlay of final gamma scan and strontium-90 sampling data.

Table 4-15. Comparison between risk-based remediation goals and performance levels achieved for the excavation of CPP-19 soils.

Contaminant of Concern	Soil Risk-Based Remediation Goal for Single Contaminant of Concern (pCi/g)	Performance Level Achieved (pCi/g) (95% upper confidence limit)
Slopes (0–10 ft bgs)		
Cs-137	23	5.1
Eu-152	270	1.3
Eu-154	5,200	1.0
Total strontium	223	108.5
Excavation floor (>10 ft bgs)		
Cs-137	NA	65.6
Eu-152	NA	14.5
Eu-154	NA	3.0
Total strontium	NA	595,357
Construction surface (essentially ground level)		
Cs-137	23	5.2
Eu-152	270	1.7
Eu-154	5,200	1.5
NA not applicable		

Table 4-16. Descriptions of the gamma-scanned soil areas within CPP-35.

CPP-35 Gamma-Scanned Area	Area Description (see also Figure 4-13 CPP-35 Final Cs-137 Gamma Scan)
Excavation floor (4 ft bgs)	Bottom of the excavation.
Slopes (0–4 ft bgs)	Slopes and vertical edges of the excavation. North and northwest section of the site had 5-ft vertical walls cut, rather than sloped, to protect utilities and structures.
West slope (0–4 ft bgs)	West-side slope of the excavation that will become new Site CPP-136.
Southwest excavation pad	Those surfaces where equipment was staged, tracked over, or under the swing radius of excavation equipment.

Table 4-17. Comparison between risk-based remediation goals and performance levels achieved for CPP-35 soils.

Contaminant of Concern	Soil Risk-Based Remediation Goal for Single Contaminant of Concern (pCi/g)	Performance Level Achieved (pCi/g) (95% upper confidence limit)
Cs-137, excavation floor (4–5 ft bgs)	NA	57.5
Cs-137, slopes (0–5 ft bgs)	82	18.7
Cs-137, west slope (0–5 ft bgs)	82	292
Cs-137, SW excavation pad	82	4.9
NA not applicable SW southwest		

4.7.4.2.6 CPP-93 – Confirmation Sampling—The project possessed the analysis equipment identified in Table 3-3 of the Field Sampling Plan and elected to perform all of the mercury analyses on site to avoid delays associated with sample analysis turnaround. No independent limitations and validation report was generated as is customary for analyses conducted by independent laboratories. Consequently, this section and the corresponding appendixes in DOE-ID (2009c) containing the sample data and quality control samples are more detailed than other sections that discuss remedial actions for Group 3 Phase II remedial actions to verify quality of the data and compliance to the Field Sampling Plan and the company quality program. No other deviations from the Field Sampling Plan or quality assurance/quality control procedures occurred.

All sampling and analysis requirements identified in the Field Sampling Plan were adhered to except as noted and explained here. Table 4-3 in the Field Sampling Plan identifies sample collection in glass bottles and sample preservation at 4°C. These are necessary observances for samples containing elemental or volatile forms of mercury, as elemental mercury will diffuse through many types of plastic containers, and all volatile forms may be lost through sample handling. The mercury in the simulated calcine material was bound as mercuric oxide and not susceptible to vaporization or loss through plastic containers. Consequently, plastic sample bottles were used and preserving the samples at low temperature was not practiced. The absence of elemental mercury was verified in the lab as the samples were being dried in a lab oven. A Jerome Mercury Analyzer (also specified in the Field Sampling Plan) was placed near the drying oven as the samples were drying, and inserted into the oven when the oven was first opened and prior to removing the samples. The Jerome did not detect mercury under either of these situations.

It was envisioned (DOE-ID 2006d, Section 1.4.22.1) that the calcine material in CPP-93 was well confined in a concentrated form between 4- and 8-ft depth bgs, approximately 16 ft wide at the widest point, and running a straight length of 61 m (200 ft). The OU 3-13 Phase II Field Sampling Plan (DOE-ID 2006g, Section 4.1.3.3) specifies: “A minimum of eight random samples will be collected ...” Under such well-defined conditions, the excavation and sampling activities would have been straightforward, and, as such, the samples were anticipated to be collected from the bottom of the excavation.

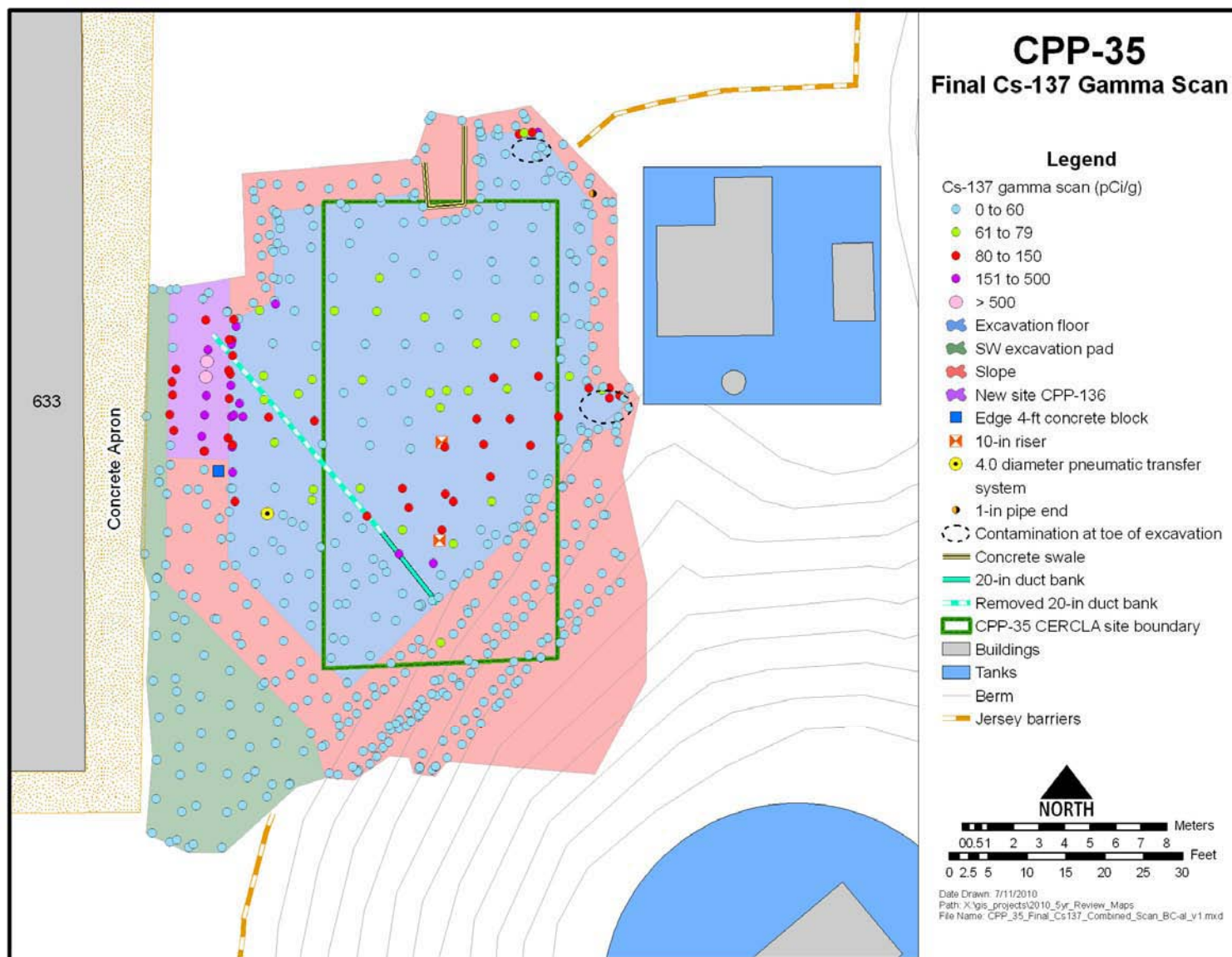


Figure 4-13. Final gamma scan map of CPP-35.

Shortly after beginning the excavation, however, calcine material was observed in locations deviating from the simple linear confined area previously described. The calcine in several areas was also interspersed with the soil and not readily observable except upon close visual inspection. As analyses later bore out, visual inspection was not accurate or reliable enough to identify the areas of calcine (and, thus, potential mercury contamination). Consequently, the project relied on soil sampling at the dig face and rapid turnaround analyses to guide the excavation. Areas of the dig face having samples with mercury concentrations above the remediation goal were excavated further. Areas of the dig face having samples with mercury concentrations below the remediation goal were not excavated further, and those sample results were included, in part, as confirmation samples.

Evaluation of the slope data (Hg concentrations) showed that the exposure point concentrations (the 95 % UCL) for CPP-93 did not exceed the “80% of the remediation goals” level, which would otherwise have required additional sampling. Consequently, no additional sampling of the slopes was conducted.

Additional samples were collected to fill in spatial gaps, as were samples collected on the bottom of the excavation, to satisfy the Field Sampling Plan requirements. In all, four different groupings of samples were collected:

1. Residential use area, slope samples between 0 to 3-m (0 and 10-ft) depth
2. Residential use area, excavation floor samples at 3-m (10-ft) depth or greater
3. Industrial use area, slope samples between 0 and 4-ft depth
4. Industrial use area, excavation floor samples at 4-ft depth.

Physical soil samples were collected using a new plastic scoop and container per sample. Several samples were collected from sheer side slopes by using a scoop taped to a long pole. Samples were collected from 0 to 6 in. deep. Sample locations accessible to personnel were surveyed. The samples were given unique identifier sample numbers, photographs were taken of the sample locations, and the samples were logged in the field team leader daily logbook. The sample containers were sealed with tape, field-surveyed for radioactive contamination, and delivered to a field laboratory set up approximately 180 m (200 yd) from the dig site for analyses. Table 4-18 summarizes the results for the four areas.

Table 4-18. Comparison between risk-based remediation goals and performance levels achieved for CPP-93 soils.

CPP-93 Area	Soil Risk-Based Remediation Goal for Single Contaminant of Concern (mg/kg mercury)	Performance Level Achieved (mg/kg [95% upper confidence limit] mercury)
RUA – slopes (0–10 ft bgs)	23	4
RUA – excavation floor (10 ft bgs)	NA	26 (high)
IUA – slopes (0–4 ft bgs)	23	7
IUA – excavation floor (4 ft bgs)	NA	49 (high)
IUA industrial use area NA not applicable RUA residential use area		

4.7.4.2.7 CPP-130 – Confirmation Sampling—Site scanning for gamma activity with the Backpack Spectroscopy Identification System was an ongoing activity throughout the excavation phase of CPP-130. The Backpack Spectroscopy Identification System was used routinely to guide excavation into areas having Cs-137 activity higher than the remediation goal. After the routine gamma scans revealed Cs-137 activity below the remediation goal for a given area, final Backpack Spectroscopy Identification System gamma scans were collected for Cs-137 (see Figure 4-14). Data from the individual sampling activities were later compiled for reporting purposes.

The data were not separated into slope and bottom scans as in the other sites reported in the remedial action report. The reason for this was because the slopes were not sufficiently distinct at only 3 to 4 ft high, with some of them vertical and others approaching 1:1.5 (rise over run). The overlap of adjacent scans for small areas (less than approximately 7 to 8 ft) composing the slope, intersection of the slope and bottom, and bottom made assigning the data to either location unreliable. As such, the scans represented the entirety of the excavation, with slope and bottom data combined.

The site gamma scans were partitioned into eight areas as defined in Table 4-19. The gamma scan data collected for CPP-130 and ProUCL (EPA 2007) statistical derivations are summarized in Table 4-20.

Evaluation of the combined slope and excavation floor data (Cs-137 activity) showed that the exposure point concentrations (the 95% UCL) for the site did not exceed the “80% of the remediation goals” level, which would otherwise have required additional sampling. Consequently, no other sampling was conducted and all of the requirements in the Field Sampling Plan and quality assurance/quality control procedure were satisfied.

The 95% UCL reported for the combined data for Zones 1–7 was used as the final performance indicator for CPP-130 and used to calculate the ICs for the area. Zones 2 and 4 have individually higher residual Cs-137 activity than the combination of zones; however, the apparent reduction in ICs for those two zones was not significant. Zone 2 was an area comprising a small fraction of the total remediated area at approximately 3 m (10 ft) square. Zone 4 was similarly a small area where the contamination was believed to reside on the external and internal surfaces of the electrical utility service structure that was the anomaly the remedial activity sought to identify. Zone 4 was hand-excavated and the soil surveyed “clean” (having no activity above background) before leaving the site. The structure, however, was contaminated on the inside at a sufficiently high activity (several hundred cpm above background) where surveys on the outside also registered above background. While not currently active, this electrical utility service structure (manhole) was left in place to support future operations at the request of the CPP-603 facility management.

4.7.4.2.8 CPP-132 – Confirmation Sampling—Site scanning for gamma activity with the LaBr backpack system was an ongoing activity throughout the excavation phase. The original footprint was dug up; whereafter, the Backpack Spectroscopy Identification System was used to locate hot spots and guide excavation into areas having residual Cs-137 activity higher than the remediation goal. Those areas were further excavated and additional gamma scans collected. A collection of the gamma scans, minus data for those areas re-excavated, was used as the final confirmation scans.

The data for the site were not partitioned into slope and floor areas because of the narrow floor and anticipated problems associated with de-convoluting the data. Thus, they are presented as a single dataset in Appendix S (DOE-ID 2009c) along with the ProUCL (EPA 2007) statistical derivations. The results are summarized below in Table 4-21. A drawing of the final gamma scan for the area is shown in Figure 4-15. There were no deviations from the Field Sampling Plan or quality assurance/quality control procedures.

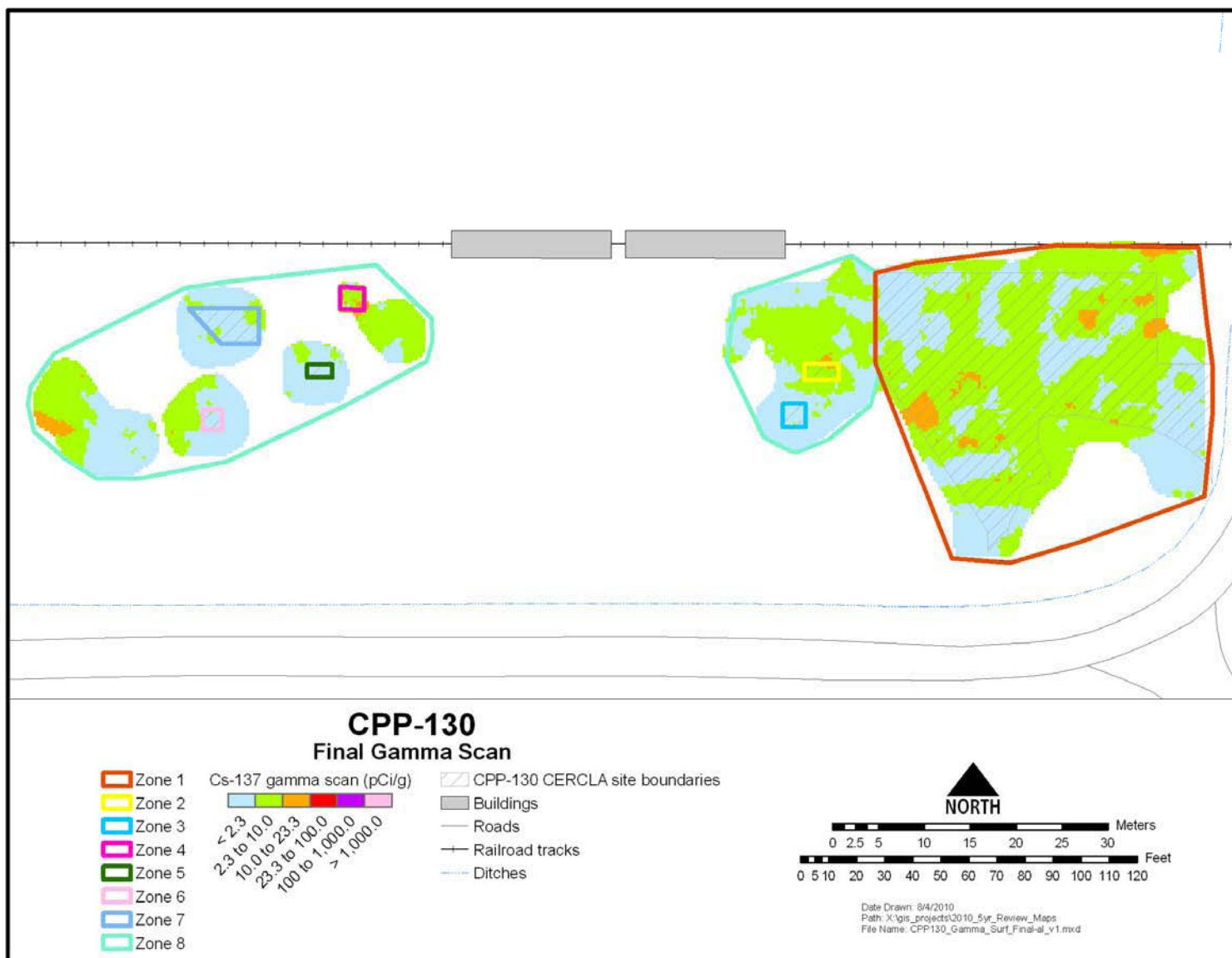


Figure 4-14. Final gamma scan for CPP-130.

Table 4-19. Descriptions of the gamma-scanned soil areas within CPP-130.

Code for CPP-130 Gamma-Scanned Area	Area Description (see also Figure 4-14 CPP-130 Final Gamma Scans)
Zone 1, E Exc E	East side of the CPP-130 site, largest single excavation, bottom of the excavation and slopes (0–4 ft bgs).
Zone 2, E Exc Cntr	East side of the CPP-130 site, 1 st small excavation west of Zone 1, bottom of the excavation and slopes (0–4 ft bgs).
Zone 3, E Exc W	East side of the CPP-130 site, 2 nd small excavation west of Zone 1 and Zone 2, bottom of the excavation and slopes (0–4 ft bgs).
Zone 4, W Exc Manhole	West side of the CPP-130 site, northeast corner of grouping of four excavations on the west, farthest north and east of the four west excavations, bottom of the excavation and slopes (0–4 ft bgs).
Zone 5, W Exc E	West side of the CPP-130 site, southeast corner of grouping of four excavations on the west, just west of Zone 4, bottom of the excavation and slopes (0–4 ft bgs).
Zone 6, W Exc SW	West side of the CPP-130 site, southwest corner of grouping of four excavations on the west, just west of Zones 4 and 5, bottom of the excavation and slopes (0–4 ft bgs).
Zone 7, W Exc NW	West side of the CPP-130 site, northwest corner of grouping of four excavations on the west, just west of Zones 4 and 5, north of Zones 5 and 6, bottom of the excavation and slopes (0–4 ft bgs).
Zone 8, Construction Surface	Ground surface areas, areas where equipment was staged or tracked over, and areas under the swing radius of excavation equipment (0 ft bgs)

Table 4-20. Comparison between the Cs-137 risk-based remediation goal and performance levels achieved for CPP-130 soils.

Code for CPP-130 Gamma-Scanned Area ^a	Soil Risk-Based Remediation Goal for Single Contaminant of Concern (pCi/g)	Performance Level Achieved (pCi/g) (95% upper confidence limit)
Zone 1, E Exc E	23.3	5.1
Zone 2, E Exc Cntr	23.3	9.6
Zone 3, E Exc W	23.3	3.2 (maximum of three data)
Zone 4, W Exc Manhole	23.3	8.8
Zone 5, W Exc E	23.3	3 (maximum of four data)
Zone 6, W Exc SW	23.3	3.3 (maximum of four data)
Zone 7, W Exc NW	23.3	1.9
Zones 1–7 Combined	23.3	5.1
Zone 8, Construction Surface	23.3	3.2
a. Bolded entry indicates zones and values used to calculate ICs.		
IC institutional control		

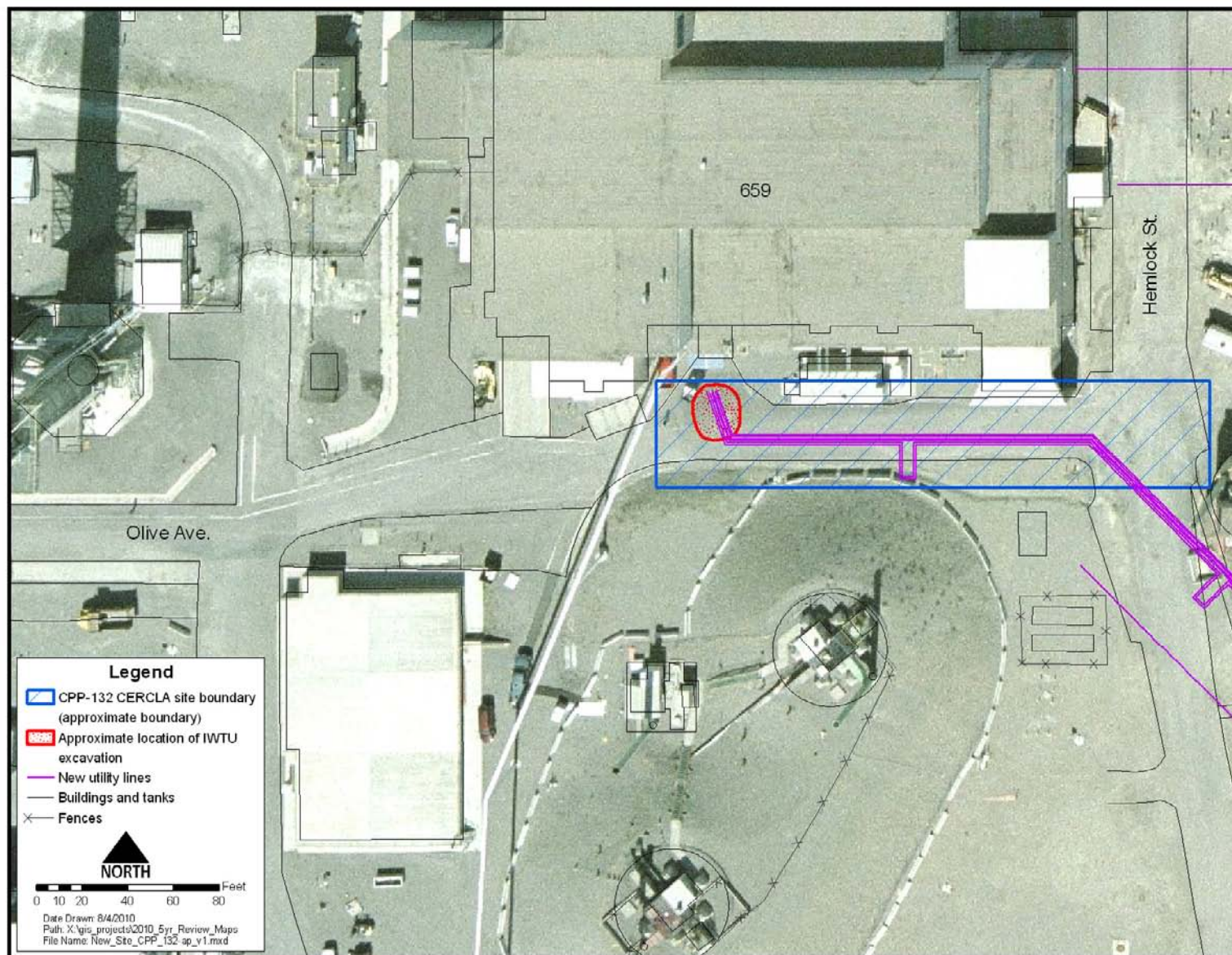


Figure 4-15. Location of CPP-132.

Table 4-21. Comparison between risk-based remediation goals and performance levels achieved for CPP-132 soils.

Contaminant of Concern	Soil Risk-Based Remediation Goal, Radionuclide (pCi/g)	Performance Level Achieved (pCi/g) (95% upper confidence limit)
Cs-137, excavation (gamma scan)	82	5.7

4.7.4.3 Statistical Treatment of the Confirmatory Sampling Data. All of the datasets resulting from the individual sampling activities were subject to statistical analyses using ProUCL (EPA 2007). Data were analyzed for potential outliers, and those identified by the software are bolded in the data printouts. Outliers were generally kept in the datasets for subsequent analyses except for one dataset.

The UCL was then determined with the “Full” data set option and “All” distributions evaluated. The 95% or 97.5% UCL recommended by the program was used in all cases to determine the period of ICs for the COCs at the respective sites.

The “Goodness-of-Fit” Q-Q plot for the identified distribution is included after the general UCL statistics, where applicable. A Q-Q plot for normal distributions is presented for those datasets having either normal or nonparametric distributions. A plot of the histogram is also presented for most datasets.

All data were used in the statistical treatments; however, not all data were used in determining the UCL for a site. The exception is the CERCLA sites adjacent to CPP-603 bottom Cs-137. The 10 soil grab samples collected under Site CPP-69 and analyzed offsite for Cs-137 and strontium total had substantially lower Cs-137 activities than those recorded using the Backpack Spectroscopy Identification System over the same area. The Cs-137 soil sample results for those 10 samples were subsequently not used in determining the UCL in preference for using the gamma scan data (see Figure 4-16). The Sr results were, however, used in determining the UCL for strontium.

In contrast to the exceptions listed above, all gamma scan data and soil grab sample data were used to determine the UCLs and subsequent ICs for the sites. This means including the negative data results for the gamma scan data and flagged results in the Sr total data.

The negative gamma scan data (negative activities reported) in the datasets were not removed as this represents the natural fluctuation of the instrument response around the “zero” or baseline. They are obviously false negatives in the sense that there cannot be negative activities; however, there will be just as many random false positive results with equal magnitudes. Since the false negatives and false positives cannot be eliminated with certainty, they are left in to cancel each other during the statistical workup. In addition, the large amount of data overwhelms the impact of a single (or even multiple) outlier or obviously erroneous negative value. Retaining and using the negative values also exemplifies the extent and thorough coverage of the sampling over the area. The fact that they are low negative values means their contribution to the UCL will be that of a nondetect and more representative of the actual potential for exposure to humans and the environment.

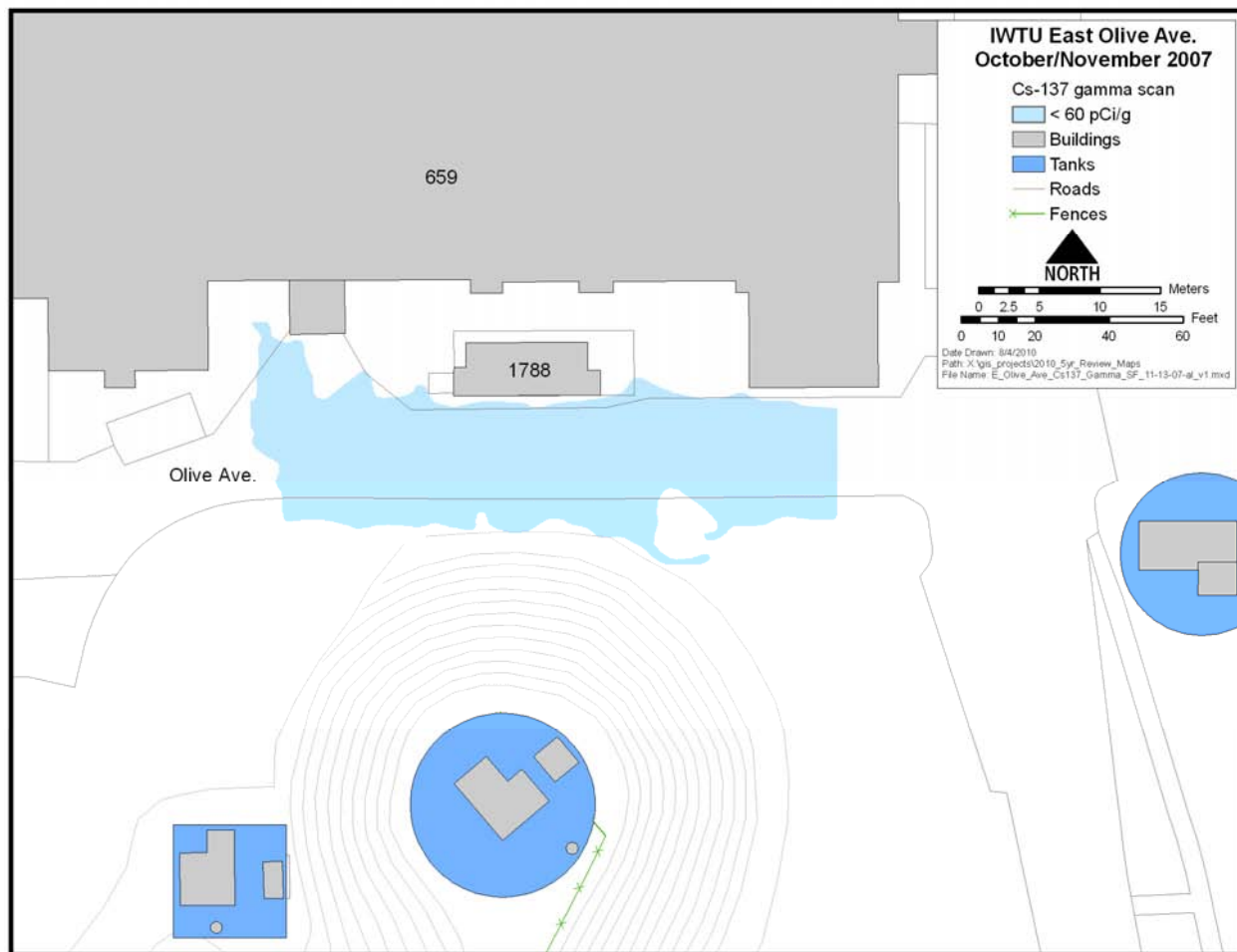


Figure 4-16. Surficial footprint of CPP-132 areas excavated, with overlaid final gamma scan data.

The flagged strontium data were similarly used in determining associated UCLs. In all cases, the flagged data had low activities and their exclusion in the UCL would have failed to show real exposure potential in the area. Further, in all of the site areas where strontium data were flagged, the UCL for Cs-137 was the sole source for calculating the period of IC. Those areas where the strontium activities were high and determined the period of IC had no flagged data.

All of the mercury data presented for CPP-93 were also used in the determination of UCLs for the four areas in the site. These data were treated differently in that the values below the method detection limit were treated as nondetects.

4.7.5 Technical Assessment

The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. The contaminated soil was excavated at all of the OU 3-13, Group 3, Phase II sites that required remediation.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?

Yes.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

Technical Assessment Summary

The Phase II Set 4 and Set 5 remediation sites were completed in accordance with the requirements established in the OU 3-13 ROD (DOE-ID 1999a) and are protective of human health and the environment. No changes to the remedy or assumptions have come to light that would call into question the effectiveness of the selected remedy.

4.7.6 Issues

No issues are identified for Group 3 that would have any effect on the selected remedy or that would require immediate attention.

4.7.7 Recommendations and Follow-Up Actions

Because no issues are identified, recommendations or follow-up actions are not required.

4.7.8 Protectiveness Statement for Operable Unit 3-13, Group 3, Phase I (Sets 1, 2, and 3) and Phase II (Sets 4, 5, and 6)

The remedy at OU 3-13 Group 3 (Phases I and II) is protective of human health and the environment. The remedial actions for Group 3 have been completed. The Group 3 Phase I and Phase II Remedial Action Reports (DOE-ID 2007e, 2009c, respectively) have been approved. No changes in the physical conditions of these sites have occurred that would affect the protectiveness of the remedy.

4.8 Operable Unit 3-13, Group 4 – Perched Water

4.8.1 Background

Perched water exists at several depths beneath the tank farm area and constitutes a pathway for contaminants to migrate downward to the SRPA (DOE-ID 1999a). Perched water and groundwater beneath the facility became contaminated as a result of past operations. Contaminant sources included the former INTEC injection well that previously received low-level radioactive aqueous waste from plant processes (service wastewater), low-level radioactive aqueous waste from the former percolation ponds, and radioactive waste at the INTEC tank farm.

As emphasized in the OU 3-13 ROD (DOE-ID 1999a), the perched water underlying INTEC does not currently pose a direct human health or environmental threat, nor is it used as a source of drinking water. Rather, the perched water exists primarily as a result of facility water use and discharges, and most of the perched water is expected to disappear when INTEC operations cease. However, the perched water does pose a threat as a contaminant transport pathway to the SRPA, and radionuclides already in the perched water potentially constitute secondary source contaminants that could impact the underlying aquifer.

4.8.2 Remedial Action

4.8.2.1 Remedy Selection. The selected OU 3-13 perched water remedy is ICs with aquifer recharge controls and includes the following four general elements:

- Implement ICs to prevent perched water use and to prevent future unauthorized drilling into or through the perched zone.
- Implement remedies to control surface water recharge to perched water by relocating the INTEC percolation ponds.
- Minimize recharge to the perched water from lawn irrigation, and line a segment of the Big Lost River channel, if necessary. Implement additional infiltration controls if perched water does not recede as predicted by the Remedial Investigation/Feasibility Study vadose zone model within 5 years of removing the percolation ponds.
- Measure moisture content and COC concentrations in the perched water zones to determine if water content and contaminant fluxes are decreasing as predicted, and use these data to verify the OU 3-13 vadose zone model and determine potential impacts to the SRPA.

4.8.2.1.1 Remedial Action Objectives—The OU 3-13 perched water (Group 4) remediation goals are to (1) reduce recharge to the perched zones and (2) minimize the migration of contaminants to the SRPA so that SRPA groundwater outside of the current INTEC security fence meets applicable State of Idaho groundwater standards by 2095.

The OU 3-13 ROD specified the following RAOs for perched water (Group 4):

- Prevent migration of radionuclides from perched water in concentrations that would cause SRPA groundwater outside the current INTEC security fence to exceed a cumulative carcinogenic risk of 1×10^{-4} , a total hazard index of 1, or applicable State of Idaho groundwater quality standards (i.e., MCLs) in 2095 and beyond.
- Prevent excavations into and drilling through the contaminated earth materials to prevent exposure of the public to a cumulative carcinogenic risk of 1×10^{-4} , a total hazard index of 1, and to protect the SRPA.

In accordance with the requirements in the OU 3-13 ROD, various remedial actions have been completed to reduce the infiltration of precipitation and anthropogenic water at INTEC, including: (1) relocation of the INTEC percolation ponds, (2) elimination of the sewage treatment plant infiltration trenches, (3) installation of concrete-lined ditches and pavement to route surface water away from the tank farm area, (4) elimination of lawn irrigation, (5) decommissioning of steam condensate drip legs, and (6) isolation and repair of clean water leaks from underground pipelines.

4.8.2.1.2 Cleanup Levels—Perched water remediation goals are to:

As stated in the OU 3-13 ROD (DOE-ID 1999a), the perched water (Group 4) remediation goals are:

1. Reduce recharge to the perched zones
2. Minimize the migration of contaminants to the SRPA so that SRPA groundwater outside of the current INTEC security fence meets applicable State of Idaho groundwater standards by 2095.

Note that SRPA groundwater quality inside the current INTEC security fence was deferred to OU 3-14.

4.8.2.2 Remedy Implementation. Table 4-22 lists the individual remedial action requirements for OU 3-13 Group 4, along with the dates when each action item was completed. Relocation of the INTEC percolation ponds was the principal remedial action specified in the ROD to reduce water infiltration and downward contaminant transport. Two new percolation ponds were constructed 3.2 km (2 miles) west of INTEC, and the new ponds became operational on August 26, 2002. The old INTEC percolation ponds were taken out of service at that time. These actions constituted Phase I of the OU 3-13 perched water remedy.

In addition to relocation of the percolation ponds, the OU 3-13 ROD specified contingent remedy requirements (Phase II) to be implemented if the perched water zones failed to drain out as predicted by the model. The contingent remedy included the following additional contingent remedial actions:

- Lining the Big Lost River (or equivalent) to minimize river recharge to perched water
- Curtailing steam condensate discharges to the subsurface
- Removing existing sewage treatment plant lagoons and infiltration galleries
- Additional measures, as necessary, to reduce water infiltration and recharge beneath the northern part of INTEC.

The decision whether to implement the contingent remedy was to follow a 5-year monitoring period to assess drain out of perched water in response to relocation of the percolation ponds. Based on the date of percolation pond relocation, the 5-year monitoring period ended on August 26, 2007.

The Group 4 Remedial Action Report (Monitoring Report/Decision Summary; DOE-ID 2007f) documented the contingent remedy decision. Monitoring data and modeling predictions indicated that, with no additional actions, the Group 4 RAOs will be met for SRPA groundwater outside the INTEC fence on or before 2095. Furthermore, OU 3-14 modeling indicated that lining of the Big Lost River would have no appreciable beneficial effect on reducing the migration of Sr-90 from shallow perched water beneath the tank farm to the SRPA. Therefore, the contingent remedy element for lining the Big Lost River would not be implemented.

The OU 3-14 RAOs require that MCLs be met by 2095 everywhere in the SRPA both inside and outside the INTEC security fence. The continued presence of thermally warm, Sr-90-contaminated shallow perched water beneath the tank farm and vicinity indicates that additional anthropogenic recharge sources still exist in that area. Therefore, further actions are being performed as part of the OU 3-14 remedy to identify and reduce or eliminate anthropogenic recharge of the northern shallow perched water, as summarized in Table 4-22 and discussed in Section 4.12.2.2.1.4 (Table 4-32).

During 2007, the Agencies made a joint decision to close out OU 3-13, Group 4 (Perched Water) and Group 5 (SRPA Groundwater) and to perform all future actions related to perched water and groundwater under the auspices of OU 3-14. This decision was documented in the Group 4 Remedial Action Report (Monitoring Report/Decision Summary; DOE-ID 2007f). Section 4.12.2 describes OU 3-14 remedial actions performed after closeout of Group 4.

4.8.2.3 Operations and Maintenance. Section 4.12.2.2 presents perched water remedial actions performed after closeout of OU 3-13 Group 4.

Table 4-22. Remedial action requirements for Operable Unit 3-13, Group 4.

Item No.	Required Action	Requirement Reference	Activity Status
1	Implement ICs	3-13 ROD, Table 11-1, p. 11-23 (DOE-ID 1999a)	ICs are in place as per the requirements in the <i>INL Site-Wide Institutional Controls, and Operations and Maintenance Plan for CERCLA Response Actions</i> (DOE-ID 2010a).
2	Relocate INTEC Percolation Ponds by 12/31/03	3-13 ROD, p. viii (DOE-ID 1999a)	Completed 8-26-02.
3	Discontinue lawn irrigation (if necessary)	3-13 ROD, p. 11-23 (DOE-ID 1999a)	Irrigation of lawns was discontinued at the end of 2005.
4	Curtail steam condensate discharges to ground (if necessary)	3-13 ROD, p. 11-23 (DOE-ID 1999a)	Eliminated the last two remaining aboveground steam drip legs along Beech Street by April 2008 and one stream drip leg, beneath Beech Street, by August 2008.
5	Discontinue use of Sewage Treatment Lagoons and infiltration trenches (if necessary)	3-13 ROD, p. 11-23 (DOE-ID 1999a)	Infiltration trenches eliminated on 12/04/04; lagoons are still operating but are not believed to constitute a significant recharge source (EDF-7142).
6	Measure perched water levels and vadose zone moisture contents	3-13 ROD, p. 11-22 (DOE-ID 1999a)	Ongoing (2003–2010) measurements of perched water levels and moisture contents (tensiometers).
7	Perform baseline groundwater sampling event	Group 4 MSIP Rev. 0, p. 3-1 (DOE-ID 2000b)	Completed 2001 (DOE-ID 2002c).
8	Measure COC concentrations in perched water	3-13 ROD, p. viii (DOE-ID 1999a); Group 4 MSIP Rev. 0; p. 3-2 (DOE-ID 2000b)	Completed: perched water sampling performed 2003–2007 and 2009.
9	Install five new Phase I monitoring well sets (CS, BLR, PP, STL and TF wellsets)	Group 4 MSIP Rev. 0, p. 3-1, 3-10 (DOE-ID 2000b)	Completed 2001-02 (DOE-ID 2003c).
10	Perform tracer study at Percolation Ponds, Sewage Treatment Plant, and BLR (if flowing)	Group 4 MSIP Rev. 0; p. 3-2, 3-12 (DOE-ID 2000b)	Completed 2001, but BLR tracer study not performed because river was not flowing (DOE-ID 2003d).
11	Perform <i>Water System Engineering Study</i> (WSES)	Group 4 MSIP Rev. 3; p. 5-7 (DOE-ID 2005h)	Completed 2003 (DOE-ID 2003e).
12	Perform quarterly water balance calculations	OU 3-14 ROD, p. 12-3 (DOE-ID 2007d), DOE-ID 2005d)	Completed; quarterly water balances have been prepared beginning in 2004 (DOE-ID 2005d, 2008d).

Table 4-22. (continued).

Item No.	Required Action	Requirement Reference	Activity Status
13	Prepare <i>Monitoring Well and Tracer Study Report</i>	Group 4 MSIP Rev. 0; p. 7-1; (DOE-ID 2000b)	Completed 2003 (DOE-ID 2003d).
14	Prepare annual perched water monitoring reports	Group 4 MSIP Rev. 0; App. E (DOE-ID 2000b)	Completed; annual perched water monitoring reports submitted beginning in 2003.
15	Perform Geochemical and Isotope Study	Group 4 MSIP Rev. 3; p. 5-7 (DOE-ID 2005g)	Completed 2003–2004 (EDF-5758).
16	Perform <i>Evaluation of Tc-99 in Groundwater at INTEC</i>	Group 4 MSIP Rev. 3; App. O (DOE-ID 2005g)	Completed 2004 (ICP 2004).
17	Install two new Phase II monitoring well sets south of tank farm	Group 4 MSIP Rev. 3; p. 5-1, App. P (DOE-ID 2005g)	Completed 2005 (DOE-ID 2006d).
18	Line segment of BLR channel (if necessary)	3-13 ROD, p. viii, 11-23 (DOE-ID 1999a)	Determined unnecessary through OU 3-14 FS modeling (DOE-ID 2006b, A-3); action not performed.
BLR	Big Lost River		
COC	contaminant of concern		
FS	feasibility study		
IC	institutional control		
INTEC	Idaho Nuclear Technology and Engineering Center		
MSIP	Monitoring System and Installation Plan		
OU	operable unit		
ROD	Record of Decision		

4.8.3 Progress Since the Last Review

4.8.3.1 Protectiveness Statements from Last Review. The protectiveness statements in the last 5-Year Review (DOE-ID 2007a) that pertain to OU 3-13, Group 4 were as follows:

Remedial actions are in progress for the remainder of the Group 3 sites and at the Group 4, 5, and 7 sites. Upon completion of remedial actions for Groups 3, 4, 5, and 7, the remedies are expected to be protective. However, new information and modeling for the OU 3-14 feasibility study will provide additional information on the SRPA within INTEC. The information is expected to impact the modeling and information on the SRPA outside of INTEC (Group 5). The information and modeling will have to be assessed when they are available in order to determine whether the remedies for Groups 4 and 5 continue to be protective.

Uncertainties exist regarding the draining of the northern perched water zone and the elevated concentration of Tc-99 in the perched water. Since the Group 4 remedy is in process, it is unknown whether additional actions will be needed for the Group 4 remedy to be fully protective. Consequently, the remedy will require evaluation through the future remedial action report.

The institutional controls and the soil management strategy remain in effect for the no-further-action sites and are protective of human health and the environment.

4.8.3.2 Status of Recommendations and Follow-Up Actions from Last Review.

Appendix C of the 2005 CERCLA 5-Year Review (DOE-ID 2007a) identified the following issue requiring further action:

“The northern perched water zone has persisted following relocation of the percolation ponds in 2002.”

Sections 4.12.2.2 and 4.12.3 discuss the status of actions performed to address this issue of perched water beneath INTEC.

4.8.4 Data Review and Evaluation

Section 4.12.2.2 presents perched water remedial actions performed after closeout of OU 3-13, Group 4.

4.8.5 Technical Assessment

The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. As documented in the Group 4 Remedial Action Report (Monitoring Report/Decision Summary; DOE-ID 2007f), the selected remedy for Group 4 specified in the OU 3-13 ROD is operating and functioning as intended. ICs are currently in place, as required by the ROD. OU 3-14 modeling predicts that, without any further remedial action, SRPA contaminant concentrations will meet MCLs outside the INTEC fence by 2095. Ongoing perched water and groundwater monitoring are being conducted under OU 3-14.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Yes.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No. No new information has arisen that would call into question the protectiveness of the implemented remedies. Ongoing efforts continue under OU 3-14 to further reduce recharge of the shallow perched water.

Technical Assessment Summary

The volume of perched water underlying INTEC has been reduced substantially since the percolation ponds were relocated further away in 2002. Continuing efforts under OU 3-14 are underway to further reduce anthropogenic recharge and perched water volumes under the northern portion of the facility. Section 4.12.2.2 provides additional details.

4.8.6 Issues

No new issues were identified.

4.8.7 Recommendations and Follow-Up Actions

Because no new issues were identified, additional recommendations and follow-up actions are not required. The previously identified issue and related follow-up actions are being performed under OU 3-14. See Section 4.12.2.2 for perched water remedial actions to be performed after closeout of OU 3-13, Group 4.

4.8.8 Protectiveness Statement for Operable Unit 3-13, Group 4

OU 3-13 Group 4 was closed out by the Group 4 Remedial Action Report (Monitoring Report/Decision Summary; DOE-ID 2007f). See the Protectiveness Statement in Section 4.12.8 of this report.

4.9 Operable Unit 3-13, Group 5 – Snake River Plain Aquifer

4.9.1 Background

The SRPA underlies the entire INL Site and is among the nation's most productive aquifers. It is the primary source of water for domestic, municipal, and industrial use in southeastern Idaho and also provides large quantities of water for agricultural irrigation. The SRPA underlying INTEC was designated as OU 3-13, Group 5.

Beginning in 1952, groundwater quality at and downgradient (south) of INTEC has been impacted by facility operations. The most significant water quality impacts resulted from the former INTEC injection well. The injection well (CPP-23) was routinely used to discharge INTEC service wastewater to the aquifer from 1952 to February 1984, when it was taken out of service. Discharge of service wastewater to groundwater through the injection well resulted in a groundwater plume containing elevated concentrations of tritium, Sr-90, Tc-99, sodium, chloride, and other solutes. In addition to the INTEC injection well, other contaminant sources that have impacted groundwater quality beneath INTEC include the former percolation ponds (sodium and chloride) and historical releases at the tank farm, most

notably the CPP-31 leak that occurred in 1972 (nitrate and Tc-99). Details regarding contaminant sources and groundwater quality impacts are summarized in the OU 3-14 Remedial Investigation/Baseline Risk Assessment (DOE-ID 2006a).

4.9.2 Remedial Action

The OU 3-13 ROD (DOE-ID 1999a) established the remedial action requirements for OU 3-13, Group 5. The remedy specified in the OU 3-13 ROD was an interim action for the SRPA. Although the remedy selection for contaminated SRPA groundwater outside the INTEC security fence was final, the final remedy for the contaminated portion of the SRPA inside the fence was deferred to OU 3-14. As a result of the interim status inside the security fence, the entire OU 3-13, Group 5, remedial action was classified as an interim action (DOE-ID 1999a). The OU 3-14 ROD (DOE-ID 2007d) established the final WAG 3 groundwater remedy.

4.9.2.1 Remedy Selection. Remedial action requirements for OU 3-13, Group 5, were detailed in the RD/RA Work Plan (Monitoring System and Installation Plan, DOE-ID 2002a). The SRPA interim remedy included the following:

1. Implement ICs over the area of the aquifer that exceeds the MCLs for H-3, Sr-90, and I-129 to prevent groundwater use while INTEC operations continue, and to restrict future groundwater use.
2. Implement ICs, including land-use restrictions to prevent the use of SRPA groundwater over the area of the aquifer that exceeds the MCLs for H-3, Sr-90, and I-129, until drinking water standards are met, which is projected to occur by 2095.
3. Establish SRPA monitoring wells outside of the current INTEC security fence to assess whether MCLs will be exceeded after 2095.

The selected OU 3-13 SRPA interim action (for contaminated portions of the SRPA both inside and outside the INTEC security fence) is ICs with monitoring and contingent remediation. This interim action remedy consisted of three components:

- Existing and additional ICs over the area of the SRPA that exceeds the MCLs for H-3, I-129, and Sr-90 to prevent current and future groundwater use until drinking water standards are met.
- Groundwater monitoring to determine if specific SRPA groundwater contaminant concentrations exceed their action levels. If action levels are exceeded, determine if the impacted portion of the SRPA is capable of producing more than 0.5 gpm, which is considered the minimum drinking water yield necessary for the aquifer to serve as a drinking water supply. If both of these conditions are met, conduct treatability studies.
- Implementing contingent pump and treat remediation if treatability studies indicate sufficient quantities of COCs and contaminated groundwater can be extracted selectively and treated cost-effectively to meet the MCLs outside the INTEC security fence by 2095 (DOE-ID 1999a).

4.9.2.1.1 Remedial Action Objectives and Cleanup Levels—The OU 3-13 ROD specified two RAOs for the aquifer outside the INTEC security fence:

- Prior to 2095, prevent current on-site workers and general public from ingesting SRPA groundwater that exceeds a cumulative carcinogenic risk of 1×10^{-4} , a total HI [hazard index] of 1, or applicable State of Idaho groundwater quality standards (i.e., MCLs)
- In 2095 and beyond, ensure that SRPA groundwater does not exceed a cumulative carcinogenic risk of 1×10^{-4} , a total HI [hazard index] of 1, or applicable State of Idaho groundwater quality standards (i.e., MCLs).

4.9.2.2 Remedy Implementation. Remedial actions associated with the interim remedy for OU 3-13, Group 5, were presented in the *Monitoring Report/Decision Summary for Operable Unit 3-13, Group 5, Snake River Plain Aquifer* (DOE-ID 2004f), which served as the remedial action report. These actions were also discussed in the previous CERCLA 5-Year Review (DOE-ID 2007a). With the signing of the OU 3-14 ROD in 2007, the final remedy for the SRPA was established, and all further groundwater monitoring and remedial actions for WAG 3 will be conducted under OU 3-14. Section 4.12.4 summarizes groundwater monitoring results and evaluates effectiveness of the SRPA final remedy.

4.9.2.3 Operations and Maintenance. Groundwater monitoring wells are routinely inspected in accordance with the INL Site-Wide IC/O&M Plan (DOE-ID 2010a). Well maintenance is performed as required by Idaho Cleanup Project (ICP) Well Services.

4.9.3 Progress Since the Last Review

4.9.3.1 Protectiveness Statements from Last Review. The protectiveness statements in the last 5-Year Review (DOE-ID 2007a) that pertain to OU 3-13, Group 5, were as follows:

Remedial actions are in progress for the remainder of the Group 3 sites and at the Group 4, 5, and 7 sites. Upon completion of remedial actions for Groups 3, 4, 5, and 7, the remedies are expected to be protective. However, new information and modeling for the OU 3-14 feasibility study will provide additional information on the SRPA within INTEC. The information is expected to impact the modeling and information on the SRPA outside of INTEC (Group 5). The information and modeling will have to be assessed when they are available in order to determine whether the remedies for Groups 4 and 5 continue to be protective.

Uncertainties exist regarding the draining of the northern perched water zone and the elevated concentration of Tc-99 in the perched water. Since the Group 4 remedy is in process, it is unknown whether additional actions will be needed for the Group 4 remedy to be fully protective. Consequently, the remedy will require evaluation through the future remedial action report.

The institutional controls and the soil management strategy remain in effect for the no-further-action sites and are protective of human health and the environment.

4.9.3.2 Status of Recommendations and Follow-Up Actions from Last Review.

Appendix C of the 2005 CERCLA 5-Year Review (DOE-ID 2007a) identified the following OU 3-13 Group 5 issue requiring further action:

- “Tc-99 is present in the Snake River Plain Aquifer two times its derived maximum contaminant level. Observed concentrations are higher than predicted.”

As a result of the discovery of elevated Tc-99 concentrations in groundwater, a special *Evaluation of Tc-99 in Groundwater at INTEC* was performed (ICP 2004). The OU 3-14 Remedial Investigation/Baseline Risk Assessment (DOE-ID 2006a) and OU 3-14 ROD (DOE-ID 2007d) also addressed the issue of elevated Tc-99 concentrations beneath INTEC. The ROD presented Tc-99 groundwater monitoring and modeling results and specified the selected groundwater remedy. Modeling results indicated that peak Tc-99 concentrations had most likely already occurred prior to 2005 and that Tc-99 levels would be expected to decline below the MCL (900 pCi/L) well before the compliance year of 2095. Groundwater monitoring results since 2005 are consistent with the modeling and have shown nearly a 50% decline in the maximum Tc-99 concentration over the past 4 years (DOE-ID 2010b).

All further groundwater remedial actions were deferred to OU 3-14. Section 4.12.4 discusses groundwater monitoring results.

4.9.4 Data Review and Evaluation

See Section 4.11.4.

4.9.5 Technical Assessment

See Section 4.12.5 for a technical assessment of groundwater.

4.9.6 Issues

None.

4.9.7 Recommendations and Follow-Up Actions

No recommendations, follow-up actions, or issues were identified.

4.9.8 Protectiveness Statement for Operable Unit 3-13, Group 5

Operable Unit 3-13, Group 5, was closed out by the Group 5 Remedial Action Report (Monitoring Report/Decision Summary; DOE-ID 2004f). See the Protectiveness Statement in Section 4.12.8 of this report.

4.10 Operable Unit 3-13, Group 6 – Buried Gas Cylinders

4.10.1 Background

Sites CPP-84 and CPP-94 compose the Buried Gas Cylinders group. Site CPP-84 is located outside the current INTEC security fence, east of Lincoln Boulevard and south of the Big Lost River (see Figure 4-17). The site consists of a buried trench where compressed gas cylinders were previously disposed of. The cylinders at the burial site originated from INTEC and contain gases used for construction. The exact number and contents of the discarded cylinders are not known, but it is believed that 40 to 100 cylinders were disposed of at the site. The gases in the cylinders may include acetylene, compressed air, argon, carbon dioxide, helium, nitrogen, or oxygen. These gases do not pose a human health risk but are considered a safety hazard because ruptures of the cylinders could lead to personal injury, fire, or explosion.

Site CPP-94 includes an area about 2.4 km (1.5 miles) northeast of the INTEC along the south side of a dirt security road (see Figure 4-17). Four exposed gas cylinders have been observed at the site and are believed to contain hydrofluoric acid. The safety hazards associated with CPP-94 are similar to those at Site CPP-84. The potential for cylinder overpressurization and bursting is considered the most serious hazard at CPP-94. The buried gas cylinders pose a safety hazard to inadvertent intruders (e.g., backhoe operators or drillers). Hydrofluoric acid is very corrosive, reacts violently with moisture, and can generate explosive concentrations of hydrogen gas. Fluoride, a chemical residual of hydrofluoric acid reactions, is a potential human health and ecological hazard.

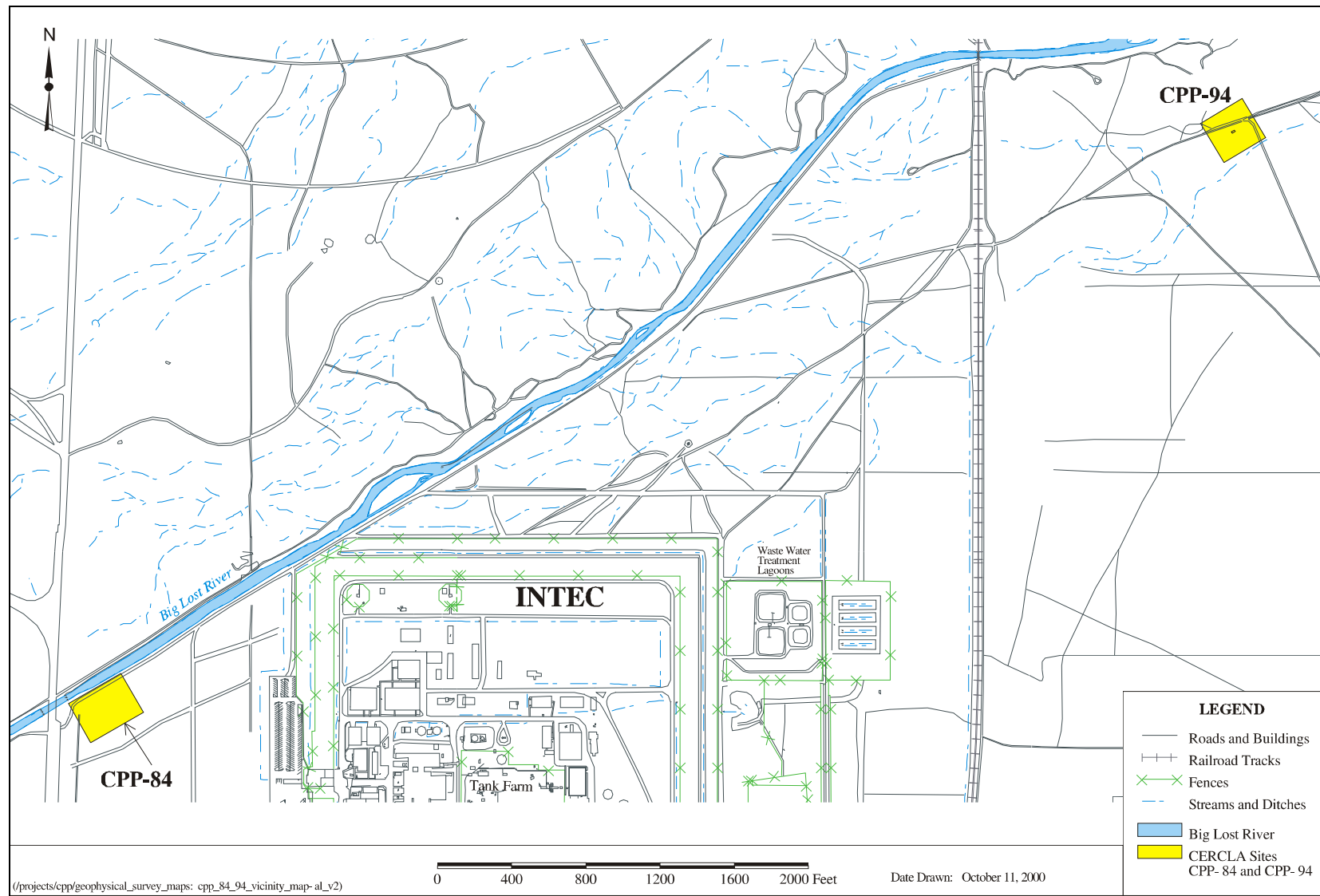


Figure 4-17. Location of Group 6 sites (from DOE-ID [2007a]).

Remediation activities at the CPP-94 site were performed in 2004 in conjunction with the CPP-84 site. The activities included site grading and reseeded with native plant species. IC signs were removed.

4.10.2 Remedial Action

4.10.2.1 Remedy Selection. The selected remedy for Group 6 was removal, treatment, and disposal of the buried gas cylinders.

4.10.2.1.1 Remedial Action Objectives—The RAOs for Group 6, as defined in the OU 3-13 ROD, are:

- Eliminate the safety hazard posed by buried compressed gas cylinders at the CPP-84 and CPP-94 sites.
- Prevent ecological receptor exposure to surface soil COCs with a concentration greater than 10 times background concentrations that may cause adverse effects to resident populations of flora or fauna, as determined by the screening-level ecological risk assessment.

4.10.2.1.2 Cleanup Levels—The remediation goal for the buried gas cylinders is to remedy the safety hazard posed by the disposed cylinders.

4.10.2.2 Remedy Implementation. The CPP-94 site was remediated in 2000 and included a geophysical survey to locate all cylinders, clearing of vegetation, mobilization of equipment, hand excavation and exhumation of six hydrofluoric cylinders, decommissioning and disposal of five empty hydrofluoric cylinders, shipment of a hydrofluoric gas cylinder containing product to an offsite facility for treatment, and post-removal soil sampling.

The CPP-84 site was remediated in 2004 and included a geophysical survey to find the cylinder burial location; clearing of vegetation; mobilization of equipment; excavation, exhumation, and segregation of 148 gas cylinders; onsite treatment of cylinders containing product other than chlorine and Freon gases; decommissioning and recycling of 125 empty cylinders as scrap metal; disposal of 18 treated and decommissioned acetylene cylinders; shipment of one full chlorine gas cylinder and four partially filled Freon gas cylinders to offsite facilities for recycling of the contents; and post-removal soil sampling.

The remedy for Group 6 has been completed and is documented in the Remedial Action Report for OU 3-13, Group 6, Buried Gas Cylinders (DOE-ID 2005c).

Post-remediation O&M are not required.

4.10.3 Progress Since the Last Review

No issues pertaining to Group 6 were identified in the previous 5-year review.

4.10.4 Data Review and Evaluation

Refer to Sections 4.9 and 4.12.4.1 for discussion of groundwater monitoring at INTEC.

Refer to Sections 4.8 and 4.12.4.4 for discussion of perched water monitoring at INTEC.

4.10.5 Technical Assessment

The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. Remedial actions are complete and no hazards remain.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Yes. The exposure assumptions, toxicity data, cleanup levels, and RAOs are still valid.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No. All material and associated contaminants have been removed from the sites.

Technical Assessment Summary

The selected remedy is complete and source removal was successful. ICs are not required.

4.10.6 Issues

No issues were identified.

4.10.7 Recommendations and Follow-Up Actions

None.

4.10.8 Protectiveness Statement for Operable Unit 3-13, Group 6

The remedy at OU 3-13 Group 6 is protective of human health and the environment. The remedial actions for Group 6 have been completed. No changes in the physical conditions of these two sites have occurred that would affect the protectiveness of the remedy.

4.11 Operable Unit 3-13, Group 7 – SFE-20 Hot Waste Tank System

4.11.1 Background

Group 7 (also known as release site CPP-69) consisted of a concrete vault containing an abandoned radioactive liquid waste tank (referred to as VES-SFE-20), an access tunnel, a pump pit, CPP-642 pump house, ancillary piping and structures and components, and contaminated soils associated with releases from the tank. For this document, the entire system will be referred to as the VES-SFE-20 tank system; VES-SFE-20 will be used to specifically reference the tank. The tank contained about 33 gal of radioactive sediment. As part of the CERCLA process mandated by the FFA/CO (DOE-ID 1991), the investigation and remediation approach for Group 7 was evaluated through the OU 3-13 Remedial Investigation/Feasibility Study process.

The VES-SFE-20 tank system was located east of Building CPP-603 (Figure 4-18). The capacity of the SFE-20 tank was 640 gal. The tank was approximately 9.5 ft long and 3.5 ft in diameter. The vault and other major components of the VES-SFE-20 tank system are shown in Figure 4-19. The utility lines (e.g., air, water, steam, condensate, or electrical conduit) that fed the VES-SFE-20 tank and that transported the waste to the process equipment waste evaporator facility were isolated from this tank and incorporated into other tank systems when the use of the VES-SFE-20 tank was discontinued in 1976.

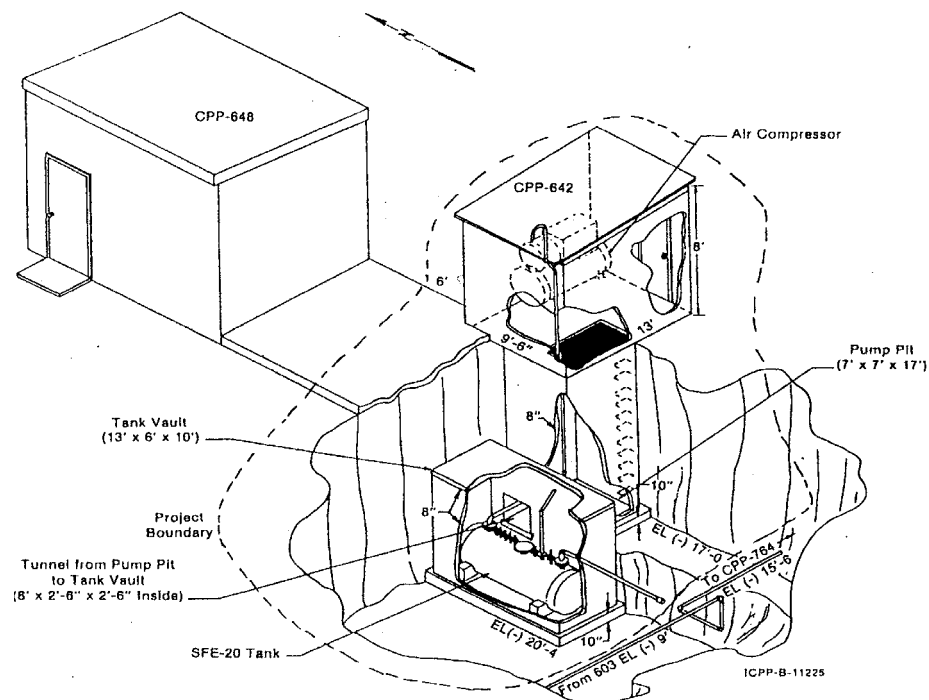


Figure 4-18. Isometric view of the tank vault and pump pit (taken from DOE-ID 2003a).



Figure 4-19. SFE-20 tank in vault before removal.

4.11.2 Remedial Action

4.11.2.1 Remedy Selection. As documented in the OU 3-13 ROD, the selected remedial approach for Group 7 was to remove the tank and its contents; the vault; the remainder of the structures, piping, and other components; and surrounding contaminated soils and transport them for either onsite or offsite storage or disposal. The remedy was selected based on the following evaluation criteria: protection of

human health and the environment; compliance with ARARs; long- and short-term effectiveness; reduction of toxicity, mobility, or volume of contaminants; implementability; and cost. The remedy consisted of:

- ICs (i.e., warning signs) until removal of the tank liquid and sludge
- Sampling the tank contents
- Removal and ex situ treatment of the tank liquid and sludge
- Excavation and removal of the tank, tank vault, pump pit enclosures, other associated structures
- On-Site disposal of the tank and associated structures.

4.11.2.1.1 Remedial Action Objectives—The following RAO was developed to protect human health and the environment:

- Eliminate the threat of release to the SRPA posed by the VES-SFE-20 Hot Waste Tank System.

The RAO for the VES-SFE-20 tank system (Group 7), OU 3-13, was developed in accordance with the National Contingency Plan and CERCLA Remedial Investigation/Feasibility Study guidance and defined in the ROD (DOE-ID 1999a). The RAO was primarily based on the results of the Baseline Risk Assessment and ARARs, as outlined in the ROD.

Section 8.1.7 of the OU 3-13 ROD identified the remediation goals for the SFE-20 tank system as follows:

1. Limit potential external exposures to workers and nonworkers
2. Remove radioactive and hazardous substances remaining in the tank system to prevent potential contaminant releases to the underlying soils or groundwater.

As specified in the ROD, these remediation goals were to be accomplished by:

1. Maintaining existing ICs to limit current worker and nonworker exposure
2. Removing, excavating, treating, and disposing of the SFE-20 Hot Waste Tank System waste and components to eliminate the threat of release to the environment (waste that meets the ICDF waste acceptance criteria will be disposed of in the ICDF)
3. Remediating contaminated soils present beneath the SFE-20 tank system that may pose an external exposure risk or threat to groundwater (waste that meets the ICDF waste acceptance criteria will be disposed of in the ICDF).

The ROD identified that these remediation goals also support the “Other Areas RAO 5a,” that is, “to eliminate the threat of release to the SRPA posed by the SFE-20 Hot Waste Tank System.” Also supported was the groundwater RAOs for INTEC-impacted groundwater (located in the groundwater contaminant plume outside of the current INTEC security fence) to restore the aquifer for use by 2095 and beyond so that: (1) risk will not exceed a cumulative carcinogenic risk of 1×10^{-4} for groundwater ingestion, (2) the aquifer will be restored to drinking water quality (below MCLs), and (3) the noncarcinogenic risk will not exceed a total hazard index of 1 for groundwater ingestion.

4.11.2.1.2 Cleanup Levels—Table 4-23 was taken verbatim from Table 8-1 in the ROD (DOE-ID 1999a). It provided the soil risk-based remediation goals, from the OU 3-13 ROD, for each of the COCs. Table 4-24, also taken verbatim from the ROD (Table 8-2), identified the SRPA remediation goals. These remediation levels were used as the cleanup requirements for this remediation effort.

Table 4-23. Soil risk-based remediation goals (verbatim from DOE-ID 1999a).

Contaminant of Concern	Soil Risk-Based Remediation Goal ^a for Single Contaminant of Concern ^b (pCi/g or mg/kg)
Radionuclides	
Am-241	290
Cs-137	23
Eu-152	270
Eu-154	5,200
Pu-238	670
Pu-239/240	250
Pu-241	56,000
Sr-90	223
Nonradionuclides^c	
Mercury (human health)	23
a. Source of risk-based soil remediation goals: Table 2-1 of the OU 3-13 FS (DOE-ID 1997b). Risk-based remediation goals developed for residential scenario. b. If multiple contaminants are present, use a <i>sum of the fractions</i> to determine the combined COC remediation goal. c. The mercury remediation goal was selected from the EPA Region 3, April 1996, screening guidance for soil ingestion under the residential scenario. (EPA 1996). COC contaminant of concern EPA Environmental Protection Agency FS feasibility study OU operable unit	

Table 4-24. Snake River Plain Aquifer remediation goals (verbatim from DOE-ID 1999a).

Contaminant of Concern	SRPA Remediation Goals (Maximum Contaminant Levels) for Single Contaminant of Concern	Decay Type
Beta-gamma emitting radionuclides		
Beta-gamma emitting radionuclides	Total of beta-gamma emitting radionuclides shall not exceed 4 mrem/year effective dose equivalent	Beta-gamma
Sr-90 and daughters	8 pCi/L	Beta
Tritium	20,000 pCi/L	Beta
I-129	1 pCi/L ^b	Beta-gamma
Alpha-emitting radionuclides		
Alpha-emitting radionuclides	15 pCi/L total alpha emitting radionuclides	Alpha
Uranium and daughters	15 pCi/L	Alpha
Np-237 and daughters	15 pCi/L	Alpha
Plutonium and daughters	15 pCi/L	Alpha
Am-241 and daughters	15 pCi/L	Alpha

Table 4-24. (continued).

Contaminant of Concern	SRPA Remediation Goals (Maximum Contaminant Levels) for Single Contaminant of Concern	Decay Type
Nonradionuclides		
Chromium	100 µg/L	Not applicable
Mercury	2 µg/L	Not applicable
a. If multiple contaminants are present, use a sum of the fractions to determine the combined COCs remediation goals. b. Derived concentration if only beta-gamma radionuclide present. COC contaminant of concern SRPA Snake River Plain Aquifer		

4.11.2.2 Remedy Implementation. The VES-SFE-20 tank system remediation was divided into two major components. This phased approach allowed for removal of the tank and waste, while allowing flexibility in coordinating the removal of the vault and associated structures and soils with other related remedial actions. Phase I and Phase II were completed sequentially. The activities associated with the treatment and disposal of the SFE-20 tank and the waste it contained occurred during the brief intermission period between Phases I and II, with the tank being shipped to Pacific EcoSolutions, Incorporated, in Richland, Washington, in May 2006, treated there by August 2006, and disposed of at the Nevada Test Site by January 2007.

4.11.2.2.1 Phase I: Removal of the Tank and Contents—Phase I consisted of removing the tank with its contents; removing associated piping and asbestos within the excavation area, tank vault, access tunnel, pump pit, and Building CPP-642; and removing loose surface contamination and any liquid from the vault floor and pump pit. Approximately 1,000 yd³ of soil was removed, stockpiled, and reused for backfill in the course of removing the tank from the vault at a depth of 11 ft.

The Phase I activities included:

- Excavation of soil to designated stockpile
- Rerouting of active utilities
- Cutting and capping of abandoned utilities
- Accessing tank vault and applying fixative to tank vault
- Removing tank vault roof
- Removing asbestos-containing material within the vault, tunnel, pump pit, and the CPP-642 building
- Removing the tank (with contents) and placing into transportation vessel and/or transferring to staging area for completion of characterization activities, if necessary
- Removing and characterizing loose surface contamination and liquid in vault and pump pit
- Installing precast, reinforced concrete roof over vault
- Backfilling, compacting, contouring, and grading of remediation area, using stockpiled soils from Phase I excavation, which were later removed as part of the Phase II excavation.

4.11.2.2.2 Phase II: Removal of Remaining Components and Vault—Phase II remedial action consisted of removing and disposing of the remaining piping, asbestos-containing material, components, structures, and contaminated soil in the ICDF. Approximately 498 tons of debris

was removed and subsequently disposed of at ICDF associated with the unearthing and demolition of the SFE-20 structures, which extended 20 ft below grade.

The Phase II activities included:

- Excavating contaminated soil and disposing of the soil at ICDF
- Cutting and capping abandoned utility and process lines at the excavation boundary
- Removing and disposing of abandoned utility and process lines within the excavation boundary
- Demolishing and removing the concrete structures (Figure 4-20), including the vault, tunnel, pump pit, pipe corridor, and Building CPP-642, and disposal at ICDF
- Collection of confirmatory samples and subsequent analysis
- Backfilling, compacting, contouring, and grading of remediation area, using locally available, naturally occurring, clean fill material found at the INL Site (Figure 4-21).



Figure 4-20. Demolition of the SFE-20 vault.



Figure 4-21. Finished grade at the SFE-20 site.

The remedy for Group 7 has been completed and is documented in the OU 3-13 Group 7 Remedial Action Report (DOE-ID 2009b).

4.11.2.3 Operations and Maintenance. None. Required remedial actions have been completed.

4.11.3 Progress Since the Last Review

No issues pertaining to Group 7 were identified in the previous 5-year review.

4.11.4 Data Review and Evaluation

The OU 3-13, Group 7, confirmatory Field Sampling Plan for the VES-SFE-20 Hot Waste Tank System (DOE-ID 2003f) was prepared to address criteria for obtaining representative samples, maintain sample integrity, and provide appropriate safety considerations for field personnel. This Field Sampling Plan was implemented with the current revision of the Quality Assurance Project Plan, which provides guidance for sampling, quality assurance, quality control, analytical procedures, and data management (DOE-ID 2002d). Together, the Quality Assurance Project Plan and Field Sampling Plan constitute the remedial action sampling and analysis plan.

The VES-SFE-20 Hot Waste Tank System Field Sampling Plan established a list of contaminants of potential concern based upon the data and process knowledge that existed at that time. Those requirements are shown in Table 4-25, which is a reproduction of Table 6-1 from the Field Sampling Plan. Section 6 of the Field Sampling Plan states: "... the list will be modified based on the results from the tank characterization sampling. For example, contaminants of potential concern that are nondetectable will be eliminated from further consideration." The results of the tank characterization sampling led to a discussion with the CERCLA Agencies in September 2008. The list of contaminants of potential concern was reduced at this time where specific contaminants had been found to not be present in the waste. The contaminants of potential concern removed from Table 4-25 are shown in Table 4-26. Table 4-27 shows the final list of analytes, the specified method, and the detection limits.

Table 4-25. Contaminants of potential concern for VES-SFE-20 tank system.^a

Chemical/Other	Radionuclides ^{b,c,d}
Universal Treatment Standard metals ^{a,b,c}	Tritium (H-3)
Appendix IX (40 CFR 264) target analyte list VOCs (including acetone, methylene chloride, 1,1,1-trichloroethane, tetrachloroethene, and trichloroethylene) ^{a,b,c}	Carbon-14
Appendix IX (40 CFR 264) TAL SVOCs ^{a,b,c}	Sodium-22
Freon-12 and -22 (dichlorodifluoromethane and chlorodifluoromethane) ^a	Potassium-40
Formaldehyde ^{a,b}	Manganese-54
PCBs ^{a,b,c}	Cobalt-60
Asbestos ^b	Strontium-90
	Niobium-95
	Zirconium-95
	Technetium-99
	Ruthenium-106
	Antimony-125
	Iodine-129
	Cesium-134, -137
	Cerium-144
	Europium-152, -154, -155
	Radium-226
	Uranium-234, -235 ^e , -238
	Neptunium -237
	Plutonium-238, -239, -240, -241, -242
	Americium-241, -243
	Curium-242, -244

a. The list of COPCs will be modified based on the data results from the Characterization Work Plan (DOE-ID 2003g).

b. Soil, tank vault, and pump pit.

c. Piping.

d. Absorbed water.

e. U-236 is reported with U-235.

COPC contaminant of potential concern

PCB polychlorinated biphenyl

SVOC semivolatile organic compound

TAL target analyte list

VOC volatile organic compound

Table 4-26. Contaminants of potential concern removed from list of contaminants sampled.

Chemical/Other	Radionuclides
Freon-12 and -22 (dichlorodifluoromethane and chlorodifluoromethane)	Manganese-54
Formaldehyde	Niobium-95
All PCBs, except Aroclor 1260	Zirconium-95
Asbestos	Ruthenium-106
	Antimony-125
	Iodine-129
	Cesium-134
	Cerium-144
	Europium-155
	Radium-226
	Neptunium-237
	Plutonium-242
	Curium-242

PCBs	polychlorinated biphenyls

Table 4-27. Final list of contaminants of concern, analytical methods, and detection limits.

Constituent	Analytical Method	Solids Detection Limits
UTS metals—report as totals and as TCLP	EPA Methods 1311, 3010A, 7760A ^a , 6010B, and 7470A	0.2–1,000 mg/kg depending on metal
Appendix IX (40 CFR 264) TAL VOCs, including acetone and 1,1,1-trichloroethane	EPA Method 8260B	5–100 g/kg depending on VOC
Appendix IX (40 CFR 264) TAL SVOCs	EPA Method 8270C	660–3,300 g/kg depending on SVOC
PCBs—Aroclor-1260 only	EPA Method 8082	350 µg/kg
Tritium	LSC	20 pCi/g
Carbon-14	LSC or GFP	3 pCi/g
Strontium-90	GFP	0.5 pCi/g
Technetium-99	LSC or GFP	1 pCi/g
Uranium isotopes	Alpha spectroscopy	0.05 pCi/g
Plutonium isotopes—Pu-238, Pu-239, Pu-240, and Pu-241	ALS	0.05 pCi/g
Plutonium-241	LSC	1 pCi/g
Americium-241, -243	ALS	0.05 pCi/g
Curium isotopes	ALS	0.05 pCi/g
Gamma emitters including Na-22, K-40, Co-60, Cs-137, Eu-152, and Eu-154	Gamma spectroscopy	About 0.1 pCi/g

a. EPA Method 7760A was not used.

EPA	Environmental Protection Agency
GFP	gas flow proportional
LSC	liquid scintillation counting
PCB	polychlorinated biphenyl
SVOC	semivolatile organic compound
TAL	target analyte list
TCLP	toxicity characteristic leaching procedure
UTS	Universal Treatment Standard
VOC	volatile organic compound

Random grab samples were collected at 10 locations beneath the SFE-20 structures. Five samples were collected from below the tank vault and five from beneath the pump pit based upon the random grab sample approach as specified in the Hazardous Waste Management Act/RCRA-approved Field Sampling Plan (DOE-ID 2003f). The OU 3-13, Group 7, remedial action was designed primarily to address the SFE-20 tank and structures. As these soils beneath the former location of the SFE-20 structures are totally within the OU 3-13, Group 3, Phase II excavation and represent only a minor fraction of that overall excavation, the establishment of ICs for the SFE-20 area will be deferred to be addressed during the completion of the OU 3-13 Group 3 Phase II Remedial Action Report.

Confirmation samples were collected on November 3, 2008, beneath the former location of the SFE-20 tank vault and pump pit. Five systematic random grab samples were collected from each location and sent to GEL Laboratories, LLC, for analysis. The analyses performed included radionuclides, polychlorinated biphenyls, VOCs, semivolatile organic compounds, and metals. Specific analytical results are presented in Appendix G of DOE-ID (2009b). This information was evaluated in accordance with the approved Hazardous Waste Management Act/RCRA Closure Plan for the VES-SFE-20 tank in the *Data Quality Assessment and Data Summary Report for the HWMA/RCRA Closure of the VES-SFE-20 Hot Waste Tank System – Soils* (RPT-622).

Soil samples were collected at a depth of 0 to 6 in. below any soil possibly disturbed during excavation to prevent sampling cross-contaminated soil or introducing outlying data otherwise attributable to experimental error. A basic assumption in the sampling effort was that the samples collected truly were representative of the soil in the immediate area. The statistical pre-calculations leading to the grid size and number of samples specified in the Field Sampling Plan account for an acceptable statistical margin of error (uncertainty) for a random sample location distribution, regardless of symmetry. The analytical methods and calibrations employed similarly preclude errors in individual analyses of sufficient size to warrant their elimination.

The data from the sampling of the soils beneath the SFE-20 tank vault and pump pit were statistically analyzed to determine an exposure point concentration without respect to consideration of outliers or anomalies. The rejection or removal of data points that could be considered outliers or anomalies would only reduce the potential concentrations evaluated with respect to risk, and, therefore, this approach is considered to be conservatively appropriate.

While the mercury data were flagged with an “R” as rejected, these data were still considered appropriate for use in this report. The reason for the “R” flag was that there was greater than 50% difference (161%) between a sample and the lab duplicate sample. Whereas, the 95% UCL for mercury was more than an order of magnitude lower than the risk-based screening for which these data were still considered acceptable.

There were five VOCs (1,4-dioxane; acetonitrile; acrolein; isobutylalcohol; and propionitrile) and three semivolatile organic compounds (4-nitroquinoline 1-oxide, aramite, and hexachlorophene) for which the analytes did either not meet initial calibration or continuing calibration criteria, and, thus, the data were “R” flagged. As these particular compounds were all nondetects, this “R” flag does not present any issue in eliminating these compounds from consideration as contaminants of potential concern.

As a result of the small areal extent of the structures, their proximity to each other, and the expected similarity between the probable sources of contamination, the data from these two subpopulations were combined and analyzed as one data set. A statistical summary was prepared for the compounds that were detected as being present within the samples. It is inappropriate to calculate a statistical summary when fewer than five data points have values above the detection limit. In those cases, the maximum reported values were utilized. The remaining analytes (with greater than three values

reported above the detection limit) were evaluated using EPA's ProUCL 4.0.2 software available from EPA's website (EPA 2009). For those data sets that contained some reported values below the detection limit, the detection limit was used for calculation of the 95% UCL, but not for the other statistical properties, such as the mean or median. In order to ensure that the combination of data sets remains conservative, the higher of the maximum or 95% UCL was used as the exposure point concentration.

The EPA software selected the appropriate distribution as well as recommended the appropriate UCL to use. According to the EPA software, all of the analytes exhibited a normal distribution except for Am-241, Cs-137, Pu-238, Pu-239/240, Sr-90, U-233/234, lead, and mercury. The Am-241 and mercury data followed a log-normal distribution while Cs-137, Pu-238, Pu-239/240, and Sr-90 followed a gamma distribution. The software was unable to discern a viable distribution pattern for either U-233/234 or lead. Further discussion and software printouts are contained in DOE-ID (2009b).

4.11.4.1 Groundwater Monitoring. Refer to Sections 4.9 and 4.12.4.1 for discussion of groundwater monitoring at INTEC.

4.11.4.2 Vadose Zone Monitoring. Refer to Sections 4.8 and 4.12.4.4 for discussion of perched water monitoring at INTEC.

4.11.4.3 Site Inspections. None. Required remedial actions have been completed.

4.11.5 Technical Assessment

The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. Remedial activities have been completed. The SFE-20 Hot Waste Tank System has been removed and properly dispositioned.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Yes. The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are still valid.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

Technical Assessment Summary

Required remedial actions have been completed, and the SFE-20 Hot Waste Tank System has been removed and properly dispositioned. No further actions are necessary.

4.11.6 Issues

None.

4.11.7 Recommendations and Follow-Up Actions

No recommendations, follow-up actions, or issues were identified.

4.11.8 Protectiveness Statement for Operable Unit 3-13, Group 7

The remedy at OU 3-13 Group 7 is protective of human health and the environment. The remedial actions for Group 7 have been completed. No changes in the physical conditions of these sites have occurred that would affect the protectiveness of the remedy.

4.12 Operable Unit 3-14

4.12.1 Background

As part of the OU 3-13 ROD (DOE-ID 1999a), the Agencies determined that they needed more information before they could make a final remedial decision for tank farm soils and SRPA groundwater. The Agencies created OU 3-14 to conduct further investigations and select a final remedy for tank farm soil and INTEC groundwater, while interim actions were being implemented under the OU 3-13 ROD. Tank Farm Interim Action (TFIA) consisted of ICs with surface water control to reduce surface water infiltration into tank farm soil until OU 3-14 remedial action begins. The OU 3-14 final remedy for tank farm soil and INTEC groundwater supersedes the OU 3-13 Group 1 and Group 5 interim actions.

The OU 3-14 ROD was signed in May 2007 (DOE-ID 2007d) and specified remedial actions to (1) contain contaminated soil to allow short-lived radionuclides to decay away in place, (2) isolate current and future workers and biological receptors from contact with contaminated soil, and (3) restore the portion of SRPA contaminated by INTEC releases to Idaho Ground Water Quality standards (same as MCLs) by the year 2095 by reducing water infiltration through Sr-90-contaminated perched water and interbeds. The OU 3-14 ROD (DOE-ID 2007d) also specified requirements for monitoring contaminant concentrations and perched water levels to assess the effectiveness of the groundwater remedy and to ensure that the portions of the SRPA contaminated by INTEC releases will meet MCLs by the year 2095.

4.12.2 Remedial Action

4.12.2.1 Remedy Selection. The selected remedy for OU 3-14 consists of remedial actions for tank farm soil and groundwater and no action for a group of sites outside the tank farm. Major components of the selected remedy are summarized below:

1. ICs will be implemented per the requirements in the *INL Site-Wide Institutional Controls, and Operations and Maintenance Plan for CERCLA Response Actions* (DOE-ID 2010a) to prevent exposure to the contaminated soil and groundwater and prevent land uses that would be inconsistent with the selected remedy.
2. Contaminant concentrations and water levels in perched water and SRPA indicator wells will be monitored in accordance with a long-term monitoring plan to assist in determining the effectiveness of the groundwater remedy and to ensure that the portions of the SRPA contaminated by INTEC releases will meet MCLs by 2095.
3. Prior to Tank Farm Facility closure, the following major remedy components will be implemented:
 - a. Install and maintain a low-permeability pavement (or equivalent barrier to reduce infiltration) over the recharge control zone outside the tank farm with expanded drainage system to reduce infiltration of precipitation without interfering with ongoing INTEC operations and remediation activities. Direct water run-off toward lined ditches, which will divert it to an evaporation pond. As buildings and structures are removed through decommissioning, extend the low-permeability pavement to maintain an infiltration-reducing barrier over the recharge control zone outside the tank farm.

- b. Maintain the TFIA system per the O&M Plan until the selected remedy's drainage and water management system is expanded. Approval of the OU 3-14 RD/RA Work Plan and expansion completes the TFIA.

Implement and maintain additional recharge controls in northern INTEC to reduce anthropogenic and storm water recharge to the northern perched water zones:

1. Following Tank Farm Facility closure, the following major remedy components will be implemented:
 - a. Install a low-permeability pavement (or equivalent barrier to reduce infiltration) over the north, central, and south tank farm to reduce infiltration of precipitation. Direct captured surface water run-off toward lined ditches, culverts, and lift station(s) for transport to the lined evaporation pond.
 - b. Maintain the drainage system and low-permeability pavement over the recharge control zone to reduce infiltration of precipitation without interfering with ongoing INTEC cleanup operations.
 - c. Maintain the recharge controls in northern INTEC to reduce anthropogenic and storm water recharge sources to the northern perched water zones.
2. As part of and coordinated with INTEC facility closure, these major remedy components will be implemented:
 - a. Install a protective cover over the north tank farm. Use characterization results to design the protective cover (i.e., maintain the low-permeability pavement, excavate soil and replace with clean backfill and new low-permeability pavement or equivalent barrier to reduce infiltration, or extend the evapotranspiration cap with capillary biobarrier that is to be placed over the central area).
 - b. Install an evapotranspiration cap with capillary biobarrier over the central and south tank farm to protect workers from exposure.
 - c. Monitor and maintain the evapotranspiration cap with capillary biobarrier, low-permeability pavement, and drainage system to reduce infiltration of precipitation.

Table 4-28 summarizes specific remedial action requirements for inspections and monitoring of the tank farm area storm water collection system (Figure 4-22).

The OU 3-14 ROD (DOE-ID 2007d) and RD/RA Work Plan also established requirements to minimize the downward transport of Sr-90 and other radionuclides through the vadose zone toward the SRPA. The OU 3-14 Long-Term Monitoring Plan (DOE-ID 2008f) listed the following remedial actions to reduce water infiltration and recharge beneath the northern part of INTEC:

- Monitor water levels and contaminant concentrations in perched water and SRPA indicator monitoring wells to determine the effectiveness of the remedy and to ensure that portions of the SRPA contaminated by INTEC sources will meet MCLs by 2095
- Perform pipeline valve isolation tests and hydrostatic pressure tests to identify leaks in suspect areas
- Perform water balance calculations to identify changes in system flows that could indicate leaks
- Expand wellhead telemetry system for monitoring perched water levels to detect subsurface leaks.

Table 4-29 summarizes the remedial action requirements related to perched water and groundwater.

Table 4-28. Inspections, monitoring, radiological surveys, and maintenance requirements for Operable Unit 3-14.

Component	Requirement	Frequency ^a
Tank farm components	Inspect to ensure integrity, monitor radiological conditions, and verify drainage to the storm water collection system.	Quarterly
Asphalt-paved areas outside the tank farm fence	Inspect to ensure integrity, monitor radiological conditions, and verify drainage to the storm water collection system.	Quarterly
Water collection system ditches and culverts	Inspect to ensure integrity of the system and to ensure drainage from the tank farm and other INTEC areas to the evaporation pond, and monitor for radiological conditions.	Quarterly
Olive Avenue lift station	Perform visual inspection of pumps, piping, slide rails, water-level hatch doors, and control panel. Perform systems check on components.	Quarterly for visual inspections. Annually ^b and following maintenance activities for systems check.
Spare parts inventory	Perform visual check of contents and condition.	Quarterly
Evaporation pond liner and perimeter	Inspect the evaporation pond liner and associated area to ensure that the liner is not leaking and that the pond is performing as designed.	Quarterly
Evaporation pond leak detection system	Inspect the leak detection system to ensure that it is functioning properly. Perform systems check on components.	Quarterly for inspections. Annually ^b and following maintenance activities for systems check.
Building gutters and downspouts	Inspect and ensure gutters and downspouts are functioning properly.	Quarterly

a. The schedule for the OU 3-14 inspections is coordinated to meet the guidance provided by “Frequencies of Inspections for Hazardous Waste Storage Areas” (EA-CER-001).

b. Inspections should have a minimum of 11 months and a maximum of 13 months between consecutive inspections (DOE-ID 2008e).

INTEC Idaho Nuclear Technology and Engineering Center

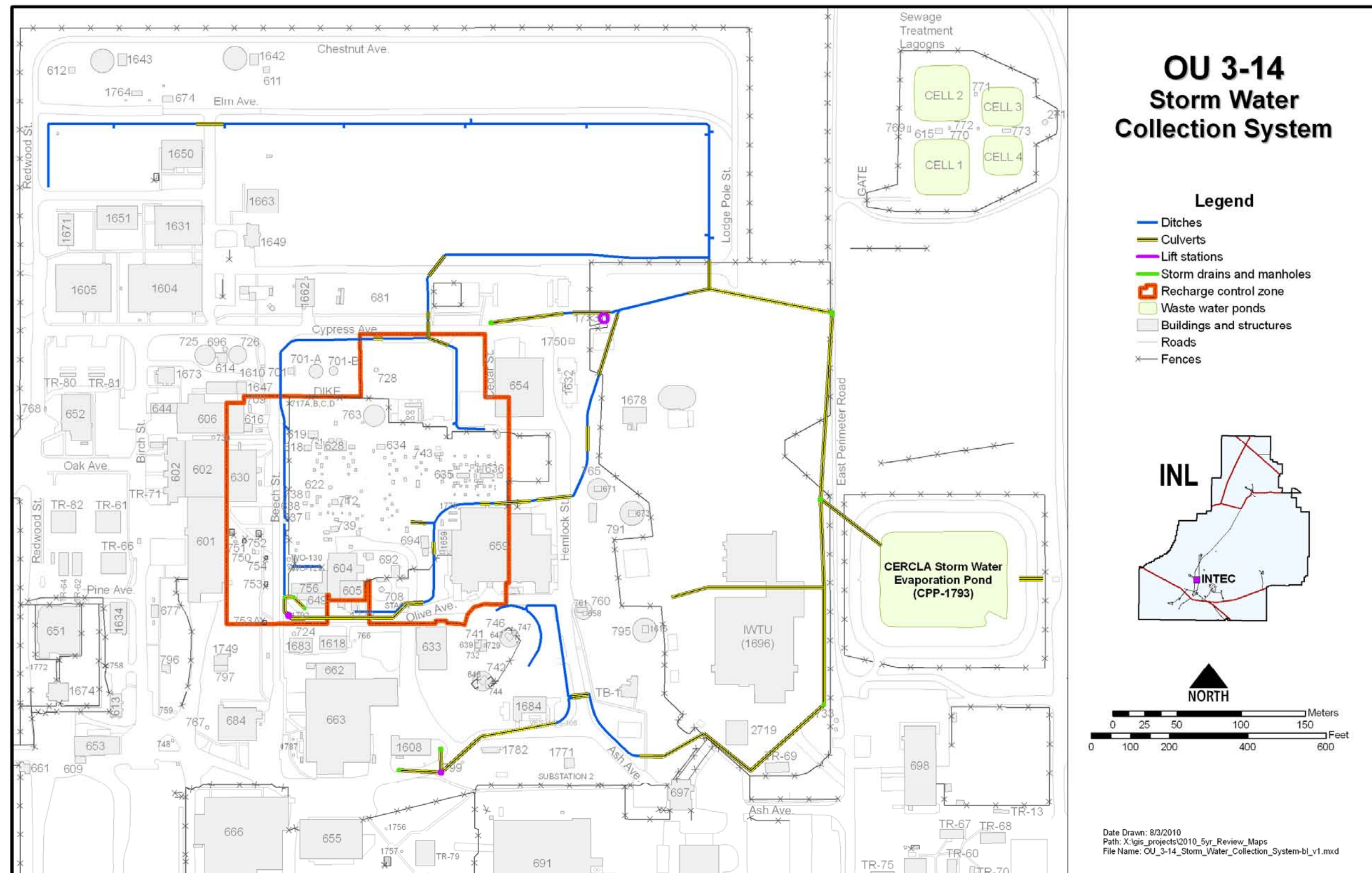


Figure 4-22. Operable Unit 3-14 storm water collection system.

Table 4-29. Summary of Operable Unit 3-14 perched water and groundwater remedial action elements.

Remedial Action	ROD Requirement?	Frequency	Performance Measure?	Desired Remedial Performance Result
Perched water sampling	Yes	Annual ^a	No	NA
Groundwater sampling	Yes	Annual ^a	Yes	Declining COC trends in SRPA
Perched water level monitoring	Yes	Monthly ^b	Yes	Declining perched water levels
Groundwater level monitoring	Yes	Annual ^a	No	NA
Tensiometer moisture monitoring	No	Monthly ^c	No	NA
Calculate INTEC water balance	Yes	Monthly ^d	Yes	Declining unaccounted water
Calculate perched water volume	Yes	Annually	Yes	Declining perched water volume
Isolate anthropogenic sources	Yes	Continuous	No	NA

a. Perched water and groundwater sampling and monitoring are planned to be performed annually. The sampling and monitoring schedules will be revised by the Agencies, as needed, as part of the CERCLA 5-year reviews.

b. Perched water monitoring wells that have contained at least 0.5 ft of water will be equipped with downhole dataloggers to record water levels, and automated water-level data will be downloaded at least monthly, either manually or using wellhead telemetry. Dataloggers will be programmed to record water levels at least once per day. Manual perched water levels will be measured at least once every 6 months in all perched water monitoring wells.

c. Tensiometer water potentials will be recorded automatically at least once per day, and data will be downloaded at least monthly, either manually or using wellhead telemetry.

d. Water balance will be calculated on a monthly basis and reported annually in the OU 3-14 O&M report.

CERCLA Comprehensive Environmental Response, Compensation and Liability Act
COC contaminant of concern
INTEC Idaho Nuclear Technology and Engineering Center
NA not applicable
O&M operation and maintenance
OU operable unit
ROD Record of Decision
SRPA Snake River Plain Aquifer

4.12.2.1.1 Remedial Action Objectives—Listed below are the RAOs for OU 3-14 as developed in the OU 3-14 ROD, Section 8 (DOE-ID 2007d). These RAOs serve as the design basis for the selected remedy for OU 3-14.

RAOs for SRPA groundwater affected by INTEC sources are defined as follows:

- I. Prior to 2095, prevent current workers and the general public from ingesting SRPA groundwater contaminated by INTEC releases that exceeds (1) MCLs, currently identified as 8 pCi/L for Sr-90, 900 pCi/L for Tc-99, 1 pCi/L for I-129, and 10 mg/L for nitrate measured as nitrogen; (2) a cumulative excess cancer risk from all carcinogens of 1 in 10,000; or (3) a hazard index of 1.
- II. In 2095 and beyond, ensure that concentrations of all contaminants in SRPA groundwater contaminated by INTEC releases do not exceed (1) MCLs; (2) a cumulative excess cancer risk from all carcinogens of 1 in 10,000; or (3) a hazard index of 1.

RAOs for the OU 3 14 soil are defined as follows:

- III. Prevent external exposure to current and future workers inside the tank farm boundary from Cs-137-contaminated alluvium and prevent biotic transport that would exceed an excess cancer risk of 1 in 10,000.
- IV. Prevent external exposure to current workers at Sites CPP-15 and CPP-58 from Cs-137-contaminated alluvium that would exceed an excess cancer risk of 1 in 10,000.
- V. Prevent internal exposure to biological receptors from Cs-137 and Sr-90 inside the tank farm boundary that would exceed an ecological hazard quotient of 10 for an individual contaminant and a total ecological hazard index of 10.

In the OU 3-14 ROD, the Agencies agreed that residential use in the proximity to the Tank Farm Facility and the Waste Calcining Facility is not a reasonably anticipated future use and that industrial future land use is appropriate. The outline of the INTEC industrial use area is shown on Figure 4-23.

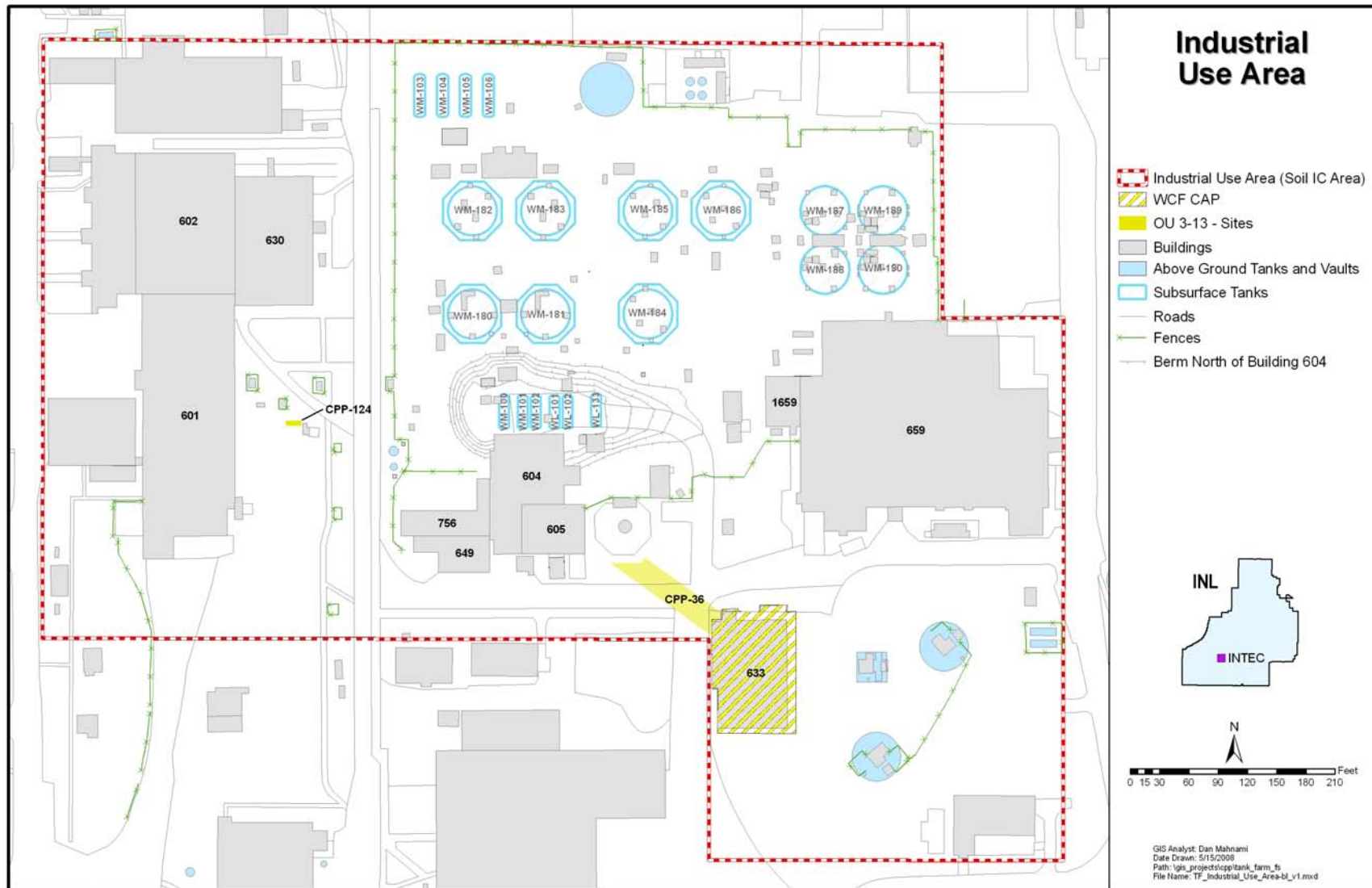


Figure 4-23. INTEC industrial use area (soil institutional control area).

4.12.2.1.2 Cleanup Levels—Groundwater remediation goals are based on meeting the MCLs in the portion of the SRPA contaminated by INTEC releases by 2095 and beyond and are presented in Table 4-30. The remediation goal for beta-gamma-emitting radionuclides (H-3, I-129, Tc-99, and Sr-90 and its daughters) is restricted to a cumulative dose of 4 mrem/year in 2095 and beyond. The cumulative dose is determined by contaminants that overlap in space and time. The cumulative dose from alpha-emitting radionuclides (such as Am-241, Np-237, and Pu isotopes) is much lower than the MCL of 15 pCi/L for all alpha-emitting radionuclides.

Table 4-30. Groundwater remediation goals for the year 2095 and beyond.^a

Contaminant of Concern ^b	Remediation Goal
Sr-90	8 pCi/L
Total (Sr-90, I-129, and Tc-99)	4 mrem/year

a. From DOE-ID (2007d), Table 9-1.
b. Tc-99, I-129, Sr-90, and nitrate currently exceed MCLs in the SRPA, but Tc-99, I-129, and nitrate are predicted to meet MCLs before 2095.

MCL maximum contaminant limit
SRPA Snake River Plain Aquifer

The remediation goals for Cs-137 in OU 3-14 soil were developed from EPA preliminary remediation goals (EPA 2010). EPA preliminary remediation goals are back-calculated, current soil concentrations that correspond to a risk of 1 in 1,000,000. They are calculated using standard EPA exposure route equations and EPA cancer slope factors.

Due to radioactive decay, the remediation goal depends on the year the cleanup is performed. The calculated outdoor worker remediation goal for year 2095 of 11.3 pCi/g is used to calculate the remediation goal for any year prior to 2095 by dividing the remediation goal by an exponential decay factor. This decay factor was calculated as $[e^{-\lambda t}]$, where λ is the Cs-137 decay rate constant (0.023 year^{-1}) and t is the decay time (in years) between the cleanup date and 2095 when the future worker exposure scenario begins.

For example, the Cs-137 remediation goal in 2006 is calculated as shown in Equation (4-1):

$$11.3 \text{ pCi/g} / e^{-[(0.023 \text{ yr}^{-1})(89 \text{ yr})]} = 87.5 \text{ pCi/g} . \quad (4-1)$$

Example calculations for future years are summarized in Table 4-31.

Table 4-31. Operable Unit 3-14 soil remediation goals for Cs-137.^a

Remedial Decision Date	Cs-137 Soil Remediation Goal (pCi/g)
2095	11.3
2035 (projected INTEC facility closure)	45
2012 (projected TFF closure)	76

a. From DOE-ID (2007d), Table 9-2.

INTEC Idaho Nuclear Technology and Engineering Center
TFF Tank Farm Facility

The remediation goal will apply to the top 4 ft of alluvium in the industrial use area. The remediation goals will be used to verify the effectiveness of the selected remedial action and to determine if additional remedial action is necessary prior to termination of the remedial action.

4.12.2.2 Remedy Implementation. Monitoring and inspection of the tank farm storm water collection system have been performed according to the remedial action requirements (Table 4-28), and the results of the inspections have been reported in annual reports for OU 3-14 (DOE-ID 2009a, 2010b). The drainage system is functioning as intended, routing rainfall and snowmelt away from the tank farm to the lined evaporation pond outside the east INTEC security fence.

During the reporting period, several significant remedial actions were completed pertaining to the storm water collection system:

- Gutters and downspouts were installed on the south side of Buildings CPP-606 and CPP-605 to direct roof run-off on toward lined drainage ditches (completed on December 16, 2008).
- North Drainage Ditch Upgrade Project: high-density polyethylene liner material installed in North Ditch to eliminate infiltration of storm run-off and cooling water flowing toward the evaporation pond outside the east boundary fence (completed July 2009).
- A total of 64 cased probeholes, located within or just south of the tank farm were properly plugged and abandoned pursuant to the Idaho well abandonment standards (IDAPA 37.03.09) in preparation for placing the low-permeability pavement over the recharge control zone. Probeholes abandoned include the following:

A-60	A-53-20	81-9	81-20	28-2	CPP-36-OW-2	A-52
A-61	B-2	81-10	81-21	31-1	CPP-36-OW-3	A-56
A-62	B-7	81-11	81-22	79-2	CPP-36-OW-5	A-59
A-63	81-1	81-12	81-23	79-4	CPP-36-OW-6	81-15
A-64	81-2	81-13	81-24	79-5	A-44	
A-65	81-4	81-14	15-1 slant	79-6	A-45	
A-66	81-5	81-16	15-2 slant	79-8	A-46	
A-53-7	81-6	81-17	15-3	79-10	A-48	
A-53-11	81-7	81-18	27 probe	CPP-36-OW-1a	A-49	
A-53-19	81-8	81-19	28-1	CPP-36-OW-1b	A-50	

- Shallow injection well 41-CPP, located just south of Building CPP-630 was plugged and abandoned in preparation for installing low-permeability pavement over the area as part of the recharge control zone (Hutchison 2009).
- In April 2009, Building CPP-1607 (located east of the INTEC main stack) was decommissioned, resulting in a 25- × 16-ft uncovered area with the recharge control zone asphalt. In addition, decommissioning actions next to the building created an additional 14- × 10-ft uncovered area where a post indicator valve was removed. As per the selected remedy, pavement will be installed as facility infrastructure is removed within the recharge control zone (DOE-ID 2008a). In June 2009, the two areas, totaling 540 ft², were covered over with asphalt.

The following additional remedial actions have been completed at INTEC since the last 5-year review to reduce infiltration and recharge of the perched water zones:

- Lawn irrigation eliminated (2005)
- Subsurface injection of steam condensate eliminated (2008)

- Leak testing of underground boiler feedwater pit (2008)
- Decommissioning of CPP-736 brine pit (2007)
- Acoustic leak detection survey performed on underground pipelines (2008)
- Infrared thermographic survey performed to identify leaks (2009)
- Wellhead telemetry for rapid notification of perched water level changes (2009)
- Development of CERCLA action request tracking system for elimination of water leaks (2009)
- Numerous underground water line leaks located and eliminated (ongoing)
- Continuous monitoring of INTEC water flow rates (ongoing)
- Monthly water balance calculations of inputs vs. outputs (ongoing)
- Daily perched water level monitoring (ongoing)
- Annual perched water sampling (ongoing)
- Annual shallow perched water volume calculations (ongoing)
- Installed a 12-channel datalogger in CPP-606 to record plant water flow data.

Additional information on these remedial actions is given below.

4.12.2.2.1 Elimination of Anthropogenic Recharge Sources—Table 4-32 lists the known anthropogenic water leaks and discharges at INTEC during the reporting period. An online web-based tracking system (CERCLA Action Request database) was created in 2009 to ensure timely investigation and/or repair of water leaks and other anthropogenic discharges at INTEC. The most significant water discharges to ground are described in the OU 3-14 annual reports (DOE-ID 2009a, 2010b).

4.12.2.2.1.1 Elimination of Lawn Irrigation—In the past, lawns have been irrigated at various locations around the INTEC facility. Grassed areas were watered with an underground sprinkler system that frequently developed leaks due to broken sprinkler heads and pipeline breaks. As recently as 2005, approximately 1.2 acres of lawns were being irrigated (EDF-6072). Elimination of lawn watering was identified in the OU 3-13 ROD (DOE-ID 1999a) as a possible action to minimize recharge to the perched water beneath INTEC, and a subsequent study estimated that approximately 3.5 M gal of water was being used at INTEC each year to water the grass (including sprinkler system leaks). An evaluation of methods to reduce water infiltration and recharge of the northern shallow perched water determined that lawn watering should be discontinued (EDF-6868), and the Agencies and INTEC management concurred. As of the end of 2005, lawn watering at INTEC was discontinued, and the underground sprinkler lines are to be cut and capped during 2010–2012.

4.12.2.2.1.2 Elimination of Steam Drip Legs—At the time of the last 5-Year Review, several steam drip legs at INTEC were still discharging hot steam condensate to the ground through shallow injection wells (see Table 3-2 in DOE-ID [2003e]). Two steam drip legs located on either side of the Beech Street viaduct (shallow injection wells 15-CPP and 44-CPP) were eliminated in April 2008 when the steam header at this location was blind-flanged as part of the demolition of nearby CPP-601. Another steam drip leg (shallow injection well 47-CPP) located in a manhole under Beech Street outside the east bay door of CPP-606 was eliminated in August 2008. The only known remaining discharges of steam condensate to ground are at CPP-1606 and CPP-1608 (Table 4-32).

Table 4-32. Leaks and other anthropogenic water recharge sources at the Idaho Nuclear Technology and Engineering Center.

Location	CERCLA Action Request No.	Water Type	Leak Eliminated?	Date Leak Identified	Date Leak Isolated	Estimated Leak Rate (gpd)	Estimated Water Volume Leaked (gal)
Leak at Palm Avenue and TFIA ditch	NA	Fire water	Yes	10-04-07	10-18-07	21,600	26,000,000
Leak at CPP-1666 (west side)	NA	Potable	Yes	12-17-07	12-19-07	144,000	300,000
Leak at HYD-0521 (northwest of CPP-644)	NA	Fire water	Yes	9-07-2007	2-06-08	10,080	1,500,000
Leak at HYD-2500 (north of CPP-666)	NA	Fire water	Yes	9-07-2007	2-07-08	Unknown	Unknown
Leak at HYD-1502 (northeast of CPP-603)	NA	Fire water	Yes	9-07-2007	2-13-08	Unknown	Unknown
Leak at HYD-1505 (southeast of CPP-603)	NA	Fire water	Yes	9-07-2007	2-13-08	Unknown	Unknown
Leak at HYD-5031 (north of CPP-656)	NA	Fire water	Yes	9-07-2007	6-04-08	Unknown	Unknown
Leak in utility tunnel fire water near CPP-666	NA	Fire water	Yes	11-30-07	Unknown	Unknown	Unknown
CPP-645 potable water leak	NA	Potable	Yes	2-23-08	2-23-08	57,600	10,800
CPP-654 potable water leak	NA	Potable	Yes	3-19-08	3-19-08	288,000	12,000
CPP-648 SFE-106 fire water leak	NA	Fire water	Yes	3-24-08	3-24-08	12,960	50,000
CPP-606 steam condensate leak (west side)	NA	Condensate	Yes	11-29-07	June 2008	Unknown	Unknown
Western Beech Street steam drip leg	NA	Condensate	Yes	NA	4-18-08	Unknown	Unknown
Eastern Beech Street steam drip leg	NA	Condensate	Yes	NA	4-18-08	Unknown	Unknown
SIW 47-CPP east of CPP-606	NA	Condensate	Yes	5-22-08	8-20-08	Unknown	Unknown
Potable water leak in utility tunnel	NA	Potable	Yes	6-05-08	6-05-08	576,000	24,000
CPP-602 east corridor to southwest sump	NA	Treated water	Yes	8-11-08	8-12-08	Unknown	Unknown
FWV-UTI-3508 fire water leak	NA	Fire water	Yes	8-19-08	8-19-08	Unknown	Unknown
CPP-1683 treated water leak (in tunnel)	NA	Treated water	Yes	8-26-08	8-08-2008	Unknown	Unknown
Leak at HYD-2500 (north of CPP-666)	NA	Fire water	Yes	9-03-08	9-09-08	Unknown	Unknown
Leak at HYD-7034 (southeast of CPP-698)	NA	Fire water	Yes	9-03-08	9-09-08	Unknown	Unknown
HYD-1502 located north of CPP-603	NA	Fire water	Yes	9-03-08	9-04-08	Unknown	Unknown
CPP-698 potable water leak	NA	Potable	Yes	8-04-09	1-08-10	Variable	2,400,000
SIW 34-CPP (from CPP-697 heat pumps)	C-2009-001	Fire water	No	5-29-08	NA	~9,000	3,300,000 ^a
Leak at HYD-7097 (north of ICDF)	C-2009-002	Fire water	Yes	9-03-08	10-01-09	2,880	1,100,000
CPP-628 raw water leak (inside CPP-628)	C-2009-003	Raw water	Yes	~6-01-07	11-18-08	9 to 20	8,400

Table 4-32. (continued).

Location	CERCLA Action Request No.	Water Type	Leak Eliminated?	Date Leak Identified	Date Leak Isolated	Estimated Leak Rate (gpd)	Estimated Water Volume Leaked (gal)
SIW 35-CPP south of CPP-1608	C-2009-004	Steam condensate	No	5-29-08	NA	Unknown	Unknown
SIW 36-CPP north of CPP-1606	C-2009-005	Steam condensate	No	5-29-08	NA	Unknown	Unknown
Fig Street west of CPP-1663	C-2009-006	Raw water	Yes	8-08	9-19-08	2,880	317,000
Leak at HYD-6511 (northeast of CPP-659)	C-2009-007	Fire water	Yes	10-02-08	10-28-08	3,743	277,000
TR-39 (outside east INTEC fence)	C-2009-008	Potable	Yes	10-21-08	10-23-08	7,200	18,000
CPP-621 fire water leak	C-2009-009	Fire water	Yes	2-06-09	2-06-09	7,200	475
ICDF west evaporation pond	C-2009-010	Raw water	Yes	7-10-09	7-13-09	108,000	300,000
Leak at HYD-2500 (north of CPP-666)	C-2009-014	Fire water	Yes	8-13-09	8-14-09	2,880	86,400
a. Leak volume is for the period February 2009 through February 2010. CERCLA Comprehensive Environmental Response, Compensation, and Liability Act ICDF Idaho CERCLA Disposal Facility INTEC Idaho Nuclear Technology and Engineering Center NA not applicable SIW shallow injection well TFIA Tank Farm Interim Action							

4.12.2.2.1.3 Boiler Feedwater Pit Leak Test—The boiler feedwater pit (VES-UTI-660) is a 20,000-gal belowgrade water storage tank located in the boiler house (CPP-606). This tank has received softened and/or demineralized water for a make-up supply to the CPP-606 boilers since it was installed in 1953 (EDF-8922). Some steam condensate is returned to the feedwater pit, which causes the water temperature to remain at approximately 100°F when the INTEC boilers are operating. In order to address questions about the integrity of the boiler feedwater pit, a falling head leak test was performed. The leak test was conducted over a 29-day period from July 8, 2008, to August 6, 2008. During the test, all contributing water lines to the boiler feed water pit were closed, and water-level measurements were taken periodically over the following month. The water level remained essentially constant, with a small drop in level (1/4-in.) towards the end of this test that is attributed to evaporation. The results indicated that the boiler feedwater pit is not leaking (EDF-8922).

4.12.2.2.1.4 Leak Detection Survey—An acoustic leak detection survey was performed at INTEC by subcontractor HD Supply Waterworks during September 3–5, 2008. The subcontractor used a sensitive microphone to listen for leak sounds at 68 fire hydrants, 166 post-indicator valves, and various other locations along the potable, raw, treated, and fire water pipelines. The leak survey resulted in the discovery (or confirmation) of six underground water leaks:

- Fire water valve FWV-UTI-3508 located east of CPP-630 was confirmed to be leaking underground (the leak was discovered on August 19, 2008).
- Fire hydrant HYD-UTI-2500 located north of CPP-666 was found to be leaking underground on September 3, 2008. Water was observed dripping into the utility tunnel directly below this location.
- Fire hydrant HYD-UTI-1502 located north of CPP-603 was found to be leaking underground on September 3, 2008.
- Fire hydrant HYD-UTI-7097 located north of ICDF was found to be leaking underground on September 3, 2008.
- Fire hydrant HYD-UTI-7034 located southeast of CPP-698 was found to be leaking underground on September 3, 2008.
- A leak in the raw water line just west of CPP-1663 was noticed on August 29, 2008, when water began to pond in that area. The leak was confirmed by the acoustic leak detection contractor on September 5, 2008.

All the leaks described above have been eliminated (Table 4-32).

4.12.2.2.1.5 Decommissioning of CPP-736 Brine Pit—The INTEC water treatment system was upgraded during 2007. The water treatment system produces softened water (treated water) for use in the INTEC boilers and for distribution to the plant. As part of the water system upgrade, the old 50,000-gal underground saltwater brine pit (CPP-736; VES-UTI-625) was replaced with an aboveground brine tank. With the startup of the new water treatment system, brine pit VES-UTI-625 was taken out of service in November 2007 (EDF-8624). Past leaks of saltwater brine from the underground brine pit and/or associated piping have impacted the shallow perched water near the northwest corner of the tank farm (DOE-ID 2006h). The elimination of the brine pit is important because of the potential of released sodium to enhance the subsurface mobility of Sr-90 (DOE-ID 2006a). Monitoring of the water level in the brine pit during November–December 2008 indicated that the tank was not leaking at that time (EDF-8624).

4.12.2.2.1.6 Fire Water Flow to CPP-697—For many years, CPP-697 (East Guard Shack) has used two heat pumps for temperature control. The heat pumps are connected to the INTEC fire water system. One heat pump discharges to the sanitary waste system, while the other

discharges to the ground via a shallow injection well (SIW 34-CPP) located north of the building. The unmetered flow of fire water to the CPP-697 heat pumps was previously identified as a potentially significant source of error in the water balance calculations. Therefore, the CERCLA project requested that a totalizer flowmeter be installed in CPP-697 to quantify this outflow. The new totalizer flowmeter was installed on February 5, 2009. During the 1-year period of February 2009 to February 2010, the meter recorded approximately 3.3 M gal of flow into CPP-697, for an average daily flow of about 9,000 gal/day. Even though CPP-697 is located outside the recharge control zone, plans are underway to eliminate this large discharge to the ground.

4.12.2.2.2 Wellhead Telemetry System—The OU 3-14 Long-Term Monitoring Plan (DOE-ID 2008f) requires installation of wellhead telemetry systems on selected perched water monitoring wells at INTEC. The telemetry system will allow wireless access to the perched water level data recorded by existing downhole pressure transducers (e.g., Levellogger data loggers) so that the data can be accessed through the ICP network. The wireless system will reduce long-term labor costs and allow nearly instantaneous access to the water-level data. The Solinst Telemetry System, selected for this project, consists of remote stations (i.e., controller, radio modem, and solar panel) at each well location and a home station radio connected to a network desktop personal computer.

In December 2008, a home station radio modem and network personal computer were installed at CPP-663 to receive the perched water level and temperature data and to make the data available on the ICP computer network. By September 2009, 21 perched water monitoring wells had been equipped with wellhead telemetry equipment, and perched water level and temperature data from these wells were being received at the home station. Two more perched water monitoring wells (i.e., MW-4 and MW-17) are to be outfitted with telemetry remote stations as soon as new concrete well pads have been installed at these wells.

4.12.2.2.3 Plant Water Use—Water use at INTEC has been reduced significantly during 2008 and 2009 (Figure 4-24). Actions taken that contribute to declining water usage include: (1) elimination of steam service to the west side of INTEC, (2) reducing treated water flow rates to condensers in CPP-601 and CPP-659, and (3) turning off the CPP-659 offgas system superheater (and associated cooling water flow).

4.12.2.2.4 Datalogger Installation in CPP-606—On January 15, 2009, staff completed installing a 12-channel Eurotherm Datalogger in CPP-606 (Service Building Powerhouse west of the tank farm), replacing an older six-channel datalogger. This replacement consolidated most of the facility's water flow data to one location. The new 12-channel Eurotherm Datalogger receives flow data from the flowmeters that monitor the two deep well pumps (CPP-611 and CPP-612), the two fire water pumps (P-UTI-672 and P-UTI-673), the combined flow from the two fire water booster jockey pumps (P-UTI-682 and P-UTI-683), and the combined flow from the two potable water wells (CPP-04 and CPP-05).

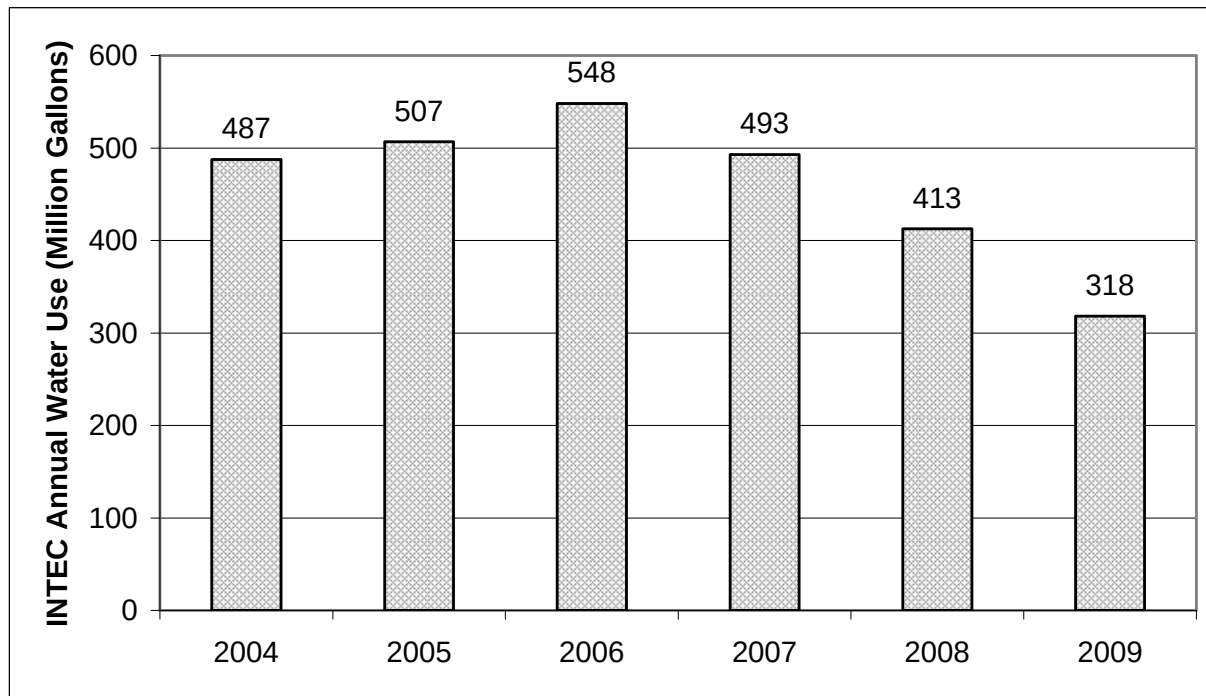


Figure 4-24. Idaho Nuclear Technology and Engineering Center annual water use.

4.12.2.3 Operations and Maintenance. In addition to routine monitoring and inspections, several additional remedial actions are planned or are currently underway at INTEC:

- To address questions regarding the service wastewater flow metering data, a test of the service wastewater flowmeter will be conducted during 2010. The test will include (1) installation of a clamp-on ultrasonic flowmeter on the service wastewater pipeline in CPP-797 to collect flow data and (2) reconfiguration of the existing flume located at the percolation pond outfall pipe. Data from the ultrasonic flowmeter and the flume will be compared with the data being generated by the permanent differential pressure flowmeter (F-YDA-797-5).
- An acoustic leak detection survey is planned for September 2010. Periodic leak detection of underground pipelines is a requirement in the OU 3-14 ROD (DOE-ID 2007d).
- Underground sprinkler system piping to be cut and capped during 2010–2012.
- Remedy schedule lists the continuation of the drainage upgrade activities outside the tank farm area within the recharge control zone. Planned for 2010 are the lining of drainage ditches along Cypress Avenue, Hemlock Street, and Ash Avenue. Drainage improvements are also scheduled for Olive Avenue. Installing low-permeability pavement over the remaining uncovered areas outside the tank farm in the recharge control zone is scheduled for 2011.

4.12.3 Progress Since the Last Review

4.12.3.1 Protectiveness Statements from Last Review. The protectiveness statements in the last 5-Year Review (DOE-ID 2007a) that pertain to tank farm soils and INTEC groundwater were as follows:

The OU 3-13 remedial actions have been completed for (1) Group 1, (2) the CPP-67 site within Group 3, and (3) Group 6. No changes in the physical

conditions of these sites have occurred that would affect the protectiveness of the remedies, and there have been no significant changes in the toxicity factors or risk factors for the COCs associated with these sites. Based on the available data, the remedial actions at the sites have been successfully completed, and the remedies are functioning as intended in the decision document.

Remedial actions are in progress for the remainder of the Group 3 sites and at the Group 4, 5, and 7 sites. Upon completion of remedial actions for Groups 3, 4, 5, and 7, the remedies are expected to be protective. However, new information and modeling for the OU 3-14 feasibility study will provide additional information on the SRPA within INTEC. The information is expected to impact the modeling and information on the SRPA outside of INTEC (Group 5). The information and modeling will have to be assessed when they are available in order to determine whether the remedies for Groups 4 and 5 continue to be protective.

Uncertainties exist regarding the draining of the northern perched water zone and the elevated concentration of Tc-99 in the perched water. Since the Group 4 remedy is in process, it is unknown whether additional actions will be needed for the Group 4 remedy to be fully protective. Consequently, the remedy will require evaluation through the future remedial action report.

The institutional controls and the soil management strategy remain in effect for the no-further-action sites and are protective of human health and the environment.

4.12.3.2 Status of Recommendations and Follow-Up Actions from Last Review.

Appendix C of the 2005 CERCLA 5-Year Review (DOE-ID 2007a) identified two issues requiring further action. Table 4-33 lists issues and recommendations identified in the last 5-year review and the current status of each.

As described in this chapter, the OU 3-14 Project has taken many steps to investigate the northern perched water zones and to reduce precipitation and anthropogenic recharge of the perched water. Although the perched water zones still persist, substantial progress has been made since the previous 5-Year Review. Section 4.12.2 describes the OU 3-14 remedial actions that have been completed to reduce anthropogenic recharge and precipitation infiltration.

As a result of the discovery of elevated Tc-99 concentrations in groundwater, a special *Evaluation of Tc-99 in Groundwater at INTEC* was performed (ICP 2004). The OU 3-14 Remedial Investigation/Baseline Risk Assessment (DOE-ID 2006a) and OU 3-14 ROD (DOE-ID 2007d) also addressed the issue of elevated Tc-99 concentrations beneath INTEC. The ROD presented Tc-99 groundwater monitoring and modeling results and specified the selected groundwater remedy. Modeling results indicated that peak Tc-99 concentrations had most likely already occurred prior to 2005 and that Tc-99 levels would be expected to decline below the MCL (900 pCi/L) well before the compliance year of 2095. Groundwater monitoring results since 2005 are consistent with the modeling and have shown nearly a 50% decline in the maximum Tc-99 concentration over the past 4 years (DOE-ID 2010b).

Table 4-33. Actions taken since the last 5-year review for Waste Area Group 3.

Issues from Previous Review ^a	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
The northern perched water zone has persisted following relocation of the percolation ponds in 2002.	The northern perched water zone is being addressed under OU 3-13, Group 4.	DOE	March 2008	Interim actions to reduce perched water were completed under OU 3-13 Group 4, and further steps to reduce perched water were identified in the OU 3-14 ROD (DOE-ID 2007d). Implementation under OU 3-14 began in June 2008 under an RD/RA Work Plan (DOE-ID 2008a). This task is complete.	June 2008
Tc-99 is present in the SRPA two times its derived MCL. Observed concentrations are higher than predicted.	This is being assessed in the OU 3-14 RI/FS. The draft OU 3-14 ROD, scheduled for submittal in December 2006, will contain groundwater monitoring and modeling results and will specify the proposed groundwater remedy.	DOE	June 2006 release draft proposed plan	The OU 3-14 RI/BRA was published in April 2006 (DOE-ID 2006a). Modeling results indicated that peak Tc-99 concentrations had most likely already occurred prior to 2005 and that Tc-99 levels would decline below the MCL (900 pCi/L) well before 2095. Groundwater monitoring results since 2005 are consistent with the modeling and have shown nearly a 50% decline in the maximum Tc-99 concentration over the past 4 years (DOE-ID 2010b). This task is complete.	April 2006

a. Issues were identified either in Appendix C of the previous 5-year review (DOE-ID 2007a) or in the addendum to Appendix C enclosed with EPA's letter of concurrence with the previous 5-year review (Opalski 2006).

BRA	baseline risk assessment
DOE	Department of Energy
EPA	Environmental Protection Agency
FS	feasibility study
MCL	maximum contaminant level
OU	operable unit
RI	remedial investigation
ROD	Record of Decision
SRPA	Snake River Plain Aquifer

4.12.4 Data Review and Evaluation

The following subsections summarize monitoring results and site inspections.

4.12.4.1 Groundwater Monitoring. Groundwater monitoring is performed in accordance with the OU 3-14 Long-Term Monitoring Plan (DOE-ID 2009d) and includes water quality sampling and water-level monitoring. Since the last review, perched water sampling has been performed and reported

for 2005 (DOE-ID 2006h), 2006 (DOE-ID 2007g), 2007 (DOE-ID 2008d), 2008 (DOE-ID 2009a), and 2009 (DOE-ID 2010b).

4.12.4.2 SRPA Groundwater Quality. Groundwater samples are collected from 19 SRPA monitoring wells to track groundwater quality trends. Figure 4-25 shows the locations of the OU 3-14 SRPA groundwater monitoring wells. Groundwater samples are analyzed for a suite of radionuclides and inorganic constituents including Sr-90, Tc-99, I-129, Cs-137, tritium, uranium and plutonium isotopes, gross alpha/beta, nitrate/nitrite, major ions, and total dissolved solids. In the following discussion, groundwater quality results are compared to MCLs for drinking water. However, monitoring wells are not used for drinking water. ICs prevent the use of contaminated groundwater, and comparison with MCLs is for reference only.

Table 4-34 summarizes the 2009 laboratory results for COCs detected in perched water and groundwater. As of 2009, only three COCs still exceed drinking water MCLs in the SRPA at and near INTEC: Sr-90, Tc-99, and nitrate. Of these, Sr-90 is of greatest environmental concern, as it exceeds the MCL at the most monitoring locations and by the greatest margin.

Sr-90 has been detected repeatedly in groundwater samples from most of the SRPA wells at and near INTEC, and, as of 2009, samples from many of the wells exceeded the Sr-90 MCL (8 pCi/L). The highest Sr-90 concentrations have historically occurred in monitoring wells located close to the former INTEC injection well. Well USGS-47 is located downgradient from the former INTEC injection well, and the persistence of Sr-90 in the aquifer at this location is believed attributable to a combination of gradual desorption of Sr-90 from the aquifer matrix and drain out of contaminated perched water that was impacted by past disposal of service wastewater to the injection well. Sr-90 concentrations in groundwater gradually declined during 2005 to 2009 (Figure 4-26).

Tc-99 was detected at 13 of 19 SRPA well locations sampled during FY 2009. Only two SRPA monitoring wells at INTEC have exceeded the Tc-99 MCL (900 pCi/L): Well ICPP-MON-A-230 (2,220 pCi/L), located north of the INTEC tank farm, and Well ICPP-2021 (1,240 pCi/L), located southeast of the tank farm. The source of elevated Tc-99 at these two wells is discussed in the OU 3-14 Remedial Investigation/Baseline Risk Assessment (DOE-ID 2006a). The Tc-99 results in groundwater show stable or declining trends.

During 2009, nitrate concentrations in groundwater exceeded the MCL (10 mg/L as N) at Wells ICPP-2021 (15.6 mg/L as N) and ICPP-MON-A-230 (11.3 mg/L). These two wells are located close to the tank farm, and these are the same two wells that currently exceed the Tc-99 MCL. Both wells show groundwater quality impacts attributed to past releases of tank farm liquid waste. Nitrate concentrations at all other SRPA monitoring locations were below the MCL.

Tritium and I-129 are still present in groundwater at and downgradient of INTEC as a result of past operations, but neither of these radionuclides has exceeded its MCL since 2007. Uranium concentrations in groundwater are at background levels. None of the plutonium isotopes have been detected in groundwater in recent years.

4.12.4.3 SRPA Groundwater Levels. Groundwater levels have been measured annually in selected SRPA monitoring wells at and near INTEC. Figure 4-27 shows water-level contours calculated from the October 2008 measurements. Measured depths to water ranged from approximately 460 to 510 ft bgs. As in previous years, the groundwater-level contour map shows that the general direction of groundwater flow near INTEC is south to southwest (Figure 4-27).

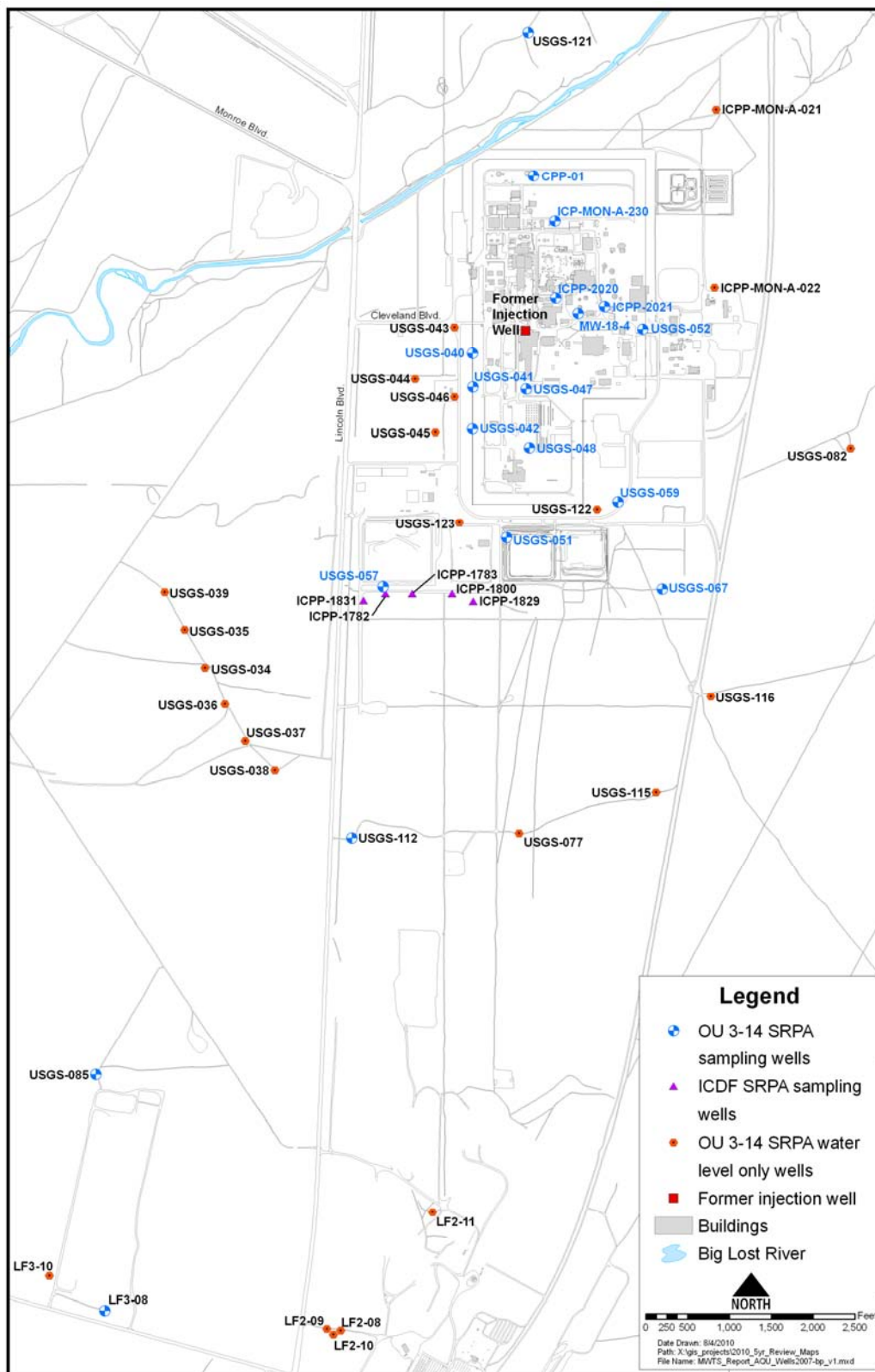


Figure 4-25. Locations of Snake River Plain Aquifer groundwater monitoring wells in Operable Unit 3-14. Wells with blue labels sampled every year; wells with black labels sampled only during odd years.

Table 4-34. Summary of constituents detected in Fiscal Year 2009 groundwater and perched water samples.

Constituent	MCL	Units	Snake River Plain Aquifer Groundwater			Shallow Perched Water		
			Maximum Value ^a	Number of Results ^b	Results >MCL ^b	Maximum Value ^a	Number of Results ^b	Results >MCL ^b
Gross alpha	15	pCi/L	4.68	20	0	20.1	17	1
Gross beta	NA	pCi/L	1,290	20	NA	311,000	17	NA
Cs-137	200	pCi/L	ND	20	0	ND	18	0
Sr-90	8	pCi/L	24.8	20	10	130,000	18	13
Tc-99	900	pCi/L	2,220	20	2	263	18	0
I-129	1	pCi/L	0.463	20	0	1.77J	13	2
Tritium	20,000	pCi/L	6,470	20	0	20,500	18	1
Pu-238	15	pCi/L	ND	20	0	ND	17	0
Pu-239/240	15	pCi/L	ND	20	0	ND	17	0
U-233/234	15	pCi/L	2.86	20	0	6.19	17	0
U-235	15	pCi/L	0.183J	20	0	0.24J	17	0
U-238	15	pCi/L	1.34	20	0	3.76	17	0
Alkalinity	NA	mg/L	158	20	NA	402	13	NA
Calcium	NA	mg/L	80.1	20	NA	89.2	13	NA
Chloride	250	mg/L	150	20	0	119	14	0
Magnesium	NA	mg/L	29.4	20	NA	55.1	13	NA
Nitrate (as N)	10	mg/L	15.6	20	2	24.1	15	3
Potassium	NA	mg/L	5.24	20	NA	11.6	13	NA
Sodium	NA	mg/L	40.8	20	NA	78.2	13	NA
Sulfate	250	mg/L	65.9	20	0	69.1	14	0
Total dissolved solids	500	mg/L	499	20	0	1,600	14	2
Bolded values exceed MCL. a. Data qualifier flags: J = estimated value. b. Includes field duplicates. MCL maximum contaminant level NA not applicable ND constituent not detected in any sample								

MCL = 8 pCi/L

Sr-90 Activity (pCi/L)

Legend:

- USGS-40
- USGS-41
- USGS-42
- USGS-47
- USGS-48
- USGS-52
- USGS-59
- USGS-67

Figure 4-26. Strontium-90 trend in Snake River Plain Aquifer groundwater.

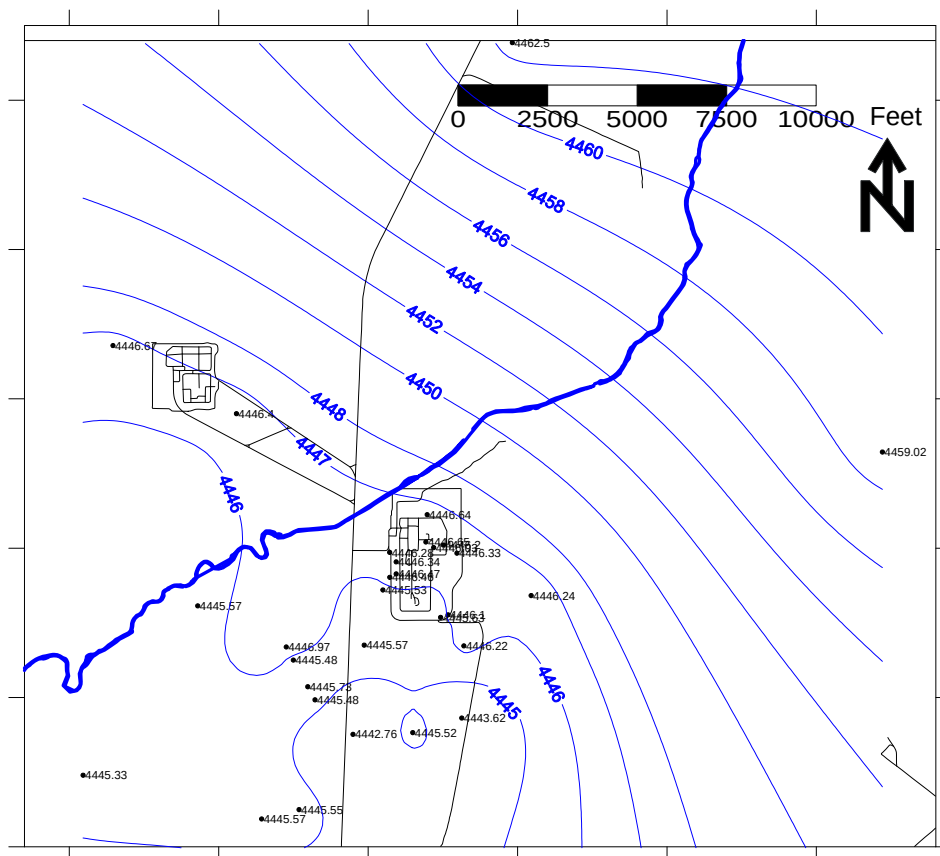


Figure 4-27. Snake River Plain Aquifer groundwater-level contours for October 2008.

The groundwater hydraulic gradient varies considerably across the map area. The gradient is relatively flat between INTEC and CFA landfill wells (i.e., LF-series wells), with less than 1.2 m (4 ft) of head difference over this 3.2-km (2-mile) distance. The water table contour map for 2008 is similar in shape to maps prepared in previous years, except that absolute groundwater levels vary from year to year in response to wet-dry climate cycles. Figure 4-28 shows groundwater hydrographs for eight aquifer wells. Groundwater levels declined from 2000 through 2005 because of the drought during this period. Groundwater levels have remained relatively constant from 2005 through 2009 as a result of near-normal precipitation during that period.

4.12.4.4 Vadose Zone Monitoring. Perched water monitoring is performed in accordance with the OU 3-14 Long-Term Monitoring Plan (DOE-ID 2009d) and includes perched water sampling and water-level monitoring. Since the last review, perched water sampling has been performed and reported for 2005 (DOE-ID 2006h), 2006 (DOE-ID 2007g), 2007 (DOE-ID 2008d), 2008 (DOE-ID 2009a), and 2009 (DOE-ID 2010b).

4.12.4.4.1 Perched Water Quality—Perched water samples are collected annually from monitoring wells specified in the OU 3-14 Long-Term Monitoring Plan (DOE-ID 2009d) (if water is present). Figure 4-29 shows the locations of the OU 3-14 SRPA perched water monitoring wells. Samples are analyzed for the following constituents: Sr-90, Tc-99, I-129, Cs-137, tritium, uranium and plutonium isotopes, gross alpha/beta, nitrate/nitrite, major ions, and total dissolved solids.

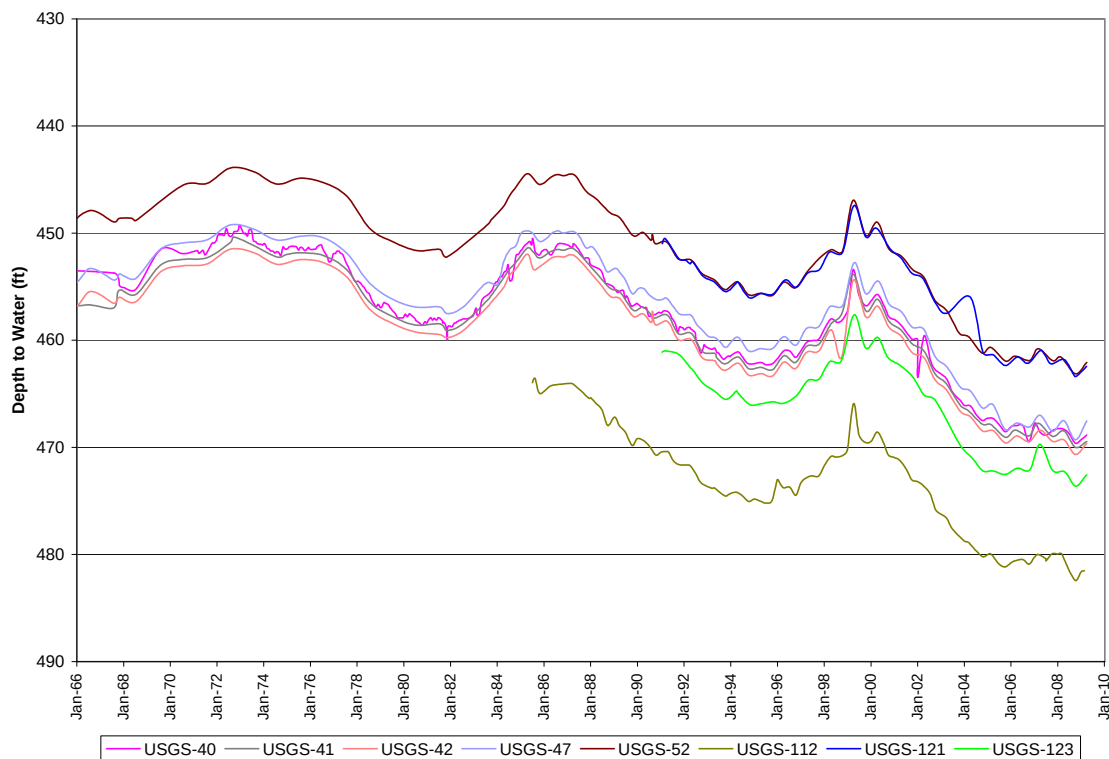


Figure 4-28. Groundwater hydrographs for selected Snake River Plain Aquifer wells near Idaho Nuclear Technology and Engineering Center.

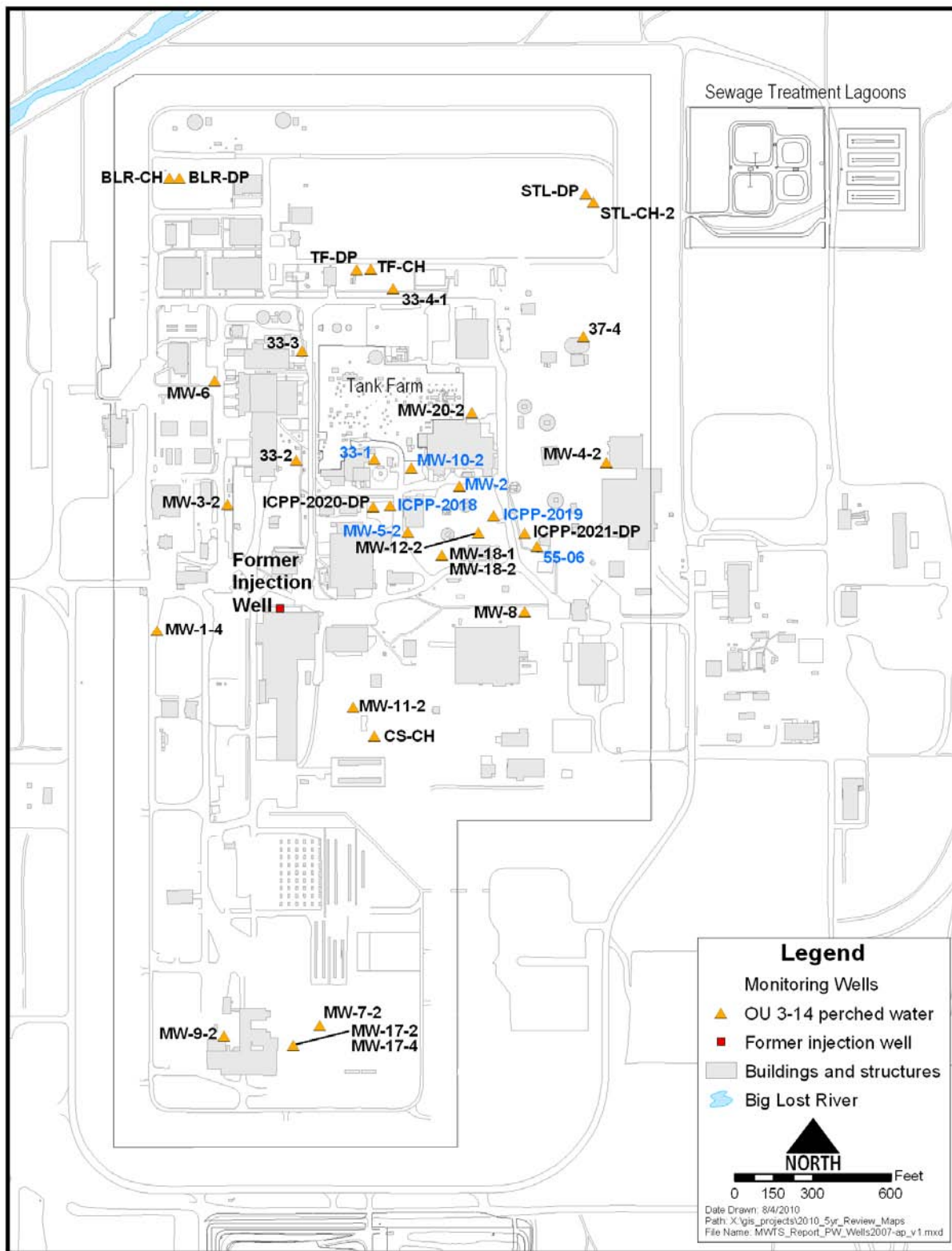


Figure 4-29. Locations of perched water monitoring within Operable Unit 3-14. Wells with blue labels sampled every year; wells with black labels sampled only during odd years.

Sr-90 is present in perched water at most well locations, and, in 2009, 11 perched water wells exceeded the Sr-90 MCL (8 pCi/L). As in the past, very high Sr-90 levels (greater than 10,000 pCi/L) were observed in the northern shallow perched water across INTEC. The highest Sr-90 concentrations were observed in wells southeast of the tank farm. The maximum Sr-90 concentration detected in 2009 was 130,000 pCi/L at Well ICPP-2018 (Figure 4-29). Sr-90 concentrations in perched water are slowly declining, and, in 2009, were approximately half as high as during the mid-1990s.

Tc-99 was detected in most perched water wells during 2009 (DOE-ID 2010b), but none of the concentrations exceeded the MCL (900 pCi/L). Tritium was detected at many of the perched water monitoring wells, but, in 2009, only Well MW-7-2 (20,500 pCi/L) exceeded the MCL (20,000 pCi/L). Tritium concentrations have been declining steadily over the years as a result of radioactive decay and dispersion. I-129 was detected in several perched water monitoring wells, but the only Well 33-2 (1.77 pCi/L) and Well MW-17-2 (1.32 pCi/L) exceeded the I-129 MCL (1 pCi/L). Declining I-129 concentrations have been a consistent trend over the past several years. Uranium concentrations in perched water are within the background range for SRPA groundwater (DOE-ID 2010b). In recent years, no plutonium isotopes have been detected in the perched water samples from INTEC.

A fuel oil release from a large aboveground storage tank in 2005 impacted the vadose zone and groundwater near the INTEC tank farm (RPT-514; RPT-656). As a result, free product (fuel oil) accumulated in perched water monitoring well ICPP-2018 during 2006–2007, and this well continued to contain measurable thicknesses of fuel oil during the reporting period. Figure 4-30 shows the nonaqueous-phase liquid layer thickness in Well ICPP-2018 over time. On April 17, 2008, a passive skimmer device was installed in Well ICPP-2018 to recover residual free-floating product (DOE-ID 2010b). As of the end of FY 2009, approximately 21 L of fuel oil had been removed from Well ICPP-2018 since the passive skimmer was first installed in the well. Except for Well ICPP-2018, free product has not been detected in any other monitoring wells at INTEC.

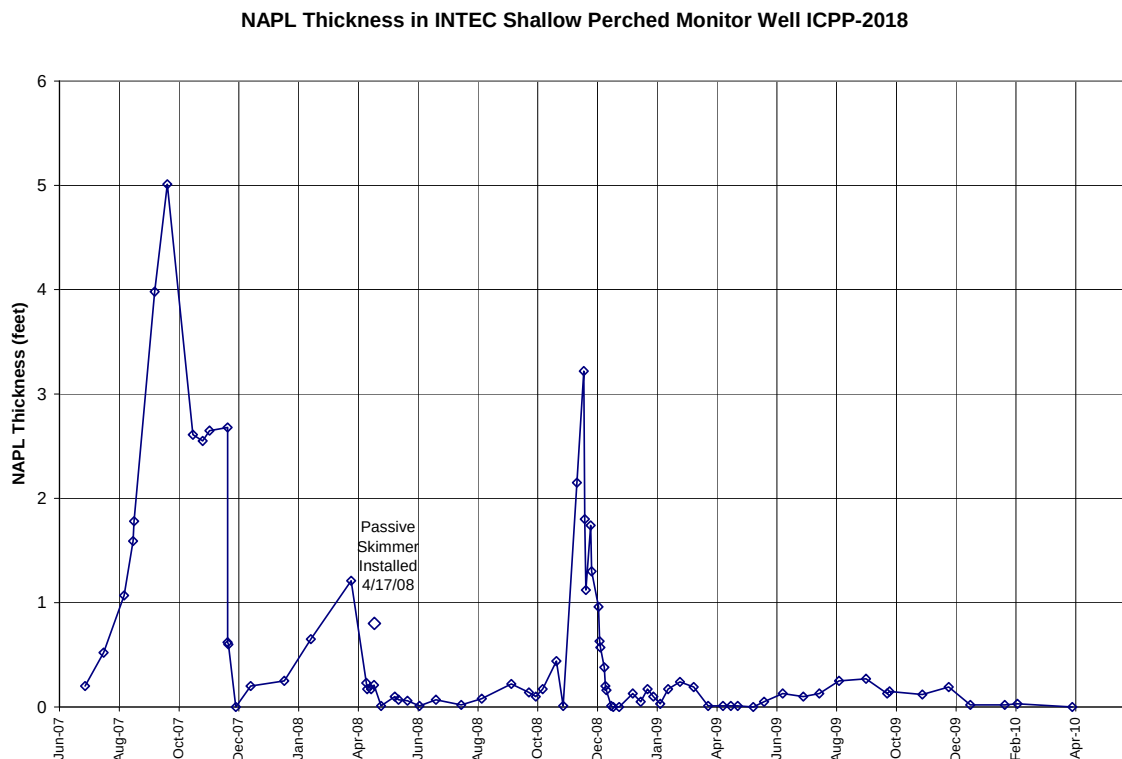


Figure 4-30. Fuel oil thickness trend in perched water monitoring well ICPP-2018.

Toluene and tetrachloroethene have been repeatedly detected in perched water samples collected by the RCRA program during the reporting period (DOE-ID 2010b). Toluene has been reported in perched water samples from Wells MW-10-2, MW-5-2, and 55-06 and in groundwater from SRPA Wells ICPP-2021 and ICPP-MON A-230. All of these wells are located near the tank farm. The highest toluene concentration (150 µg/L) reported during FY 2009 was at Well 55-06. The appearance of toluene in Wells 55-06 and MW-10-2 seems to have coincided with a fuel oil leak that occurred in 2005. The MCL for toluene is 1,000 µg/L.

Tetrachloroethene was detected on several occasions in perched water samples from monitoring well MW-10-2 at concentrations as high as 4.6 µg/L. Similar tetrachloroethene levels have been observed over the past few years at this location. The source of the tetrachloroethene has not been identified. The MCL for tetrachloroethene is 5 µg/L.

4.12.4.4.2 Perched Water Levels—Figure 4-31 shows the approximate lateral extent of the northern shallow perched water during 2009. As required by the OU 3-14 Long-Term Monitoring Plan (DOE-ID 2009d), perched water levels are monitored to help identify anthropogenic recharge sources, such as water leaks from underground pipelines. Figure 4-32 shows hydrographs for perched water monitoring wells located in the northern portion of INTEC near the tank farm. The perched water elevation data are also used to generate water-level contour maps (Figure 4-33). These maps indicate east or southeasterly lateral flow in the shallow perched water beneath the northern portion of INTEC, with the highest water level often observed at Well 33-2 (Figure 4-33). The inferred flow direction from the hydraulic gradient generally coincides with the southeasterly dip of the top of the 110-ft interbed beneath and south of the tank farm. Downward vertical flow also is expected for shallow perched water; however, such vertical flow cannot be shown on plan-view water-level maps.

4.12.4.4.3 Perched Water Temperatures—Perched water temperatures span a very wide range from well to well, ranging from approximately 11°C (52°F) to nearly 22°C (72°F) (DOE-ID 2010b). Historically, the highest perched water temperatures have occurred in the area southeast of the tank farm. Elevated temperatures in these wells suggest the presence of nearby anthropogenic recharge sources. Warm-water sources at INTEC include buried steam and steam condensate pipelines as well as service wastewater, which is warm because of the introduction of steam into service waste lines. SRPA groundwater temperatures are close to 11°C (52°F). Therefore, any leakage from fire water or raw water pipelines should be close to this temperature.

4.12.4.4.4 Shallow Perched Water Volume—Based on water-level monitoring data, the volume of northern shallow perched water is periodically estimated using MATLAB software, as described in the OU 3-14 Long-Term Monitoring Plan (DOE-ID 2009d). Figure 4-34 shows a graph of inferred changes in the volume of the northern shallow perched water over time, along with antecedent precipitation. In general, the graph indicates declining shallow perched water volumes from 2006 through 2009. Superimposed on this long-term declining trend are shorter-duration upticks that have occurred each year in November or March. The perched water volume increase that often occurs during late autumn is believed to result from the discharge of water to the ground from a heat pump at CPP-697 (East Guard Station). Perched water volume increases during the spring months are attributed to melting of snow and infiltration of the resulting melt water.

4.12.4.5 Site Inspections

4.12.4.5.1 Video Inspection of Service Wastewater Pipeline—To address questions regarding the integrity of the service wastewater pipeline, a video camera survey of the line was performed on November 20, 2008, to determine the internal condition of the pipeline (DOE-ID 2010b). In particular, the inspection was to determine obvious breaks or offsets in the pipe that might permit leakage

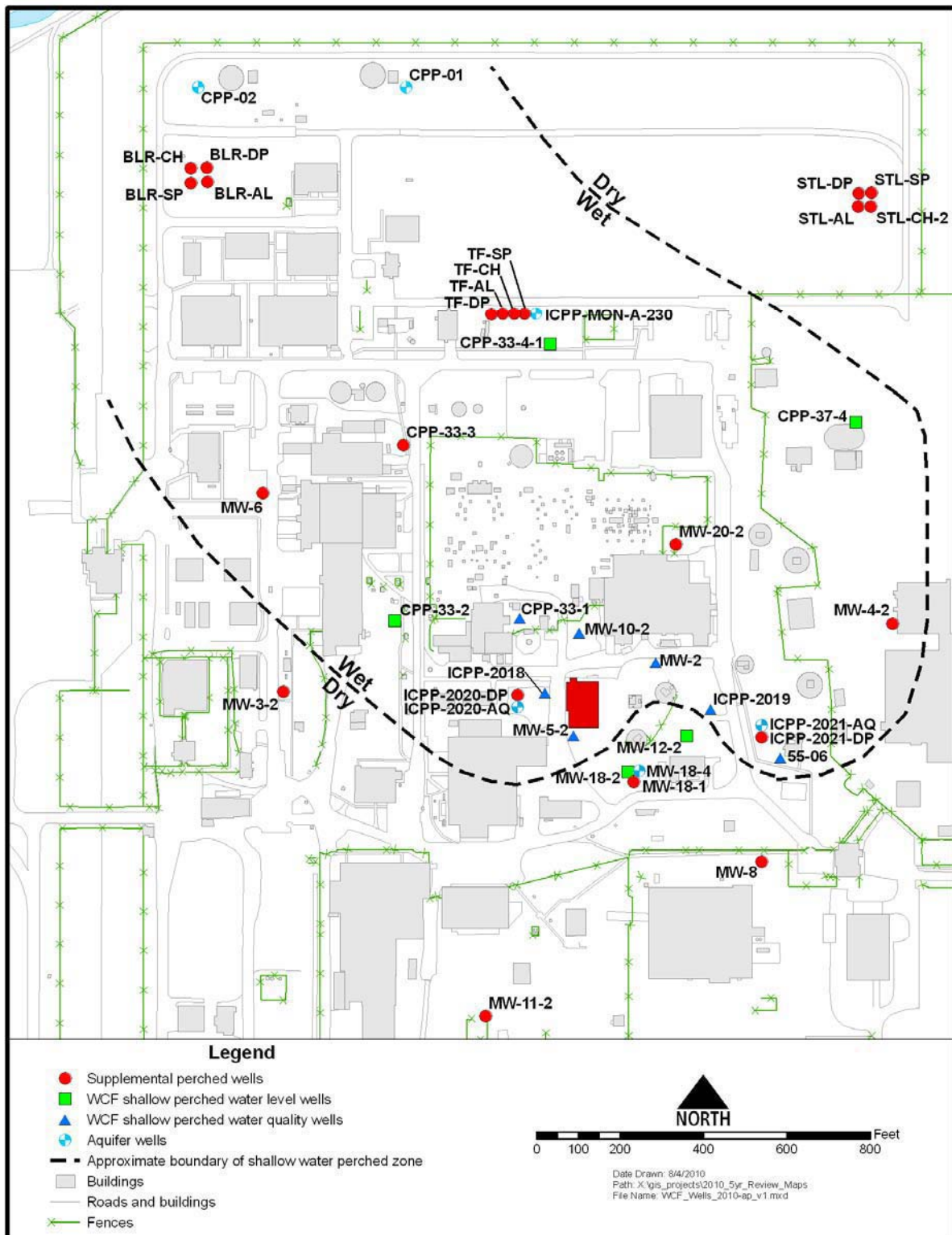


Figure 4-31. Lateral extent of the northern shallow perched water zone in 2009.

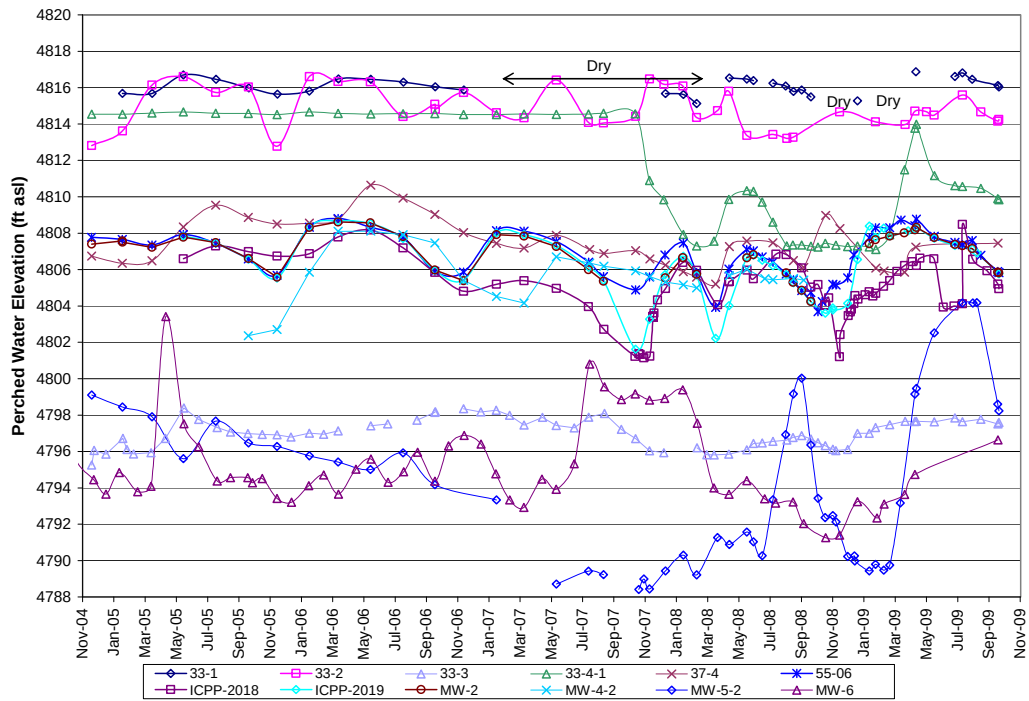


Figure 4-32. Hydrographs of shallow perched water.

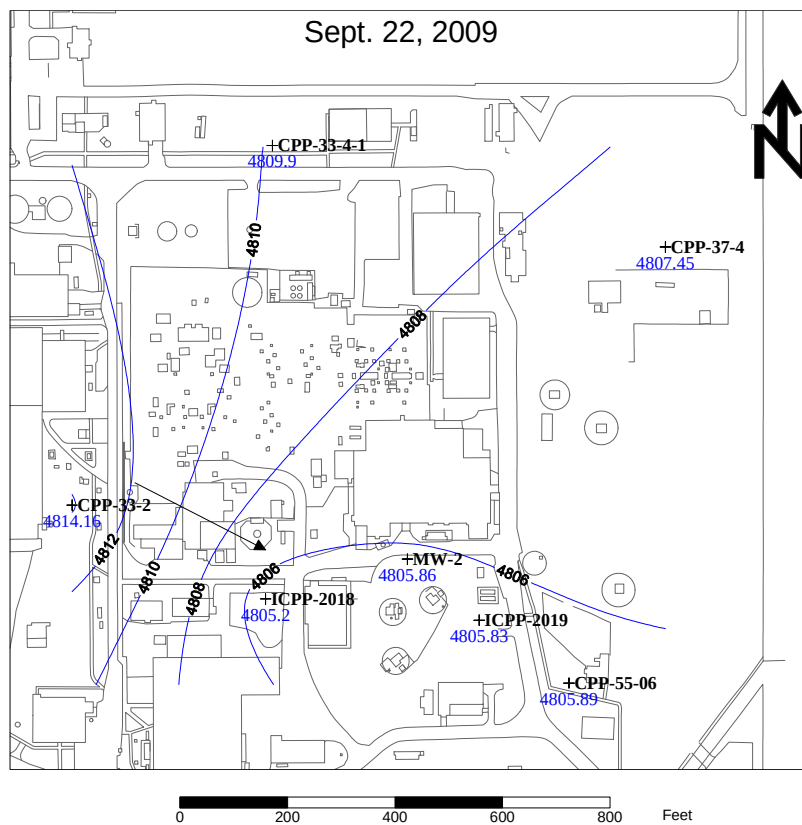


Figure 4-33. Contours of upper shallow perched water level, September 2009.

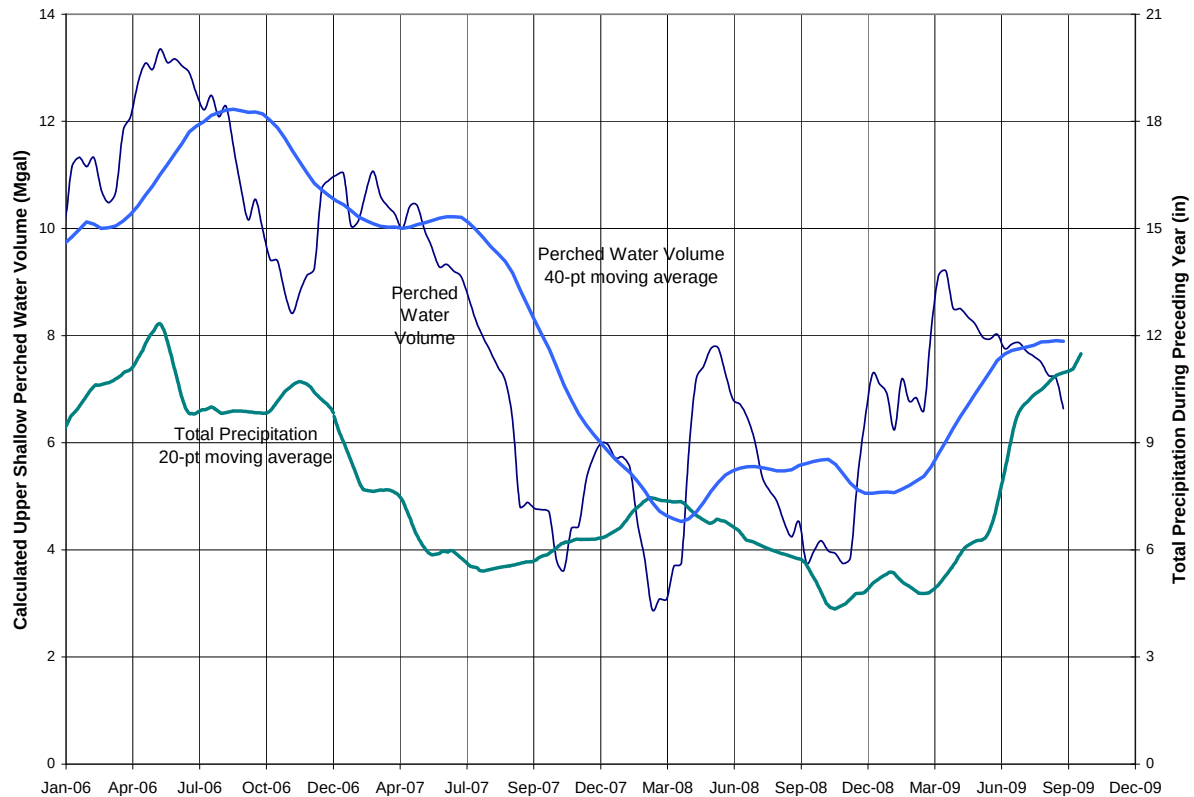


Figure 4-34. Trend in shallow perched water volume.

of wastewater. The camera and pipe crawler were steered upstream against the water flow to avoid the resulting downstream turbid conditions and improve clarity of the video images. The following sections of service wastewater pipeline were inspected:

- Manhole 1749 (nearest to CPP-797) downstream to CPP-797
- Manhole 1749 upstream to Manhole MAH-YDA-SW-102
- Manhole MAH-YDA-SW-102 upstream to Manhole MAH-YDA-SW-142
- Manhole MAH-YDA-SW-142 upstream to Manhole MAH-YDA-SW-107
- Manhole MAH-YDA-SW-107 upstream to Manhole MAH-PHE-SW-106
- Manhole MAH-PHE-SW-106 upstream to 90-degree bend in SW Line SW-NS-100641.

Subsequent review of the video logs did not reveal any obvious pipeline breaks or leaks; however, water turbulence prevented inspection of the lower portion of the pipe in some sections.

4.12.4.5.2 Infrared Thermographic Survey—An investigation of soil surface temperatures near perched water monitoring well 33-2 was conducted on April 22, 2009, using a ThermoCAM infrared camera (DOE-ID 2010b). Approximately 140 images were acquired in both the visual and infrared wavelengths from a platform lift approximately 40 ft above the ground. The survey was to locate possible subsurface water leaks near the well. Water leaks at shallow depth can produce warm or cold temperature anomalies at the soil surface. No leaks were found; however a cold surface temperature anomaly was identified that appears to correspond with the former location of an underground vault (CCP-631). It is hypothesized that cold snowmelt water flowing down the slope from CPP-601 may have accumulated in the underground concrete structure that remains at CCP-631.

4.12.4.5.3 Water Balance Calculations—Water balance calculations are performed periodically to compare inflows to and outflows from the INTEC water system, as described in the OU 3-14 Long-Term Monitoring Plan (DOE-ID 2009d). The difference between water inputs and outputs is termed “unaccounted water,” and any unknown or undiscovered pipeline water leaks would be included in this difference. Figure 4-35 shows the temporal trend in the percentage of unaccounted water, based on water balance calculations (DOE-ID 2010b). Except for an anomalous negative water balance during the first quarter of 2009 (due to a problem with service wastewater flowmeter), the percentage of unaccounted water has ranged from approximately 6 to 12% of plant inflow.

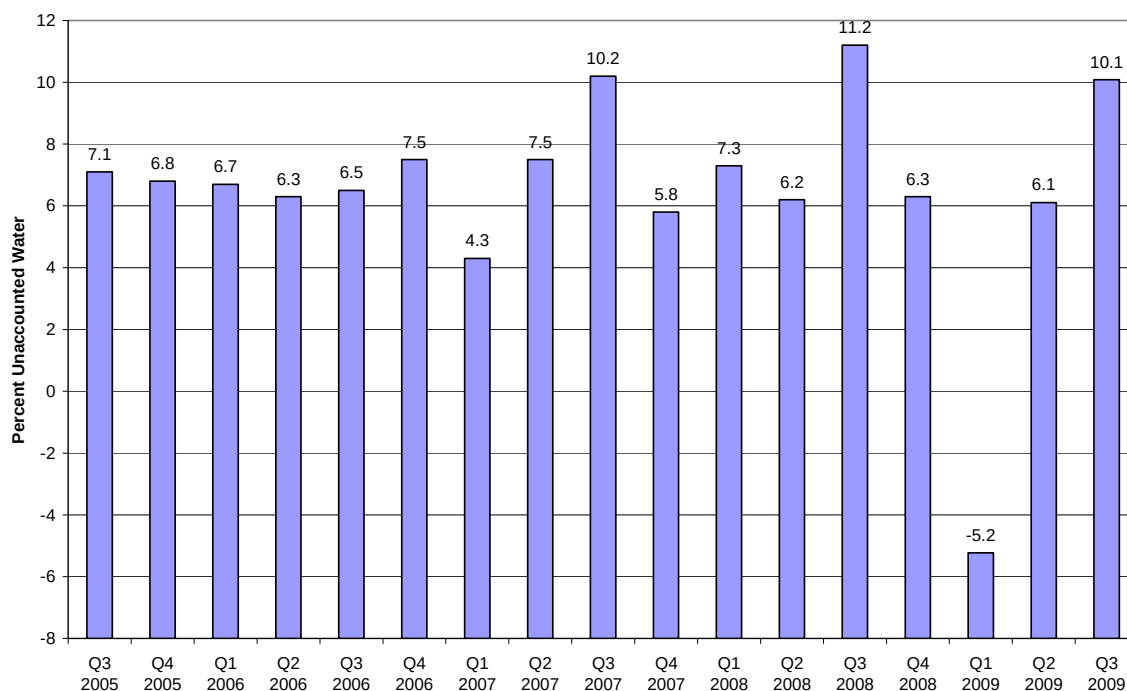


Figure 4-35. Trend of percent unaccounted-for water.

4.12.4.5.4 Evaporation Pond Leak Detection System—Monitoring data were collected during quarterly inspections to evaluate the performance of the leak detection system at the evaporation pond. This pond was installed in 2003 under the OU 3-13, Group 1, TFIA and transferred to OU 3-14 in 2008 as part of the final remedy for tank farm soil and INTEC groundwater. The following data were recorded:

- Hour-meter reading (records the amount of time the sump pump operated)
- Water-level reading (displays the level of water in the leak detection sump during the inspection)
- Totalizer readings (records cumulative gallons of water pumped from the leak detection sump and into the evaporation pond) on both the day of the inspection and the following day
- Estimated surface area of pond bottom covered with water.

The evaporation pond consists of two high-density polyethylene liners with a collection sump between the liners. The leak detection system is used to evaluate the integrity of the top liner by measuring the amount of water that seeps through the top liner and enters the sump. Water that enters the sump is pumped out and returned to the pond. Collected data are used to determine a leak rate measured as gallons per day. As per the OU 3-14 O&M Plan, no action is required for leak rates lower than 6,018 gal/day. The collected and calculated data to determine the evaporation leak rate are contained in Table 4-35.

Table 4-35. Evaporation pond leak detection quarterly monitoring data.

Inspection Date	Hour Meter (hr)	Water Level (in.)	Totalizer Day 1 ^a (gal)	Totalizer Day 2 ^a (gal)	Totalizer Difference (gal)	Estimated Surface Area of Water (ft ²)	Pond Bottom Covered ^b (%)	Leak Rate ^c (gal/day)
11/06/08	5,424.2	9.3	36,020.6	36,020.6	0	28,486	37	0
3/24/09	5,426.7	12.6	37,650.0	37,650.0	0	76,989	100	0
6/09/09	5,426.7	14.8	37,650.0	37,650.0	0	76,989	100	0
9/03/09	5,426.9	13.1	37,794.3	37,794.3	0	65,441	85	0
a. The leak-rate calculation requires the inspector to record totalizer readings once per day over 2 consecutive days. "Day 1" is the first day of the inspection visit and "Day 2" the second. b. The bottom surface area of the evaporation pond is 76,989 ft². c. Leak rate = (totalizer reading Day 2 – totalizer reading Day 1)/percent of pond bottom covered by water.								

4.12.4.5.5 Schedule—Table 4-36 lists the OU 3-14 Phase I remedy components (to be completed before Tank Farm Facility closure and outside the tank farm perimeter) and their current completion status. This table is a modification of Table 2-4 contained in the OU 3-14 RD/RA Work Plan (DOE-ID 2008a).

4.12.5 Technical Assessment

The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. Based on the results of monitoring and inspections performed to date, the OU 3-14 remedy is functioning as intended by the decision documents. OU 3-14 remedial actions began following signature of the ROD in 2007. Since that time, significant progress has been made toward reducing precipitation infiltration and anthropogenic recharge at INTEC. Installation of the low-permeability cover over the tank farm and surrounding area will proceed as those facilities are decommissioned. Because many of the required remedial actions have not yet been completed, their ultimate effectiveness cannot be assessed. However, all indications are that the selected remedy will have the desired effect.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

Yes.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

Technical Assessment Summary

The OU 3-14 ROD was signed in May 2007 and requires that SRPA groundwater meet MCLs for all COCs by the year 2095. Implementation of the OU 3-14 remedy began during summer 2007 and is proceeding according to the schedule established in the RD/RA Work Plan (DOE-ID 2008a). Based on the results of perched water and groundwater monitoring performed since that time, the remedy should be successful in meeting its objectives.

Table 4-36. Current status of Operable Unit 3-14 Phase I remedy components (prior to Tank Farm Facility closure).

Component of the Selected Remedy	Status	Actions
Implement ICs for the INTEC groundwater that exceeds MCLs, the contaminated tank farm soil, and the area close to the tank farm designated for industrial land use.	Completed	Implemented ICs under <i>INL Site-Wide Institutional Controls, and Operations and Maintenance Plan for CERCLA Response Actions</i> (DOE-ID 2010a).
Install and maintain a low-permeability pavement over the RCZ outside the tank farm to reduce infiltration.	In process Projected completion: September 2011	Initiated design; finalization of design and implementation delayed, pending final demolition of CPP-601 and CPP-630 (within the RCZ).
Expand drainage system to reduce infiltration of precipitation without interfering with ongoing INTEC operations and remediation activities.	In process.	Lined north INTEC drainage ditch with HDPE, July 2009.
	Projected completion: September 2010	Prepared final design for drainage improvement along Cypress Avenue, Olive Avenue, Hemlock Street, and Ash Street. Construction planned for summer 2010.
Extend the low-permeability pavement as buildings and structures are removed through decommissioning to maintain an infiltration-reducing barrier over the RCZ outside the tank farm.	In process	Decommissioned Building CPP-1607 and nearby post-indicator valve. Areas covered with asphalt, June 2009.
	Projected completion: facility closure	Decommissioning actions outside CPP-606 left an uncovered area within the RCZ. Subcontractor to be selected to install asphalt over area. Projected completion date: November 2009.
Design the low-permeability pavement to abut existing buildings and structures, as practical, to minimize (to the extent possible) surface water infiltration.	In process Projected completion: facility closure	Initiated design; finalization of design and implementation delayed, pending final demolition of CPP-601 and CPP-630 (within the RCZ).
Direct water run-off toward lined ditches, which will divert it to an evaporation pond.	Ongoing	Maintain existing ditches and evaporation pond in accordance with the OU 3-14 O&M Plan (DOE-ID 2008e).
Capture and send to the evaporation pond an equivalent volume of infiltration that would fall on the RCZ outside the tank farm.	In process Projected completion: 2011	Initiated design for installation of final asphalt outside the tank farm. Finalization of design and implementation delayed, pending final demolition of CPP-601 and CPP-630 (within the RCZ).

Table 4-36. (continued).

Component of the Selected Remedy	Status	Actions
Maintain the TFIA system per the OU 3-13 O&M Plan until the system is incorporated into, and expanded to accommodate, the drainage and water management requirements of the selected remedy.	In process Projected completion: 2010	Incorporated TFIA system into the OU 3-14 remedy upon finalization of the OU 3-14 Work Plan in 2008. System is maintained in accordance with the OU 3-14 O&M Plan (DOE-ID 2008e). Drainage system to be expanded as facility and decommissioning activities will allow.
Prepare an OU 3-14 O&M Plan that will incorporate the components of the TFIA into the selected remedy.	Completed June 2008	Completed OU 3-14 O&M Plan (DOE-ID 2008e).
Implement and maintain additional recharge controls in northern INTEC to reduce anthropogenic and storm water recharge sources to northern perched water.	Ongoing Projected completion: facility closure	Use water balance information, telemetry system data, and facility information to identify and isolate anthropogenic discharges.
Capture roof run-off from area buildings.	Completed December 2008	Installed gutters and downspouts in Buildings CPP-605 and CPP-606.
Eliminate excessive landscape watering.	In process Projected completion: 2012	Discontinued lawn water at INTEC as of October 2005 (DOE-ID 2008a). Irrigation water supply piping to be cut and capped as part of decommissioning activities or other facility maintenance activities. Piping elimination completed for CPP-699 and CPP-637.
Eliminate steam condensate drip-leg discharges.	Completed 2008	Isolated steam drip legs associated with shallow injection wells 15-CPP and 44-CPP, April 2008.
		Eliminated two steam traps located in utility tunnel under Olive Avenue, December 2004. These were the last two drip legs still discharging to the ground.
Line drainage ditches and improve INTEC drainage.	In process Projected completion: 2011	Several drainage ditches lined at part of the TFIA (2000 to 2003). TFIA system was incorporated into the OU 3-14 remedy upon finalization of the OU 3-14 Work Plan in 2008.
		Lined north INTEC drainage ditch with HDPE, July 2009.
		Prepared final design for drainage improvement along Cypress Avenue, Olive Avenue, Hemlock Street, and Ash Street. Construction planned for summer 2010.

Table 4-36. (continued).

Component of the Selected Remedy	Status	Actions
Perform actions designed to detect anthropogenic recharge to include pipeline valve isolation tests and hydrostatic tests to identify leaks in suspect areas.	Ongoing Project completion: facility closure	Actions performed on a continuous basis.
Calculate water balances to identify changes in system flows that could indicate leaks.	Ongoing	Perform quarterly water balances.
Install additional flowmeters to improve the accuracy of water balances.	Completed 2004	Installed water metering in accordance with recommendations of the water system engineering study report (DOE-ID 2003e)
Expand the telemetry for real-time water-level monitoring in perched water wells to detect subsurface leaks.	Completed April 2009	Installed telemetry system at perched water wells at INTEC.
Monitor contaminant concentrations and water levels in indicator monitoring wells to determine effectiveness of the groundwater remedy.	Ongoing	Monitoring of contaminant concentrations and water levels in indicator monitoring wells ongoing under the OU 3-14 Long-Term Monitoring Plan (DOE-ID 2008f).
Monitor perched water and groundwater in SRPA to ensure that the portions of SRPA contaminated by INTEC sources will meet MCLs by 2095.	Ongoing	Monitoring of perched water and SRPA groundwater ongoing under the OU 3-14 Long-Term Monitoring Plan (DOE-ID 2009d).
Supersede monitoring of perched water and SRPA under the OU 3-13 ROD (DOE-ID 1999a) with a long-term monitoring plan for OU 3-14.	Completed June 2008	Monitoring superseded under the OU 3-14 Long-Term Monitoring Plan (DOE-ID 2009d).
HDPE high-density polyethylene IC institutional control INTEC Idaho Nuclear Technology and Engineering Center MCL maximum contaminant level		O&M operation and maintenance OU operable unit RCZ recharge control zone SRPA Snake River Plain Aquifer TFIA Tank Farm Interim Action

4.12.6 Issues

No new issues have been identified.

4.12.7 Recommendations and Follow-Up Actions

The OU 3-14 project should continue to monitor the northern perched water zones and maintain previous efforts to reduce precipitation and anthropogenic recharge of the perched water. No other recommendations, follow-up actions, or issues were identified.

4.12.8 Protectiveness Statement for Operable Unit 3-14

The remedy at OU 3-14 is expected to be protective of human health and the environment upon completion, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled. OU 3-14 remedial actions are being implemented according to the established schedule. Although OU 3-14 remedial actions are only partially complete at this time, the actions to date are functioning as intended in the decision document, and monitoring results indicate that the OU 3-14 remedy will be protective.

4.13 Idaho CERCLA Disposal Facility

4.13.1 ICDF Chronology

The chronology prior to, and including, the OU 3-13 ROD that mandated construction and operation of the ICDF was presented in Table 4-1. The post-ROD ICDF chronology of significant documents and events is presented in Table 4-37.

Table 4-37. Post-Record of Decision Idaho CERCLA Disposal Facility chronology of significant documents and events.

Date	Document or Event
February 2003	<i>INEEL CERCLA Disposal Facility Complex Remedial Action Work Plan</i>
September 16, 2003	Began ICDF operations
September 2004	Completed construction of Cell 2
November 2005	Cell 2 began receiving waste
February 2007	Completed previous 5-year review
ICDF	Idaho CERCLA Disposal Facility

4.13.2 Background

The OU 3-13 ROD (DOE-ID 1999a) requires the construction and operation of the ICDF within the WAG 3 area of contamination and development of waste acceptance criteria to ensure that hazardous substances disposed of in the ICDF will not result in exceeding groundwater quality standards in the underlying SRPA. ICDF was constructed for the disposal of hazardous low-level waste, mixed low-level waste, and polychlorinated biphenyl-contaminated soil and debris waste types that (1) are generated by CERCLA remedial and removal actions at the INL Site and (2) meet the landfill waste acceptance

criteria. ICDF is located south of INTEC and adjacent to the remediated percolation ponds (Figure 4-36). Landfill disposal cells, including a buffer zone, cover approximately 40 acres and have a total disposal capacity of approximately 510,000 yd³. The evaporation ponds each have a capacity of 2.2 M gal.

The ICDF landfill meets the substantive requirements of RCRA Subtitle C (42 USC § 6921 et seq.), HWMA (1983), DOE O 435.1 Chg 1, and TSCA (15 USC § 2601 et seq.). The ICDF landfill uses a modular design consisting of two cells. Cell 1 was constructed in 2003. Construction of Cell 2 began in 2004 and was completed in September 2005.

Cell 2 began receiving waste in November 2005. ICDF includes the subsystems and support facilities necessary to provide a complete waste management system. ICDF is a facility that provides centralized waste acceptance, inspection, and disposal of CERCLA-generated waste types resulting from remediation and decommissioning activities at the INL Site.

4.13.3 Remedy Implementation

The major components of the ICDF Complex are:

- Landfill disposal cells (two cells)
- Evaporation pond consisting of two cells (east and west)
- Administration facilities
- Weigh scale
- Decontamination building with treatment systems (not in use)
- Contaminated equipment pad (not in use)
- Staging and storage areas.

The following sections briefly discuss the major components of the ICDF. Refer to DOE-ID (2008g) for additional information.

4.13.3.1 ICDF Landfill. The ICDF landfill is the consolidation point for CERCLA-generated waste within the INL Site boundaries that meets waste acceptance criteria.

4.13.3.2 ICDF Evaporation Pond. The ICDF evaporation pond, designated as a RCRA corrective action management unit in the OU 3-13 ROD (DOE-ID 1999a), is the disposal site for ICDF leachate and other aqueous waste that results from operating the ICDF Complex. Other aqueous waste generated at the INL Site, such as purge water from CERCLA sampling of monitoring wells, may also be disposed of in the evaporation pond in accordance with the waste acceptance criteria for the pond.

4.13.3.3 Administration Facilities. The administration facilities include a scale and an administration (“admin”) trailer with an office area, a public use area, restrooms, and utility rooms to support activities involving waste receipt, paperwork (electronic or hardcopy format) verification, and determination of the immediate destination of waste shipments.

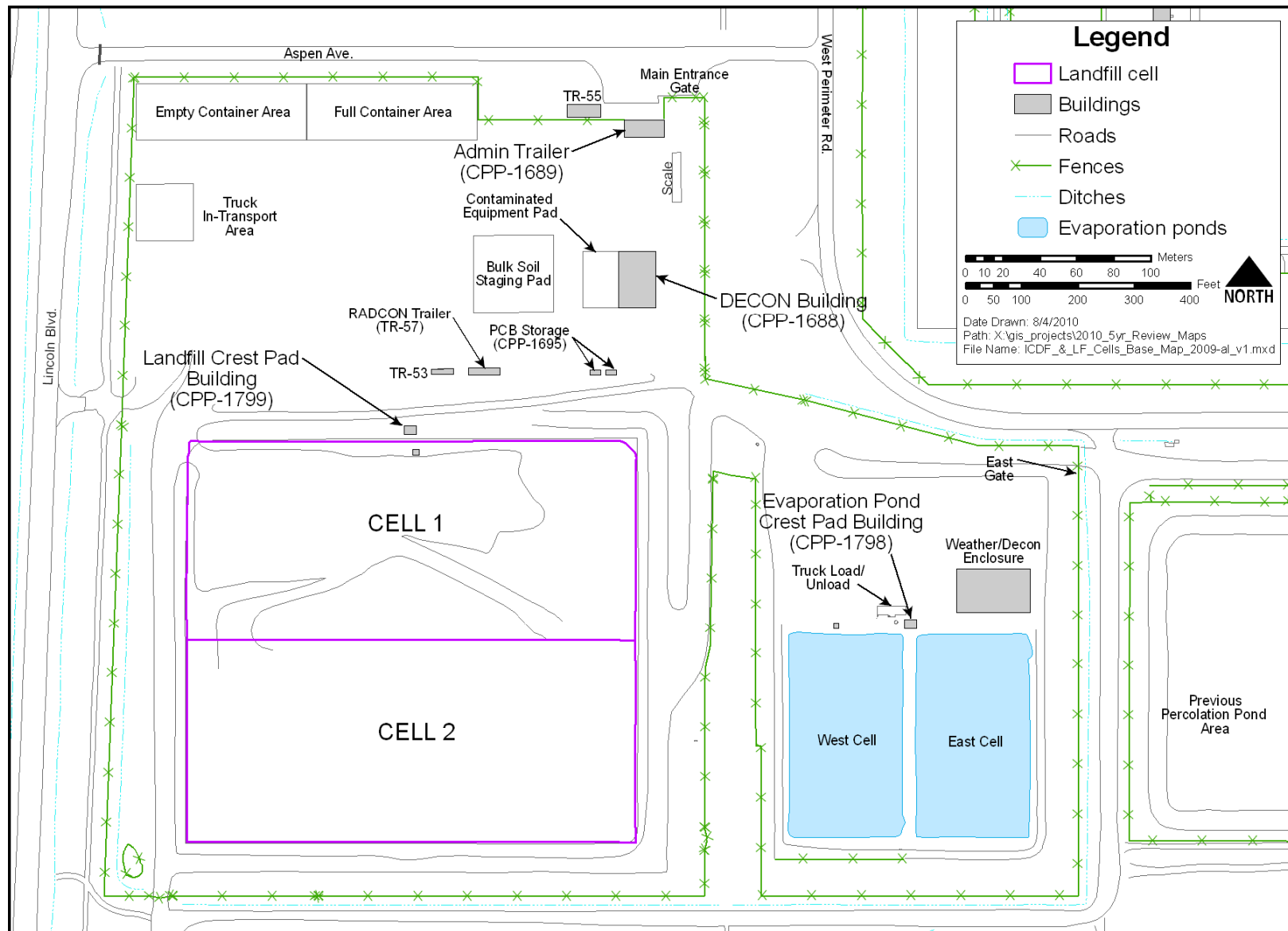


Figure 4-36. Location and plan view of the Idaho CERCLA Disposal Facility.

4.13.3.4 Weigh Scale. The weigh scale is located immediately south of the administration trailer. All waste shipments coming into the ICDF Complex are weighed and documented at this location. Tare weights of permanent, reusable equipment (e.g., transport trucks or roll-on/roll-off containers) are initially obtained, and tare weights of other haul vehicles may be obtained, if necessary, when the vehicles leave the ICDF Complex. The weigh data are recorded into the waste database in the administration trailer.

4.13.3.5 Decontamination Building. The decontamination building is an engineered metal building, located near the landfill entrance. It provides an equipment decontamination area and an area for the treatment, if necessary, of small volumes of waste prior to disposal in the landfill. The decontamination building is in warm standby condition. Facility deficiencies must be corrected prior to use of the building for decontamination, treatment, or stabilization of any wastes. The building has gone through partial closure. Administrative controls are in place prohibiting staging or storage of wastes within the building.

4.13.3.6 Contaminated Equipment Pad. The contaminated equipment pad, located west of and adjacent to the decontamination building, was used for staging and storing contaminated equipment that is no longer in use. The contaminated equipment pad was taken out of service due to deficiencies in the drain system. There are currently no plans to repair it or use it in the future.

4.13.3.7 Staging and Storage Areas. Within the ICDF Complex are staging and storage areas, including bulk soil staging pad, full and empty container storage areas, truck-in-transport area, polychlorinated biphenyl storage unit, and full and empty container queues. Detailed descriptions of each area are presented in DOE-ID (2008g).

4.13.4 Basis for Taking Action

The construction and operation of the ICDF are intended to reduce the overall areal extent of INL Site-wide soil contamination.

4.13.5 Remedial Action

The following sections describe the remedy and remedial action.

4.13.5.1 Remedy Selection. The selected remedy is construction and operation of the ICDF.

4.13.5.1.1 Remedial Action Objectives—The RAOs for WAG 3 were previously presented under Group 3 (see Sections 4.6.2.2 and 4.7.2.2). An RAO was established that requires maintenance and IC of the ICDF landfill cap after closure. Because the ICDF is still actively receiving waste, RAOs will not be discussed further.

4.13.5.1.2 Cleanup Levels—Because ICDF is a new facility designed to accept CERCLA wastes from cleanup activities conducted at other INL Site facilities, there are no cleanup levels for ICDF.

4.13.5.2 Remedy Implementation. The ICDF Remedial Action Work Plan (DOE-ID 2003h) was finalized in February 2003. The landfill opened on September 16, 2003. Facility O&M, monitoring, and inspections have been performed in accordance with approved documentation and are discussed in the sections below.

4.13.5.3 Operations and Maintenance. O&M activities are performed in accordance with the ICDF Complex O&M Plan (DOE-ID 2008g) and associated subcontractor standard operating procedures.

The ROD operational requirements are discussed below along with information pertaining to how these requirements are being implemented:

1. ROD Requirement #1. Limit disposed wastes to those generated by the Idaho National Engineering and Environmental Laboratory CERCLA program.
 - The ICDF Complex waste acceptance criteria were developed to identify the types and quantities of waste allowable for receipt and the requirements for accepting such waste. The ICDF Complex waste acceptance criteria are divided into four sections: (1) ICDF Complex; (2) Landfill; (3) Evaporation Pond; and (4) Staging, Storage, Sizing, and Treatment Facility (SSSTF). The ICDF Complex section contains the compliance details, which are the same for all areas of the ICDF. Corresponding sections contain details specific to the landfill, evaporation pond, and the SSSTF. Waste placed in the ICDF landfill and evaporation pond must not cause groundwater in the SRPA to exceed MCLs, a hazard index of 1, or 10^{-4} cumulative risk levels. Refer to DOE-ID (2009e) for detailed information concerning the waste acceptance criteria. The waste acceptance criteria limit disposal to waste generated by the CERCLA program.
2. ROD Requirement #2. Limit disposed wastes to those with contaminant concentrations that will not result in MCLs being exceeded in the SRPA.
 - This requirement is met by adherence to the waste acceptance criteria, as discussed above.
3. ROD Requirement #3. Limit disposed wastes to low-level radioactive waste, polychlorinated biphenyl solids, hazardous, and mixed low-level radioactive waste.
 - This requirement is met by adherence to the waste acceptance criteria, as discussed above.
4. ROD Requirement #4. Treat waste (soils, debris, and treatment residues) on-Site as necessary to meet Agency-approved waste acceptance criteria developed during the remedial design.
 - Waste treatment has been performed in the past; however, the treatment portion of the facility is currently in warm standby (see Section 4.13.3.5). When waste is treated, it is treated in accordance with an approved waste treatment plan, which ensures the treated waste meets the waste acceptance criteria.
5. ROD Requirement #5. Treat waste (soils, debris, and treatment residues originating from outside the WAG 3 area of contamination) to comply with the land disposal restrictions specified in IDAPA 16.01.05.011 (40 CFR 268 and 40 CFR 268.49) as applicable.
 - Waste treatment has been performed in the past; however, the treatment portion of the facility is currently in warm standby (see Section 4.13.3.5). When waste is treated, it is treated in accordance with an approved waste treatment plan, which ensures that the land disposal requirements specified above are met. If waste cannot be treated on the INL Site to meet the land disposal restrictions, waste is shipped off the INL Site for treatment and disposal.

6. ROD Requirement #6. Minimize leachate generation. Leachate will be collected and treated using physical/chemical treatment (i.e., evaporation in a surface impoundment designed in accordance with the substantive requirements of hazardous waste surface impoundments (IDAPA 16.01.05.008 [40 CFR 264.221])). Residues from the evaporation process will be managed in the ICDF as necessary during the active life and post-closure period of the ICDF cells.
 - The waste acceptance criteria ensure that leachate does not need physical or chemical treatment (see waste acceptance criteria description above). To date, no management of residues from the evaporation pond has been necessary.

Compliance with the waste acceptance criteria (DOE-ID 2009e) for ICDF ensures protection of human health and the environment, including the SRPA. Implementation of the waste acceptance criteria ensures compliance with the OU 3-13 ROD.

4.13.6 Progress Since the Last Review

No issues pertaining to ICDF were identified in the previous 5-year review.

4.13.7 Data Review and Evaluation

The following subsections summarize the groundwater, vadose zone, and leachate monitoring for ICDF.

4.13.7.1 Groundwater Monitoring. To ensure that the ICDF Complex remedial action is protective of groundwater, a detection monitoring network was installed in the SRPA. The detection monitoring network consists of five downgradient aquifer monitoring wells (i.e., ICPP-1831, ICPP-1782, ICPP-1783, ICPP-1800, and ICPP-1829) and one upgradient well (USGS-123). The network meets the substantive requirements of 40 CFR 264, Subpart F. Water samples from the SRPA are collected semiannually and analyzed for indicator parameters. The original list of indicator parameters consisted of chromium, mercury, Sr-90, Tc-99, and 40 CFR 264, Appendix IX, VOCs. Once a sufficient number of leachate samples had been collected and analyzed, concentrations in the leachate were compared to concentrations in the SRPA to better select indicator parameters. New indicator parameters, U-233/234, U-238, bicarbonate alkalinity, and sulfate, were selected because they occur in higher concentrations in the ICDF leachate than in the groundwater and are relatively mobile (Cahn 2007). Field parameter data (i.e., pH, specific conductance, and temperature) are also collected semiannually.

Samples from SRPA monitoring wells were collected for an extensive list of analytes in March 2006, which was 2.5 years after the landfill opened. This was a one-time sampling requirement per the revision to the *ICDF Complex Groundwater Monitoring Plan* (DOE-ID 2007h).

Detection monitoring reports are prepared annually (ICP 2006c; DOE-ID 2007i, 2008h, and 2009f). These reports verify that the landfill is not leaking, that the ICDF is operating as designed, and that ICDF is protective of the underlying aquifer.

4.13.7.2 Vadose Zone Monitoring. Six perched water wells were installed in 2002 and baseline samples were collected prior to ICDF becoming operational. The majority of the perched water wells have been dry since the landfill and evaporation ponds began receiving waste. Perched water levels are being monitored; however, perched water wells are not part of the detection monitoring network at this time.

4.13.7.3 Leachate Monitoring Program. The Leachate Collection and Recovery System and the primary and secondary leak detection and recovery systems are routinely monitored. The ICDF Complex O&M Sampling and Analysis Plan (DOE-ID 2003i) addresses routine sampling for several systems including sampling of the leak detection systems, landfill leachate through the Leachate Collection and Recovery System, evaporation pond water and sediment sampling, and sampling of the pump station (near the decontamination building) liquid. The Leachate Collection and Recovery System consists of the in-cell drainage/sumps, collection piping, pumps, and the evaporation pond. The purpose of the Leachate Collection and Recovery System is to collect the landfill leachate and allow for disposition of the leachate collected. These data, along with water-level data and data from existing wells, are used to ascertain whether a release from the ICDF landfill or evaporation pond(s) has occurred. The data are also evaluated to verify or modify the list of indicator parameters to be considered for groundwater monitoring. These data are also used as quality assurance to ensure that the total contaminant mass disposed of to the landfill does not produce a leachate that poses an unacceptable risk to the SRPA and to assess and predict performance of the landfill. A summary of the current systems sampled, analyses performed, and the frequencies at which these systems are sampled is presented in Table 4-38. A summary of the most recent performance assessment is presented in Koslow and Rood (2009). The analytical results from the leak detection system are presented in that report. The report concludes that the landfill has not leaked.

Table 4-38. Summary of Idaho CERCLA Disposal Facility sampling and analysis requirements.

Sampling Location	Sample Media	Sampling Frequency	Analyses
LCRS sump	Leachate	Monthly	I-129, field parameters (pH, specific conductance, temperature)
	Leachate	Quarterly	Appendix IX ^a metals + tin (filtered)
			Radionuclides (H-3, I-129, Np-237, Tc-99, Sr-90, Pu-239/240, Pu-238, U-234, U-235, U-238, gamma spectroscopy)
			Major anions (nitrate, sulfate, bicarbonate-alkalinity, chloride)
			Sulfide, C-14, total cyanide
	Leachate	Annually (formerly quarterly)	Appendix IX OC pesticides
			Appendix IX chlorinated herbicides
			Appendix IX VOCs and SVOCs
			Appendix IX OP pesticides
			Appendix IX PCDDs/PCDFs
			PCBs
Evaporation ponds	Liquid	Annually	Appendix IX metals + tin (unfiltered) Radionuclides (Cs-137, I-129, Sr-90, Pu-238, U-234, gamma spectroscopy) Appendix IX SVOCs
	Sediments	Annually	Appendix IX metals + tin (Hg not required)
	Liquid	Every 5 years	Appendix IX VOCs and SVOCs
			Appendix IX metals + tin (filtered)
			Appendix IX metals + tin (unfiltered)
			Appendix IX OC pesticides Appendix IX OC herbicides Appendix IX OP pesticides
			Appendix IX PCDDs/PCDFs
			PCBs, sulfide, C-14, total cyanide

Table 4-32. (continued).

Sampling Location	Sample Media	Sampling Frequency	Analyses
Evaporation ponds (continued)			Radionuclides (H-3, I-129, Np-237, Tc-99, Sr-90, Pu-239/240, Pu-238, U-234, U-235, U-238, gamma spectroscopy)
			Major anions (nitrate, sulfate, bicarbonate-alkalinity, chloride)
	Sediment	Every 5 years	Appendix IX VOCs and SVOCs
			Appendix IX metals + tin (filtered)
			Appendix IX metals + tin (unfiltered)
			Appendix IX OC pesticides Appendix IX OC herbicides Appendix IX OP pesticides
			Appendix IX PCDDs/PCDFs
			PCBs, sulfide, C-14, total cyanide
			Radionuclides (H-3, I-129, Np-237, Tc-99, Sr-90, Pu-239/240, Pu-238, U-234, U-235, U-238, gamma spectroscopy)
Pump station	Liquid	Annually	Total suspended solids, oil, and grease
	Sediments	Annually	Oil and grease
PLDRS	Liquid	Annually	Field parameters (pH, specific conductance, temperature)
SLDRS	Liquid	Annually	Field parameters (pH, specific conductance, temperature)
a. 40 CFR 264. LCRS Leachate Collection and Recovery System OC organochlorine OP organophosphorous PCB polychlorinated biphenyl PCDD polychlorinated dibenzo-p-dioxins PCDF polychlorinated dibenzofurans PLDRS primary leak detection and recovery system SLDRS secondary leak detection and recovery system SVOC semivolatile organic compound VOC volatile organic compound			

As stated in the 2003 ICDF O&M Plan (DOE-ID 2003i), sampling of the Leachate Collection and Recovery System will be performed biannually. However, if the concentration of any constituent in the Leachate Collection and Recovery System exceeds the maximum leachate concentrations presented in Appendix C of EDF-ER-274, the frequency of the Leachate Collection and Recovery System leachate sampling will be increased from biannually to quarterly. ICDF has been conducting quarterly Leachate Collection and Recovery System sampling since February 2004, because of concentrations of anions/cations, metals (Sr), and radionuclides (Y-90) exceeding the predicted values presented in EDF-ER-274. Based on the quarterly Leachate Collection and Recovery System sampling results, the Agencies agreed in December 2007 to reduce the quarterly sampling and analysis requirements for Appendix IX VOCs, semivolatile organic compounds, pesticides/herbicides, and polychlorinated biphenyls to an annual basis (see Table 4-38). Evaporation pond water and sediments are sampled and analyzed annually for the analytes listed in Table 4-38 to address ecological issues described in Section 3.4 of the 2003 ICDF O&M Plan. Field parameters measured from the primary leak detection and recovery system and secondary leak detection and recovery system liquid are tracked and trended with time. Evaporation pond water is sampled annually to determine whether the concentrations exceed the operational limits established to ensure compliance with IDAPA 58.01.01.585 and IDAPA 58.01.01.586 requirements for the toxic air pollutants. Evaporation pond water and sediment are sampled every 5 years to support waste acceptance criteria compliance. To date, all evaporation pond sampling results are within

the operational limits, support waste acceptance criteria compliance, and are within the limits established for addressing ecological concerns, with the exception of Cs-137. Samples collected from the west evaporation pond in 2009 were in excess of the action limit listed in the 2003 ICDF O&M Plan. This exceedance is most likely associated with the CPP-603 basin waste stream and is consistent with Cs-137 results observed in previous years since receiving the CPP-603 waste. This exceedance does not jeopardize the exceedance of the ICDF National Emissions Standards for Hazardous Air Pollutants goal of 1 mrem/year (Bradford 2009).

In summary, since 2004, seven constituents in the Leachate Collection and Recovery System have exceeded the predicted values in EDF-ER-274 (calcium, chloride, nitrate, potassium, sodium, strontium, and Y-90). Of these, chloride, nitrate, and sodium have accounted for 90% of the exceedences. Transmittals to the Agencies have stated, "These greater values are not abnormal in that they are naturally-occurring within the INL soils, and have been observed in previous sampling events" (Waters 2009). The remaining exceedences have been infrequent and only slightly above the predicted levels in EDF-ER-274. The fluid level in the primary leak detection and recovery system has remained low, and no leachate has been detected in the secondary leak detection and recovery system. As expected, liquid is generated in the primary leak detection and recovery system from compaction of the landfill liner. In 2005, a leaky check valve, which allowed liquid to leak into the primary leak detection and recovery system, was discovered and repaired.

4.13.7.4 Site Inspections. Various inspections routinely occur at the ICDF Complex, including perimeter, significant storm event, dust suppression, landfill, evaporation pond, waste staging/storage, decontamination building, and tank inspections, as appropriate. Detailed information regarding these inspections is contained in the 2008 ICDF O&M Plan (DOE-ID 2008g) and subcontractor standard operating procedures. Inspections are performed weekly, unless otherwise noted, and are documented through the use of logbooks, checklists, or other appropriate electronic or hardcopy format. No significant issues have been identified during site inspections.

4.13.7.5 Other Data Collected. After 5 years of operation, 52% of the available volume of the ICDF landfill has been filled based on a recent aerial survey (EDF-9071). The net volume of waste disposed of in the ICDF landfill between October 1, 2004, and September 30, 2009, is 231,309 yd³. The net volume of liquid disposed of in the ICDF evaporation pond during this same period is 1,419,445 gal. The actual and projected waste volumes through FY 2012 are presented in Koslow and Rood (2009). As presented in this report, some radionuclide activities are greater than the inventory activities assessed in the original Performance Assessment (DOE-ID 2003j), and some waste forms disposed of at the ICDF are different than those originally modeled/evaluated (e.g., compacted soil versus reactor vessels, tanks, decommissioning debris, or activated metal). This report concludes, however, that the ICDF landfill complies with DOE O 435.1 Chg 1. Even though the actual radionuclide inventories disposed of are higher in some cases than the design basis inventory for the facility, the groundwater protection requirements have been met, and the facility is protective of human health and the environment.

4.13.8 Technical Assessment

The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. Based on implementation of the operational requirements as presented in the OU 3-13 ROD and a review of the monitoring data collected to date, the ICDF is operating and functioning as intended by the decision documents.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Yes. The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection are still valid. The ICDF RAOs apply to the cap, which is designed to be protective once the landfill is closed.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No. Additional information has not been discovered that calls into question the protectiveness of the remedy.

Technical Assessment Summary

The ICDF was constructed in accordance with the requirements established in the OU 3-13 ROD and is operating as intended and as mandated by the operational requirements set forth in the ROD. There are no identified issues that call into question the effectiveness of the facility.

4.13.9 Issues

No issues were identified.

4.13.10 Recommendations and Follow-Up Actions

Because no issues were identified, recommendations were not required.

4.13.11 Protectiveness Statement for the Idaho CERCLA Disposal Facility

The remedy at ICDF is expected to be protective of human health and the environment upon completion, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled. ICDF has been in operation since September 16, 2003, providing a cost-effective treatment and disposal unit for CERCLA cleanup at the INL Site in accordance with the requirements set forth in the OU 3-13 ROD. Compliance with the requirements set forth in the ICDF Complex RD/RA Work Plan and various ICDF waste acceptance criteria (DOE-ID 2009e) ensures protection of human health and the environment, including the SRPA.

4.14 Removal Actions – INTEC Decontamination and Decommissioning Activities

EPA guidance for 5-year reviews (EPA 2001) lists post-ROD removal actions under remedy implementation. Because of the complex configuration of remedial groups and the equally complex relationship of OU 3-13 and OU 3-14, removal actions do not fit neatly under any of the previously discussed remedial elements for either OU. Therefore, this subsection addresses post-ROD removal actions separately.

4.14.1 Background

The joint DOE and EPA *Policy on Decommissioning of Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)* (DOE and EPA 1995) established the CERCLA NTCRA process as an approach for decommissioning. Prior to 2006, a separate action memorandum was prepared for each facility. In 2006, the CERCLA Agencies (DOE-ID, EPA, and Idaho DEQ) selected this approach for general decommissioning of facilities at the

INL Site in the *Action Memorandum for General Decommissioning Activities under the Idaho Cleanup Project* (DOE-ID 2006e). After this date, major facilities identified in this document could begin the decommissioning process, but a separate action memorandum would be necessary to select the final end state.

Although the general decommissioning of buildings and structures is not specifically addressed in previous RODs at the INL Site, NTCRAs are consistent with the RAOs of previous RODs and support the overall cleanup objectives established through the FFA/CO (DOE-ID 1991).

4.14.2 Facilities Decommissioned under General Decommissioning Action Memorandum

WAG 3 facilities or structures decommissioned as NTCRAs under the General Decommissioning Action Memorandum during the period from October 1, 2004, to September 30, 2009, are listed in Table 4-39. These facilities or structures were removed and the area graded to match surrounding contours. Based upon specific requirements, the waste from these facilities was shipped to an appropriate treatment or disposal facility as follows: Mixed waste was shipped to a permitted facility, such as the Energy Solutions facility in Clive, Utah. Most radioactive waste was disposed of at the ICDF. Nonradioactive friable asbestos was shipped to the CFA landfill. Other wastes were sent to the INTEC CERCLA Demolition Waste Landfill. Some of the equipment removed from these facilities (e.g., office trailers) was reclaimed for use at other locations.

Figure 4-37 shows typical photos for some of the facilities that are identified in Table 4-39. As all of these facilities are within OU 3-13 CERCLA area CPP-88, minor radionuclide contamination may be found at all of these sites. Similarly CPP-1607 was within the OU 3-14 established industrial use zone, and the residual contamination is slightly higher but less than the OU 3-14 remediation goals. As CPP-648 and CPP-764 were within an active remedial action work area, the removal of CPP-648 and CPP-764 took place in coordination with that remedial action. This remedial action was for soils adjacent to CPP-603 under Group 3 of OU 3-13. Upon completion of that remedial action, ICs for the entire area were addressed in OU 3-13 Group 3 Phase II Remedial Action Report (DOE-ID 2009c). Upon completion of the NTCRAs listed in Table 4-39, no contamination remained at the removal locations that would require controls beyond those established for OU 3-13 CPP-88, OU 3-14 industrial use area, or the remediation area just east of CPP-603.

Table 4-39. Non-time-critical removal actions completed under the General Decommissioning Action Memorandum.

Facility ID	Facility Name	Completion Date
CPP-1607	Automatic Foam Fire Prot. Bldg	5/13/2009
CPP-1619	Haz Chem/Rad Waste Fac.	11/18/2008
CPP-1644	Bulk Chemical Unloading	4/7/2009
CPP-1677	Change Room	8/21/2008
CPP-1682	Kerosene Tank Pump House	7/7/2009
CPP-1740	Camera Tower	4/9/2009
CPP-1752	Camera Tower	4/9/2009
CPP-1755	Cesspool for VES-CFE-6013	8/12/2008
CPP-1759	Diesel Storage Tank Basin	11/24/2008
CPP-1760	Kerosene Storage Tank Basin	7/7/2009
CPP-1784	Aluminum Nitrate Containment	7/15/2009
CPP-2716	HIC Enclosure	5/7/2009
CPP-621	Chemical Storage Pumphouse	3/12/2009
CPP-641	Waste Holdup Pump House	9/14/2009
CPP-645	Office Building	3/6/2008
CPP-648	VES-SFE-106 Tank System	10/1/2008
CPP-656	Office Building	7/8/2008
CPP-660	Chem. & Haz. Material Storage	1/15/2009
CPP-668	Engineering Support Offices	3/6/2008
CPP-687	Coal-Fired Boiler House	7/8/2008
CPP-688	Coal Plant Unload Bldg	4/17/2008
CPP-689	Coal Plant Guard House	1/17/2008
CPP-690	Coal Plant Storage Bldg	6/11/2008
CPP-696	Coal Plant Offices	6/10/2008
CPP-699	Training/Prod. Office Bldg.	9/18/2008
CPP-719	Nitric Acid Storage System	6/18/2009
CPP-720	Aluminum Nitrate Storage System	6/18/2009
CPP-727	FDP FAST HF Acid Storage VES-CS-169	9/21/2009
CPP-730	Liquid Nitrogen Storage Tank	7/8/2009
CPP-740	Settling Basin and Dry Well	9/4/2008
CPP-755	Coal Storage Pad So CPP-687	8/21/2008
CPP-757	Vault Fluoric Acid Supply Systems	6/18/2009
CPP-764	SFE Hold Tank Vault	11/18/2008
CPP-775	Fuel Oil Pump Shed, Coal Fired Power Plant	1/17/2008
CPP-776	Car Thaw Station, Coal-Fired Power Plant	1/17/2008
CPP-778	Elec. Substation, Coal-Fired Power Plant	3/10/2008
CPP-787	Stack Exhaust Tapered	4/15/2008

Table 4-39. (continued).

Facility ID	Facility Name	Completion Date
CPP-788	Boiler Baghouse #1, Coal-Fired Power Plant	1/17/2008
CPP-789	Boiler Baghouse #2, Coal-Fired Power Plant	1/17/2008
CPP-792	Ash Silo, Coal-Fired Power Plant	2/19/2008
CPP-793	Limestone Silo, Coal-Fired Power Plant	6/9/2008
CPP-794	Coal Handling Dust Collector	1/17/2008
CPP-NCE-140-1	VES-NCE-140-1 Diesel Underground Storage Tank	9/16/2009
CPP-NCE-140-2	VES-NCE-140-2 Diesel Underground Storage Tank	9/16/2009
CPP-SAA-101	Liquid Nitrogen Tank	6/18/2009
CPP-SAA-104	Liquid Nitrogen Tank	6/18/2009
CPP-TB-5	Unloading Station	9/30/2008
CPP-TR-35	Office Trailer	1/17/2008
CPP-UTI-709	Sulfuric Acid Tank	9/9/2009
FDP	Fluorinel Dissolution Process	
FAST	Fluorinel Dissolution Process and Fuel Storage	
HF	hydrofluoric	
HIC	high-integrity container	
SFE	Storage Facility Exterior	



Figure 4-37. Photographic examples of non-time-critical removal actions at the Idaho Nuclear Technology and Engineering Center completed between October 1, 2004, and September 30, 2009.

4.14.3 Facilities Decommissioned Under Facility-Specific Action Memoranda

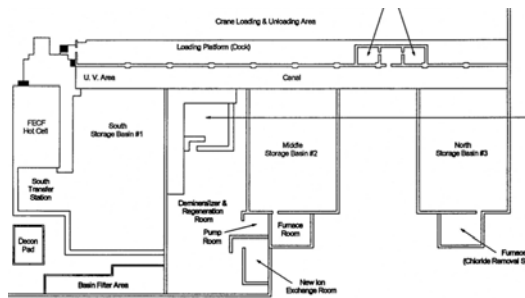
At WAG 3, two facilities were decommissioned as NTCRAs under facility-specific action memoranda from October 1, 2004, till September 30, 2009 (Table 4-40). These facilities are further discussed in the following subsections.

Table 4-40. Waste Area Group 3 non-time-critical removal actions completed under facility-specific action memoranda.

Facility ID	Facility Name	Completion Date	Action Memoranda	Removal Action Report
CPP-603A	Wet Fuel Storage Facility Basin	11/3/2006	<i>Action Memorandum for the Non-Time Critical Removal Action at the CPP-603A Basins, Idaho Nuclear Technology and Engineering Center (DOE-ID 2005a)</i>	<i>Final Removal Action Report for the CPP-603A Basin Facility (DOE-ID 2007b)</i>
CPP-627	Remote Analytical Facility	1/16/2006	<i>Action Memorandum for the Decontamination and Decommissioning of Building CPP-627, the Remote Analytical Facility (DOE-ID 2004d)</i>	<i>Final Report for the Decontamination and Decommissioning of CPP-627 Remote Analytical Facility (ICP 2006d)</i>

4.14.3.1 CPP-603A. The facility-specific Action Memorandum for the NTCRA at the INTEC CPP-603A Basins (DOE-ID 2005a) (CPP-603A Action Memorandum) selected an interim action remedy for the CPP-603A basins. The CPP-603A Action Memorandum determined that the selected action was consistent with the OU 3-13 RAOs. CPP-603 consists of three storage basins and a transfer canal. The storage basins are reinforced concrete structures with most of their volume below grade. The selected action was to stabilize the basins, which included removal, treatment, and disposal of the sludge in accordance with Hazardous Waste Management Act/RCRA; removal and transport of the basin water to the ICDF evaporation pond; removal of highly radioactive objects; and filling of the basins with grout (Figure 4-38). Debris objects contaminated with radioactive cobalt (short half-life) were consolidated and encapsulated in the grout. The positions of the debris objects were noted for future location and removal, if necessary. The grout provides shielding for the radioactive contamination embedded on the basin walls, eliminating possible migration and airborne contamination. The final end state for the CPP-603A facility was not determined. That is expected to occur along with the determination of the end state for the remainder of the CPP-603 facility. This interim action was not intended to prejudice the selection of a final end state. CPP-603A is listed in the General Decommissioning Action Memorandum as a high-risk facility, allowing actions preparatory to decommissioning to take place at this time. However, final decommissioning will require the development of an engineering evaluation/cost analysis as well as an action memorandum. Maintenance of the CPP-603 facility will provide adequate protection of the environment until such time as the final end state is decided upon.

4.14.3.2 CPP-627 Remote Analytical Facility. The Remote Analytical Facility (CPP-627) (Figure 4-38) was a two-story facility built upon a concrete slab at grade level in 1955. The facility shared common walls with CPP-601, -602, and -640. This facility was inactive since 1989. CPP-627 housed analytical, experimental, and decontamination facilities. The CPP-627 Action Memorandum (DOE-ID 2004d) documents the selection of the removal of the building to the concrete slab as a NTCRA. The CPP-627 Action Memorandum determined that these actions were consistent with the OU 3-13 ROD.



CPP-603A Wet Fuel Storage Facility Basin, north, middle, and south basins



CPP-603A Wet Fuel Storage Facility Basin, south basins after grouting



CPP-627, Remote Analytical Facility pre-decommissioning



CPP-627, Remote Analytical Facility, shift laboratory



CPP-627, Remote Analytical Facility, emission spectrometry laboratory



CPP-627, Remote Analytical Facility, slab being reinforced



CPP-627, Remote Analytical Facility, slab after demolition

Figure 4-38. Photographs of CPP-603A and CPP-627.

The primary objectives of the NTCRA were to (1) eliminate potential safety hazards and exposure to hazardous materials and (2) dismantle and dispose of the building to support accelerating footprint reduction at the INL Site. The work began in February 2004 and was completed January 2006. The work was documented in CPP-627 Action Memorandum (DOE-ID 2004d).

The building was demolished to the existing concrete slab (Figure 4-38) and disposed of in the ICDF. Contaminated waste piping beneath the concrete slab was left in place due to the proximity of the surrounding buildings and the anticipated schedule for their decommissioning. An additional layer of concrete was placed over the existing building slab to preclude infiltration of water and migration of the contaminants below the slab until the final end state for the entire group of buildings could be determined.

The CPP-601/640 Action Memorandum (DOE-ID 2008b) determined that the final end state for CPP-601 and CPP-640 was to demolish the upper portions of those facilities, to fill void spaces with grout, and to install an earthen cover when the end state for the facilities in the northern area of INTEC had been achieved (approximately 2035). In addition, the Phase I Closure Plan for the CPP-601 Deep Tanks System (DOE-ID 2009g) confirmed that the former location of Building CPP-627 would be included within and managed as part of the landfill established by that Closure Plan. The final earthen cover will cover all three facilities.

The NTCRA for the CPP-601 and CPP-640 facilities is still in progress. As such, the contamination left within the piping beneath the CPP-627 pad will be addressed at the same time as the contamination left within the CPP-601 and CPP-640 facilities in the remedial action report for those facilities. At that time ICs will be established as necessary for the combined CPP-601/627/640 facilities. Except for the earthen cover, the work on the NTCRA and the remedial action report are expected to be complete prior to the next 5-year review.

4.14.4 Major Facilities Where Decommissioning Has Begun Under Facility-Specific Action Memoranda

At this time, two WAG 3 facilities are being decommissioned as NTCRAs under facility-specific action memoranda (Table 4-41). These facilities are further discussed in the following subsections.

Table 4-41. Non-time-critical removal actions in process under facility-specific action memoranda.

Facility Identifier	Facility Name	Action Memorandum
CPP-601	Fuel Processing Building	<i>Action Memorandum for Decommissioning CPP-601/640 Fuel Reprocessing Facilities</i> (DOE-ID 2008b)
CPP-640	Headend Process Plant	<i>Action Memorandum for Decommissioning CPP-601/640 Fuel Reprocessing Facilities</i> (DOE-ID 2008b)

4.14.4.1 CPP-601 Fuel Processing Building and CPP-640 Headend Process Plant. The CERCLA Agencies determined that the CPP-601 and CPP-640 facilities should be decommissioned as a NTCRA in the CPP-601/640 Action Memorandum (DOE-ID 2008b). The CPP-601 facility was built in 1953. It contains chemical processing equipment used to recover uranium from spent nuclear fuel. Nuclear fuel reprocessing at CPP-601 was terminated in 1992. The process vessels and piping were flushed to remove uranium from the facility to the maximum extent practical but had the added benefit of removing other contaminants as well. The facility is essentially rectangular (244 × 102 ft), contains 25 process cells, and consists of six levels (mostly below ground). The CPP-640 Headend Processing Plant facility performed spent nuclear fuel dissolution. The aqueous product solution was then sent to

CPP-601 for uranium extraction. The processing of fuel in CPP-640 ended in June 1984. CPP-640 contains five heavily shielded process cells and is a five-level, rectangular, 66- × 89-ft structure that is located west of and adjacent to CPP-601. These facilities share a common wall with each other, as well as formerly sharing common walls with CPP-627.

The selected alternative essentially removes the buildings and components down to the process cell level, filling the process cells with grout and leaving a concrete monolith nominally 11 ft above the surrounding grade. Other void areas, such as the operating corridor and larger vessels and piping, will also be filled with grout. The top surface of the monolith will be sloped to facilitate integration of precipitation drainage control with the OU 3-14 remedial action to the extent practicable. The concrete monolith will require routine maintenance, monitoring, and ICs to ensure that future risk remains acceptable until such time as the earthen cover is applied. The installation of the earthen cover is not expected until approximately 2035 when an integrated end state has been established for the rest of the facilities within the northern end of INTEC. The CPP-601/640 Action Memorandum determined that the selected action was consistent with the OU 3-13 and OU 3-14 RAOs.

4.14.4.2 Progress and Remaining Work as of September 30, 2009. As of September 30, 2009, most components outside the areas to be grouted have been removed (Figure 4-39). Approximately 70% of the grouting was complete. The Hazardous Waste Management Act/RCRA closure of the piping and tanks in CPP-640 is complete but has not yet been certified for CPP-601. Other activities that remain include removal of the building structures for CPP-601 and CPP-640, installation of a sloped sealing cover on top of the monolith to prevent water infiltration, and the eventual installation of the earthen cover. With the exception of the earthen cover, these activities are expected to be complete prior to the next 5-year review.

4.14.4.3 Integration with Hazardous Waste Management Act/RCRA. The Hazardous Waste Management Act/RCRA piping and tanks within CPP-601 are being closed as a Hazardous Waste Management Act/RCRA landfill in accordance with the Phase I Closure Plan for the CPP-601 Deep Tanks System (DOE-ID 2009g). Lead objects in the basement of CPP-640 (impracticable to remove) and the abandoned piping beneath the CPP-627 floor slab are included in this landfill closure plan. Therefore, the final end state and management for these three facilities require the integration of CERCLA and Hazardous Waste Management Act/RCRA requirements. Some of the activities to be integrated include design of the sloped sealing cover, installation and operation of monitoring wells, as well as inspection, monitoring, and maintenance activities.

4.14.4.4 CPP-601, -640, and -627 End State. Upon completion of the NTCRA activities (with the exception of the final earthen cover), a removal action report will be prepared documenting the work accomplished, the contamination left in place, and the need for ICs. This report is expected to be complete prior to the next 5-year review. The installation of the earthen cover is not expected until approximately 2035.

4.14.5 Further Non-Time-Critical Removal Actions Anticipated at Waste Area Group 3

Additional facilities at WAG 3 have been identified for decommissioning as NTCRA and are shown in Table 4-42. If further facilities are identified for decommissioning, they will be submitted to the CERCLA Agencies either for inclusion in the General Decommissioning Action Memorandum or for preparation of facility-specific action memoranda.



Figure 4-39. Photographs of CPP-601 and CPP-640.

Table 4-42. Additional Waste Area Group 3 facilities for decommissioning under the General Decommissioning Action Memorandum.

Facility ID	Facility Name
CPP-1634	Technology Dev. Facility
CPP-1635	Haz. Chemical Storage Facility
CPP-1636	Warehouse
CPP-1637	FPR Weld Fab Shop Warehouse
CPP-1638	Radiological Contaminated Storage Building
CPP-1646	Anti-C Safety Handling
CPP-1651	Operations Training Facility
CPP-1662	Remote Insp. Engr. Facility
CPP-1649	Instrument Storage & Maintenance Facility
CPP-1653	Subcontractor's Warehouse
CPP-1656	Warehouse
CPP-1666	Engineering Support Office
CPP-1672	Access Control Building (TF)
CPP-1678	Contractors Lunch Room
CPP-1794	Pad For Trailers
CPP-602	CPP-602 Laboratory/Offices Bldg
CPP-603A	Wet Fuel Storage Facility Demo
CPP-609	Cold Waste Facility Office
CPP-618	Tank Farm Measure/Control
CPP-619	Waste Storage Controlhouse
CPP-622	Tank Farm Instrument House
CPP-623	Tank Farm Instrument House
CPP-628	Tank Farm Controlhouse
CPP-630	CPP-630 Safety/Spectrometry
CPP-632	Instrument House, Tank Farm Area
CPP-634	Waste Station WM-185
CPP-635	Waste Stations WM-187-188
CPP-636	Waste Stations WM-189-190
CPP-638	Waste Station WM-180
CPP-651	Unirradiated. Fuel Storage Facility
CPP-653	Waste Handling Facility
CPP-654	Receiving Warehouse/Offices
CPP-674	Utilities Replacement Enhancement Project Substation #40
CPP-679	Tent Fabrication Facility
CPP-698	Morrison Knudsen (MK) Offices/Warehouse

Table 4-42. (continued).

Facility ID	Facility Name
CPP-711	Unloading Shelter at CPP-603
CPP-712	Bldg. Instrument House
CPP-713	Tank Enclosure (VES-WM-187, -188, -189, -190)
CPP-717A	Waste Storage Tank/VES-WM-103
CPP-717B	Waste Storage Tank/VES-WM-104
CPP-717C	Waste Storage Tank/VES-WM-105
CPP-717D	Waste Storage Tank/VES-WM-106
CPP-721	Condenser Pit/VES-WM-182
CPP-722	Condenser Pit/VES-WM-183
CPP-723	Relief Valve Pit/VES-WM-181
CPP-736	Salt Storage Pit
CPP-737	Condenser Pit/HE-WM-300
CPP-738	Cooling Water Pit / HE-WM-301
CPP-739	Condenser Pit for HE-WM-302
CPP-743	Condenser Pit for HE-WM-387
CPP-751	Service Waste Monitor Station
CPP-752	Service Waste Diversion Station
CPP-758	MAH-STA-WQ-415
CPP-762	West Side Condensate Pump Pit
CPP-763	Tank Waste Vault VES-WM-191
CPP-780	Waste Tank Vault/VES-WM-180
CPP-781	Waste Tank Vault/VES-WM-181
CPP-782	Waste Tank Vault/VES-WM-182
CPP-783	Waste Tank Vault/VES-WM-183
CPP-784	Waste Tank Vault/VES-WM-184
CPP-785	Waste Tank Vault/VES-WM-185
CPP-786	Waste Tank Vault/VES-WM-186
CPP-796	West Side Service Waste Building
CPP-WO-129	Liquid Nitrogen Tank
CPP-WO-130	Liquid Nitrogen Tank
FPR	Fuel Processing Restoration

4.14.6 Technical Assessment

The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. Decommissioning removal actions are progressing as intended by the decision documents.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

Yes.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

Technical Assessment Summary

The CERCLA Agencies selected the NTCRA approach for general decommissioning of facilities at the INL Site (DOE-ID 2006e). Although the general decommissioning of buildings and structures is not specifically addressed in previous RODs at the INL Site, NTCRAs are consistent with the RAOs of those RODs and support the overall cleanup objectives established through the FFA/CO. As detailed in this chapter, numerous major and minor facilities have been decommissioned at INTEC since the previous 5-year review. These removal actions help ensure that the overall WAG 3 RAOs will be met.

4.14.7 Issues

No issues have been identified that would adversely effect the protectiveness of the remedy.

4.14.8 Recommendations and Follow-Up Actions

Because no issues were identified recommendations and follow-up actions were not required.

4.14.9 Protectiveness Statement for Non-Time-Critical Removal Action Sites

Based on the removal of contaminated buildings and structures as NTCRAs and implementation of ICs, as necessary, in accordance with the selected remedy for WAG 3 sites in CPP-88 for the OU 3-13 ROD or in the industrial use area and recharge control zone for the OU 3-14 ROD, the selected remedy with respect to the NTCRA sites remains protective of human health and the environment.

4.15 Summary and Conclusions

The FFA/CO divided WAG 3 into 13 OUs, with OU 3-13 intended to provide a comprehensive investigation of WAG 3. Figure 4-1 is a map of INTEC showing the location of the OU 3-13 CERCLA sites. The OU 3-13 ROD was signed in October 1999 and established final remedies for perched water and most of the contaminated soil sites. OU 3-13 sites designated for remedial action were divided into the following groups:

1. Group 1: Tank Farm Soils
2. Group 2: Soils Under Buildings and Structures

3. Group 3: Other Surface Soils
4. Group 4: Perched Water
5. Group 5: Snake River Plain Aquifer
6. Group 6: Buried Gas Cylinders
7. Group 7: SFE-20 Hot Waste Tank System.

However, data gaps and uncertainties associated with contaminant source estimates, the extent of contamination, potential releases from the tank farm soil, and site risk prevented the Agencies from reaching a final remedial decision on the former INTEC injection well, groundwater inside the INTEC security fence, and the tank farm soils. As a result, the Agencies created OU 3-14 to address the final action, while interim actions were implemented for tank farm soil and groundwater under the OU 3-13 ROD, which was signed in October 1999 (DOE-ID 1999a). The interim actions were designed to control the principal threat wastes at the tank farm site due to direct radiation exposure and due to potential leaching and transport of contaminants to the perched water or the SRPA. The interim actions were in place until the final remedy for these sites was selected and implemented as part of the OU 3-14 Remedial Investigation/Feasibility Study process. The OU 3-14 Remedial Investigation was performed during 2005–2006 to establish remedies for Group 1 (Tank Farm Soils) and Group 5 (Snake River Plain Aquifer), and the OU 3-14 ROD was signed in May 2007.

Technical assessments of the many components of the WAG 3 selected remedy found that remedial actions are proceeding in accordance with decision documents.

4.15.1 Issues and Recommendations

No issues were identified.

4.15.2 Protectiveness Summary

The overall WAG 3 remedy is progressing on schedule and is expected to be protective of human health and the environment upon completion. The RAOs established in the decision documents for the various WAG 3 groups are anticipated to be met before the compliance date (2095). Groundwater monitoring is being conducted annually in accordance with the OU 3-14 Long-Term Monitoring Plan, and results to date demonstrate that COC concentrations in the SRPA are gradually declining, as predicted by the groundwater contaminant transport model.

Since the last review in 2005, significant progress has been made toward contaminant source removal and disposition, including remedial actions completed at contaminated soil sites under OU 3-13 Group 3, and NTCRAs of contaminated reprocessing facilities and associated infrastructure. Contaminated soil and demolition debris have been placed in the ICDF landfill, an engineered facility designed to contain these materials until they no longer present an unacceptable hazard. Ongoing or upcoming actions include the placement of a low-permeability cap over the tank farm and continued efforts to further curtail anthropogenic recharge of the contaminated perched water zones beneath INTEC. At this time, there is no reason to suspect that these efforts will not be successful.

4.15.3 Next Review

Because remediation is ongoing at WAG 3, the 5-year statutory reviews will continue. The next 5-year review is expected to cover the period FY 2010 through 2014.

4.16 References

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5. WASTE AREA GROUP 4—CENTRAL FACILITIES AREA

5.1 Introduction

CFA, WAG 4, incorporated 13 OUs containing 52 individual release sites. The comprehensive Remedial Investigation/Feasibility Study for WAG 4 was completed in 2000 (DOE-ID 2000a), followed by a ROD (DOE-ID 2000b). Responses identified in the ROD were completed between 2000 and 2005, allowing the previous INL Site-wide 5-year review (DOE-ID 2007a) to eliminate all but five of the 52 WAG 4 sites from further 5-year reviews. Of those five, ICs are the only ongoing response at one site, the french drain site CFA-07, which is addressed under INL Site-wide ICs (see Section 10.5). In addition to ICs, O&M and monitoring are required for the remaining four sites—three landfills (Sites CFA-01, -02, and -03) and the sewage treatment plant drainfield (Site CFA-08).

5.2 Site Chronology

Table 5-1 summarizes the chronology of significant documents and events relevant to CERCLA response actions at CFA. The remainder of this section focuses on those four sites that warrant 5-year review.

Table 5-1. Chronology of significant documents and events for Waste Area Group 4.

Date	Publication or Event
January 1993	<i>Record of Decision Central Facilities Area Motor Pool Pond, Operable Unit 4-11, Waste Area Group 4</i> (DOE-ID 1993)
1994	Completed time-critical removal action for the mercury pond (CFA-04 site)
1995	Completed time-critical removal action at the French drains (CFA-07 site)
October 1995	<i>Record of Decision Declaration for Central Facilities Area Landfills I, II, and III (Operable Unit 4-12), and No Action Sites (Operable Unit 4-03)</i> (DOE-ID 1995)
April 1996	<i>Remedial Design/Remedial Action Work Plan for Central Facilities Area Landfills I, II, and III Native Soil Cover Project, Operable Unit 4-12</i> (DOE-ID 1996)
April 1996	<i>Post Record of Decision Work Plan Central Facilities Area Landfills I, II, and III Operable Unit 4-12</i> (Neher 1996)
June 1996	Began remedial action at CFA Landfills I, II, and III
April 1997	Completed construction of remedial action at CFA Landfills I, II, and III
June 1997	<i>Post-Record of Decision Monitoring Work Plan Central Facilities Area Landfills I, II, and III Operable Unit 4-12</i> (INEEL 2003)
September 1997	<i>Remedial Action Report CFA Landfills I, II, and III Native Soil Cover Project Operable Unit 4-12</i> (DOE-ID 1997)
July 2000	<i>Comprehensive Remedial Investigation/Feasibility Study for the Central Facilities Area Operable Unit 4-13 at the Idaho National Engineering and Environmental Laboratory</i> (DOE-ID 2000a)
July 2000	<i>Final Comprehensive Record of Decision for Central Facilities Area Operable Unit 4-13</i> (DOE-ID 2000b)

Table 5-1. (continued).

Date	Publication or Event
April 2001	<i>Remedial Design/Remedial Action Work Plan Idaho National Engineering and Environmental Laboratory Central Facilities Area, Operable Unit 4-13 Transformer Yard (CFA-10) (DOE-ID 2001)</i>
June 2001	Began remedial action at the transformer yard (CFA-10 site)
August 2001	Completed remedial action at the transformer yard (CFA-10 site)
March 2002	<i>Remedial Design/Remedial Action Work Plan for Waste Area Group 4, CFA-08 Sewage Plant Drainfield, OU 4-13 (DOE-ID 2002a)</i>
March 2002	Began remedial action at the sewage plant drainfield (CFA-08 site)
March 2002	<i>Operations and Maintenance Plan for the Final Selected Remedies and Institutional Controls at Central Facilities Area, Operable Unit 4-13 (DOE-ID 2002b)</i>
April 2002	<i>Construction Complete Report for the Idaho National Engineering and Environmental Laboratory, Central Facilities Area, Operable Unit 4-13, Transformer Yard (CFA-10) (DOE-ID 2002c)</i>
November 2002	Completed remedial action at the sewage plant drainfield (CFA-08 site)
November 2002	First statutory 5-year review of CFA Landfills I, II, and III (DOE-ID 2002d)
February 2003	<i>Waste Area Group 4 Remedial Design/Remedial Action Work Plan, CFA-04 Pond Mercury-Contaminated Soils, Operable Unit 4-13 (DOE-ID 2003a)</i>
June 2003	<i>Construction Complete Report for the Idaho National Engineering and Environmental Laboratory, Central Facilities Area, Operable Unit 4-13, CFA-08 Sewage Plant Drainfield (DOE-ID 2003b)</i>
February 2003	<i>Explanation of Significant Differences for the Record of Decision for the Central Facilities Area Operable Unit 4-13 (DOE-ID 2003c)</i>
June 2003	Began remedial action at the mercury pond (CFA-04 site)
November 2003	Completed remedial action at the mercury pond (CFA-04 site)
September 2004	<i>Remedial Action Report for the Idaho National Engineering and Environmental Laboratory, Central Facilities Area, Operable Unit 4-13 (DOE-ID 2004a)</i>
January 2005	Completed installation of monitoring wells CFA-1931 and CFA-1932 at CFA Landfills I and II
October 2005	<i>Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory (DOE-ID 2007a)^a</i>
June 2009	<i>Long-Term Monitoring and Field Sampling Plan for the Central Facilities Area Landfills I, II, and III under Operable Unit 4 12 (DOE-ID 2009)</i>
a. Revision 0 of the 5-year review was completed in October 2005. Subsequent revisions did not affect analysis of Waste Area Group 4.	
CFA Central Facilities Area	

5.3 Background

5.3.1 Physical Characteristics

CFA is located on the Eastern Snake River Plain in Big Lost River alluvial deposits overlying basalt bedrock. The sediments composing these deposits are primarily sands and gravels and contain very few fine-grained materials. The depth to basalt beneath the facility ranges from 3 to 11.3 m (10 to 37 ft), and the depth to groundwater is approximately 149 m (490 ft). The vadose zone comprises a relatively thin layer of surficial alluvial sediments and thick sequences of interfingering basalt flows and thinner sedimentary interbeds. The SRPA, one of the largest and most productive groundwater resources in the United States, underlies CFA. The SRPA consists of a series of water-saturated basalt flows and interlayered pyroclastic and sedimentary deposits.

5.3.2 Land and Resource Use

CFA was originally built and operated by the U.S. Navy as a proving ground for battleship guns and to conduct other munitions experiments. Construction of the proving ground facility was completed in 1943. The U.S. Navy continued to use the facilities until 1949, when munitions experiments were discontinued. Since then, DOE housed numerous support services and facilities for INL Site operations at CFA, including administrative offices, research laboratories, emergency and medical services, construction and support services, workshops, warehouses, vehicle and equipment pools, bus operations, laundry facilities, landfills, and a sewage treatment plant. Current land use at CFA is limited to industrial applications associated with INL Site missions.

5.3.3 History of Contamination

CFA landfills were used for disposal of refuse from 1949 to 1984. Contaminant sources in the CFA landfills can be generally described as solid and liquid nonradioactive materials. Waste inventory records indicate that the major types of waste accepted at the landfills included trash sweepings, cafeteria garbage, wood and scrap lumber, masonry concrete, scrap metal, weeds and grass, dirt and gravel, asphalt, and asbestos. To a lesser extent, potentially hazardous wastes were also discarded in the landfills and may have included waste oil, solvents, chemicals, and paint (DOE-ID 2002d).

The sewage treatment plant drainfield (CFA-08) received effluent from sewage waste lines from chemical laboratories, craft shops, warehouses, photographic services, vehicle services, a medical dispensary, a maintenance repair shop, and laundry facilities that processed low-level radiologically contaminated clothing.

5.3.4 Initial Response

Numerous time-critical and non-time-critical removal actions were executed at CFA between 1995 and 1999. All but one involved sites that previously were eliminated from further 5-year reviews. The exception is Site CFA-07 (french drains at Building CFA-633). The french drain and contaminated soil were excavated in 1995 in accordance with an action memorandum (INEL 1995). The site was retained for ICs (see Section 10.5) because of residual concentrations of lead and arsenic in subsurface soil.

5.3.5 Basis for Taking Action

Though risk assessment of the CFA Landfills I, II, and III concluded the landfills do not present unacceptable risk, uncertainty associated with the landfill contents justified remedial action (DOE-ID 1995). The CFA-08 sewage treatment plant drainfield posed unacceptable risk to human health,

primarily from external exposure to Cs-137. Nitrate detected in the SRPA in concentrations exceeding the MCL provides additional basis for action.

5.4 Operable Unit 4-13

The comprehensive ROD for OU 4-13 integrated the ongoing portions of previous decisions into the final selected remedy for WAG 4 under a single OU. Responses identified in the ROD were completed between 2000 and 2005. Subsections that follow focus on groundwater monitoring and the four sites: three landfills (Sites CFA-01, -02, and -03) and the sewage treatment plant drainfield (Site CFA-08) that remain subject to 5-year review. These four sites have been remediated. Ongoing responses comprise ICs and post-remediation O&M. Figure 5-1 shows the CERCLA sites.

5.4.1 Remedial Action

5.4.1.1 Remedy Selection. The three CFA landfills and the sewage treatment plant drainfield were remediated during previous 5-year review periods by containment with soil covers. The OU 4-13 ROD (DOE-ID 2000b) requires post-remediation long-term ICs. The ROD also required that DOE develop a WAG 4-specific O&M plan that includes ICs, followed by annual IC monitoring reports. ICs in the ROD focus on maintaining land-use restrictions to inhibit intrusion into buried waste. Additionally, the ROD reiterated that groundwater monitoring for all wells at WAG 4 would continue until 5-year reviews show, and the Agencies agree, that it is no longer necessary. In particular, the ROD specified that groundwater sampling would continue under the post-ROD monitoring program until nitrate levels decline below the MCL (DOE-ID 2000b). As specified in the OU 4-13 ROD (DOE-ID 2000b) and the INL Site-wide IC/O&M Plan (DOE-ID 2010), ICs are required at Landfills I, II, and III (CFA-01, CFA-02, and CFA-03 sites) and the sewage treatment plant drainfield (CFA-08) to restrict drilling and excavation.

5.4.1.1.1 Remedial Action Objectives—The general RAOs for WAG 4 sites as listed in the OU 4-13 ROD (DOE-ID 2000b) were as follows:

- Prevent direct exposure to radionuclide COCs that would result in a total excess cancer risk greater than 1 in 10,000
- Prevent ingestion and inhalation of radionuclide and nonradionuclide COCs that would result in a total excess cancer risk greater than 1 in 10,000 or a total of hazard index greater than 1
- Prevent exposure to lead at concentrations over 400 mg/kg, the EPA residential screening level for lead
- Prevent exposure of ecological receptors to contaminated soil with concentrations greater than or equal to a screening level of 10 times background values that result in a hazard quotient greater than or equal to 10
- Monitor the groundwater at WAG 4 until the nitrate level falls below the MCL of 10 mg/L.

The specific RAOs for Landfills I, II, and III are as follows (DOE-ID 2000b):

- Prevent direct contact with the landfill contents
- Minimize the potential for erosion and infiltration at the surface
- Ensure that drinking water standards are not exceeded in the SRPA as a result of the migration of contaminants from the landfills.

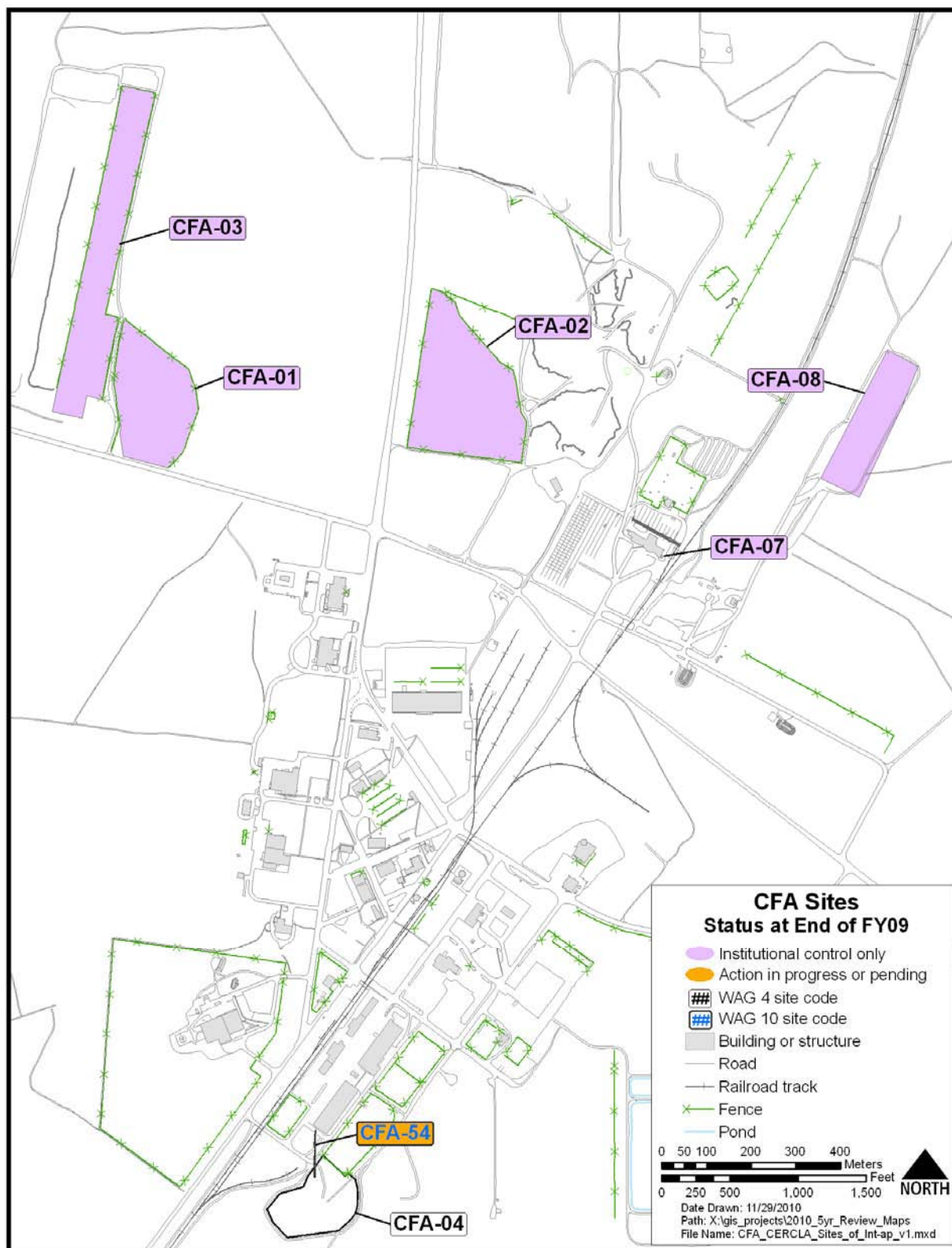


Figure 5-1. Waste Area Groups 4 and 10 sites.

5.4.1.1.2 Cleanup Levels—Table 5-2 lists the CFA release sites that required remediation, the COCs for each site, and the cleanup goals for each site.

Table 5-2. Contaminants of concern for Waste Area Group 4.

Site (Site Code)	COC	Remediation Goals ^{a,b}
Landfills I, II, and III (CFA-01, CFA-02, and CFA-03)	Not applicable ^b	Not applicable ^b (containment)
Sewage Plant Drainfield (CFA-08)	Cs-137	Not applicable (containment)

a. The maximum Cs-137 concentration at the CFA-08 drainfield (180 pCi/g) will naturally decay to 23 pCi/g in the 100-year IC period for the INL Site. However, the ultimate goal for unrestricted access is 2.3 pCi/g, the 1E-04 future residential risk-based concentration. That concentration will be achieved in an additional 89 years through continued natural decay. Note that 23 pCi/g is not a true remediation goal in that soil is being removed to this level; the goal will be achieved through radioactive decay. Confirmatory soil sampling to demonstrate that this level is achieved during the 100-year period will not be performed under this remedy because the known radioactive half-life for Cs-137 is 30 years.

b. The OU 4-12 ROD does not detail specific COCs or remedial action goals. The remedies for CFA Landfills I, II, and III were implemented in accordance with EPA presumptive remedy guidance (DOE-ID 1995).

CFA Central Facilities Area
COC contaminant of concern
EPA Environmental Protection Agency
IC institutional control
INL Idaho National Laboratory
OU operable unit
ROD Record of Decision

5.4.1.2 Remedy Implementation. Full descriptions of the completed remedial actions are in the OU 4-12 Remedial Action Report (DOE-ID 1997) and the OU 4-13 Remedial Action Report (DOE-ID 2004a).

The remedial action at the CFA landfills consisted of installing native soil covers and environmental monitoring equipment. The covers consist of three layers: (1) general backfill to bring the existing grade up to the design slope; (2) a compacted low-permeability soil layer to inhibit the transport of moisture to the landfill contents; and (3) a topsoil layer for the final grade, allowing for vegetation growth. In addition, a layer of riprap was placed in the northeast corner of Landfill II to provide slope stability. A detailed description of the remedial action is contained in the OU 4-12 Remedial Action Report (DOE-ID 1997).

As part of the CFA landfills remedy, environmental monitoring equipment was installed in and around each of the three landfills covers. Soil moisture monitoring was conducted using neutron access tubes and time-domain reflectometry. Vadose zone gas sampling is conducted to monitor for potential transport of gases from the landfill, and routine groundwater monitoring is conducted across a network of wells upgradient and downgradient from the landfills. The sampling locations and frequencies for the environmental monitoring points are detailed in the OU 4-12 Post-ROD Monitoring Work Plan (INEEL 2003). ICs were established at the landfills to restrict access to the sites. The ICs, site-specific O&M, and environmental monitoring will continue until deemed unnecessary based on the results of a 5-year review (DOE-ID 2002b).

The OU 4-13 remedy also addressed elevated nitrate concentrations in the SRPA, which originated in the CFA mercury pond. Remediation at the CFA-04 mercury pond in 2003 removed any potential residual source of nitrate in the pond sediments. Because the source no longer exists, the groundwater nitrate plume downgradient of CFA is expected to gradually dissipate. Groundwater sampling continues under the post-ROD monitoring program as required (DOE-ID 2000b).

5.4.1.3 Operations and Maintenance. O&M requirements at CFA-01, -02, -03, and -08 include inspections for animal intrusions, subsidence, erosion, and vegetative growth. Inspections are conducted annually, and the results are presented in annual reports (DOE-ID 2005a, 2006a, 2007b; RPT-544, RPT-672). Table 5-3 summarizes O&M at CFA in 2009 (from RPT-672).

Table 5-3. Summary of operations and maintenance in 2009.

Landfills	CFA -01	CFA -02	CFA -03	Comments/Recommendations
Vegetative Cover				
1. Inspect for nongrowth/sparse growth/weeds	X ^a	X	X	Vegetation at all three landfills is well established and thriving. No noxious weeds were present at CFA-02, but Canadian thistles were identified and removed from CFA-01, and CFA-03. No other noxious weeds were present.
Soil Cover				
1. Inspect for erosion areas/animal intrusion	X	X	X	Some evidence of small animal burrows on the shoulders of each site was observed. No substantial damage was apparent.
2. Inspect for subsidence areas or slope movement	X	X	X	No evidence of subsidence or slope movement. Surface drainage appears to be appropriate.
3. Conduct topographical survey	NA	NA	X	Topographical survey of the previous area of subsidence at CFA-03 was conducted.
Rock Armor				
1. Inspect to verify no more than 12 in. of subsidence of rock armor	NA	X	NA	No evidence of subsidence.
2. Conduct topographical survey	NA	NA	NA	No evidence of subsidence or movement; therefore, no topographical survey was performed. A topographical survey will be performed in spring 2010 as part of the 5-year review.
Sewage Treatment Plant Drainfield	CFA-08			Comments/Recommendations
1. Document no excavations or drilling	X			No excavations or drilling activities were performed at the site in the past year.
2. Inspect vegetation for sparse growth	X			Scattered vegetation and areas of less dense growth; however, these areas are showing improvement.
3. Inspect vegetation for weed encroachment	X			No noxious weeds are present.
4. Inspect vegetation for nongrowth	X			Vegetation is filling-in nicely. Some slower-growing species (sagebrush) are beginning to develop.

Table 5-3. (continued).

Table 5-3: (continued).

Landfills	CFA -01	CFA -02	CFA -03	Comments/Recommendations
5. Inspect for erosion	X			Minimal erosion on the shoulders (rills less than 2 in. deep). No corrective action is required.
6. Inspect for subsidence	X			No evidence of subsidence noted.
7. Inspect for animal intrusion	X			Evidence of small animal burrows primarily on the shoulders was observed.
a. X = activity performed.				
CFA Central Facilities Area NA not applicable				
Source: Adapted from Table 9 in <i>INL Sitewide Institutional Controls and Operations and Maintenance Annual Report – FY 2009</i> (RPT-672).				

In 2004, subsidence of the engineered earthen cap was noted near the south end of CFA Landfill III (Site CFA-03). The subsidence was repaired in 2004 but reappeared again in 2006 (RPT-362). By 2007, the subsidence had enlarged to an area approximately 5 × 6 m (15 × 20 ft) and approximately 0.3 m (1 ft) below the surrounding area. In 2008, additional repairs of the subsidence area were completed, bringing the surface back to the elevation of the surrounding area. A topographic survey of the south end of the landfill was completed following the repair of the subsidence to verify the results of the repairs. No further subsidence has been noted since that time. Refer to Section 5.4.3.3 for further discussion of this issue.

Inspections performed in 2009 found O&M at CFA to be functioning as intended. Site coordinates were reviewed in the IC database and found to be complete. Vegetation assessments revealed that the vegetation at CFA-01, CFA-02, and CFA-03 is well established, and the vegetation at CFA-08 showed improvement from past years. The noxious weeds observed at CFA-01 and CFA-03 were uprooted, bagged, and removed from the site in July. Topographic survey results of the CFA-03 cap indicate that it has not subsided since repairs were performed in 2008. No corrective actions are required at the CFA sites.

5.4.2 Progress Since the Last Review

5.4.2.1 Protectiveness Statements from Last Review. The protectiveness statements in the last 5-year review (DOE-ID 2007a) were as follows:

Based on the data reviewed and the site inspections, the remedies are functioning as intended by the OU 4-12 ROD (DOE-ID 1995) and the OU 4-13 ROD (DOE-ID 2000b), as modified by the ESD (DOE-ID 2003a). No changes in the physical conditions of the site have occurred that would affect the protectiveness of the remedies. There have been no changes in the toxicity factors or risk factors for the COCs. Several issues have been identified that warrant further evaluation; however, there is no information that negates the protectiveness of the remedies at the WAG 4 sites at this time.

Table 5-4 lists issues and recommendations identified in the last 5-year review and the current status of each. All issues have been addressed by completing previously identified recommendations and follow-up actions.

Table 5-4. Actions taken since the last 5-year review for Waste Area Group 4.

Issues from Previous Review ^a		Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
VOCs are present in perched aquifers (per EPA [Opalski 2006]).		Continue annual monitoring to determine if concentrations of VOCs reflect variability in concentration or a migrating front.	DOE	Annually until next 5-year review	Soil vapor samples were collected annually and compared to trigger values. Soil gas concentrations have consistently been less than the trigger values, and VOCs have not been detected in groundwater. Therefore, additional actions to mitigate vapor contaminants into groundwater are not necessary, as concluded in RPT-645 in July 2009. Monitoring continues in accordance with requirements (DOE-ID 2009). This task is complete.	July 2009
Nitrate concentration in the SRPA exceeds the MCL (per EPA [Opalski 2006]).		The source of nitrates is known. Continue monitoring to determine if concentrations of nitrates (as nitrogen) will decline to less than the MCL by 2095.	DOE	Annually until next 5-year review	Annual monitoring yielded nitrate concentrations ranging from 15.3 to 18.2 mg/L-N in CFA-MON-A-002 and from 8.3 to 24 mg/L-N in CFA-MON-A-003. No distinct temporal trend is evident (RPT-645). Monitoring and reporting continue in accordance with requirements (DOE-ID 2009). Monitoring continues.	Annually since the last 5-year review
Subsidence was identified at the CFA Landfill III that compromised the integrity of the cover, creating the potential to allow surface water to contact the waste and potentially carry contaminants into the SRPA (DOE-ID 2007a).		The area of subsidence will be filled and repaired in accordance with established O&M requirements for the CFA landfills.	DOE	November 2006	The area of subsidence was repaired in 2004 and again in July 2008 (RPT-544). Topographic surveys were performed annually following the repairs in accordance with the O&M Plan (DOE-ID 2010). This task is complete.	July 2008
a. Issues were identified either in Appendix C of the previous 5-year review (DOE-ID 2007a) or in the addendum to Appendix C enclosed with EPA's letter of concurrence with the previous 5-year review (Opalski 2006).						
CFA	Central Facilities Area	O&M	operation and maintenance			
EPA	Environmental Protection Agency	SRPA	Snake River Plain Aquifer			
MCL	maximum contaminant level	VOC	volatile organic compound			

The first issue pertains to subsidence at Landfill III, where the engineered earthen cap experienced a localized area of subsidence near the south end. The subsidence area was repaired in 2008, and no further subsidence has been noted since that time. Refer to Section 5.4.3.3 for a discussion of this issue.

Regarding the occurrence of subsurface VOCs, perched water is not present beneath the CFA landfills, so it is assumed that the EPA comment refers to VOCs present in vadose zone soil vapor. The last 5-year review (DOE-ID 2007a) recommended that the need for additional vadose zone actions be based on comparison of the landfill gas results with soil gas trigger concentrations. The WAG 4 2005 Annual Report (RPT-196) presented the basis for the trigger concentrations. Soil vapor samples have been collected annually and compared to trigger concentrations. Soil gas concentrations have consistently been less than the trigger values; therefore, no additional actions have been taken to mitigate the migration of vapor contaminants into groundwater. Moreover, most of the VOCs present in the landfill gas have not been detected in groundwater. Refer to Section 5.4.3.2 for more discussion of landfill gas monitoring results.

The last issue pertains to nitrate concentrations in groundwater exceeding the MCL. Annual groundwater monitoring indicates that nitrate concentrations continue to exceed the MCL in Well CFA-MON-A-002. Similar exceedances have been observed in this well since it was first sampled in 1996. Well CFA-MON-A-003 has also occasionally exceeded the nitrate MCL but has fallen below the MCL during the past 3 years. Since the last 5-year review, nitrate concentrations have ranged from 15.3 to 18.2 mg/L-N in CFA-MON-A-002 and from 8.3 to 24 in CFA-MON-A-003. No distinct temporal trend is evident. Section 5.4.3.1.3 contains additional discussion of the groundwater nitrate plume downgradient of the CFA landfills.

5.4.3 Data Review and Evaluation

This section summarizes monitoring and site inspection results obtained since the last 5-year review (DOE-ID 2007a). Monitoring results are contained in WAG 4 annual reports for 2004 (ICP 2005), 2005 (RPT-196), 2006 (RPT-362), 2007 (RPT-511), 2008 (RPT-645), and 2009 (RPT-714). Inspection results are presented in annual IC and O&M reports for 2004 (DOE-ID 2004b, 2005b), 2005 (DOE-ID 2005a, c), 2006 (DOE-ID 2006a, b), 2007 (DOE-ID 2007b, c), 2008 (RPT-544), and 2009 (RPT-672). This 5-year review summarizes 6 years of data because the annual WAG 4 monitoring was performed a few months before the cutoff date for data to be included in this 5-year review.

5.4.3.1 Groundwater Monitoring. In accordance with the ROD (DOE-ID 1995), annual groundwater monitoring has been conducted at the CFA landfills to (1) establish a baseline of potential contaminant concentrations in the SRPA against which future data can be compared and (2) ensure that drinking water standards are not exceeded in the SRPA as a result of migration of contaminants from the landfills. Soil gas is monitored to evaluate the migration of VOCs from the landfills to the aquifer. To evaluate the performance of the landfill covers in reducing infiltration, soil moisture was monitored. Groundwater levels were measured at wells in the vicinity of the CFA landfills to evaluate flow directions and hydraulic gradients. To fulfill the requirements of the OU 4-13 ROD, nitrate contamination in the aquifer south of CFA is also monitored. Table 5-5 lists the CFA monitoring wells, and Figure 5-2 shows well locations.

5.4.3.1.1 Groundwater-Level Monitoring—Since the last 5-year review, water levels were measured annually in the wells that are sampled. Water-level maps for CFA were prepared from data collected in June 2004, June 2005, November 2007, September 2008, and August 2009.

Table 5-5. Groundwater monitoring wells and sampling rationale.

Well	Well Completion Depth (ft bgs)	Sampling Rationale
CFA Landfill Monitoring Wells		
LF 2-08	Screened (485–495)	Downgradient of Landfill II
LF 2-09	Screened (469.6–497)	Downgradient of Landfill II
LF 2-11	Screened (484–499)	Upgradient of Landfill II
LF 3-08	Screened (500–510)	Downgradient of Landfills I and III
LF 3-09	Screened (490–500)	Downgradient of Landfills I and III
LF 3-10	Screened (481–501)	Adjacent to Landfill III
USGS-128	Screened (457–615)	Upgradient of Landfills I and III
CFA-1931	Screened (480–520)	Downgradient of Landfill II
CFA-1932	Screened (485–525)	Downgradient of Landfill I
CFA Monitoring Wells (Nitrate Plume)		
USGS-083	Screened (516–752)	Downgradient of CFA
CFA-MON-A-001	Screened (488–518)	Downgradient of CFA
CFA-MON-A-002	Screened (488–518)	Downgradient of CFA
CFA-MON-A-003	Screened (488–518)	Downgradient of CFA

bgs below ground surface
 CFA Central Facilities Area

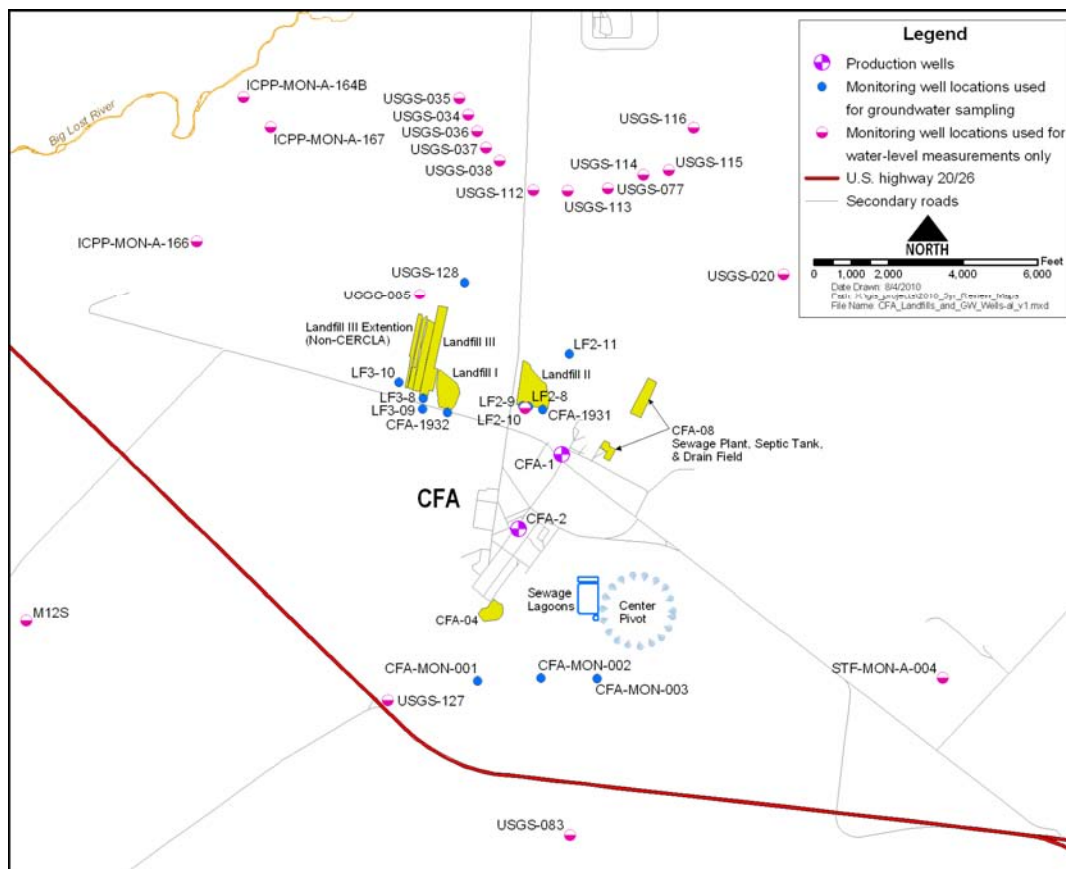


Figure 5-2. Groundwater monitoring wells and water-level-measurement wells.

Figure 5-3 shows groundwater-level contours in the vicinity of CFA. The apparent groundwater flow direction from CFA Landfills I and III varies from south to southwest. The apparent direction of groundwater flow from Landfill II is predominantly southeast. Overall, groundwater flow directions have remained consistent over the monitoring period (ICP 2004, 2005; DOE-ID 2002e; RPT-196; RPT-362; RPT-511; RPT-645).

The groundwater gradient has remained slight over the area between INTEC and the CFA landfills 3.2 km (2 miles) to the south, with less than 0.6 m (2 ft) of head difference per mile (see Figure 5-3). Steeper gradients are present south of CFA and to the east of CFA between the Security Training Facility and the Power Burst Facility. The gradients from Well CFA-1931 to Well CFA-MON-A-003 and from Well LF3-08 to Well M12S average a little over 5 ft/mile since monitoring began.

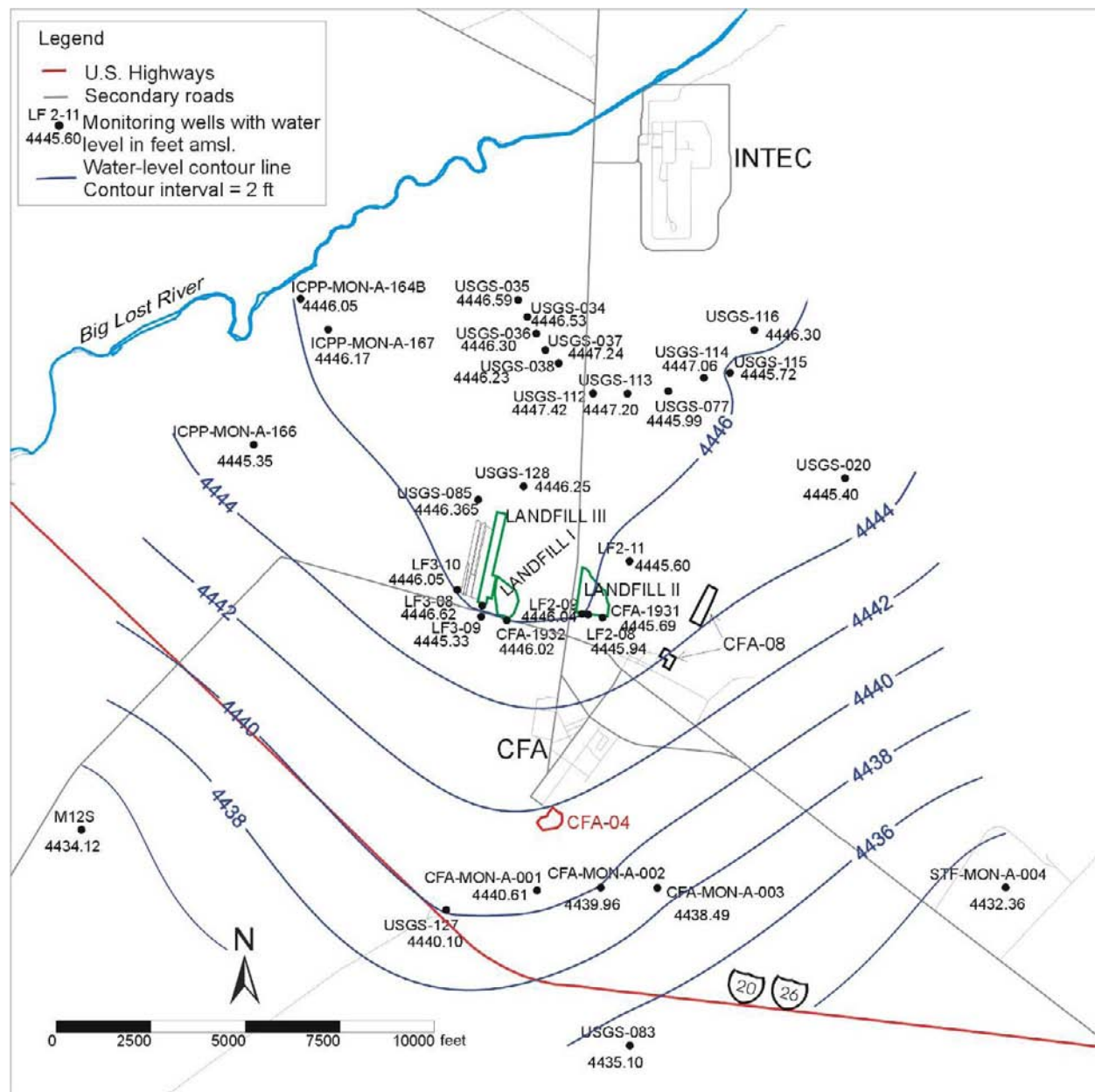


Figure 5-3. Groundwater-level contour map for the Central Facilities Area in August 2009 (RPT-714).

Water levels and trends in CFA wells are monitored annually. Water levels dropped 2.7 to 3 m (9 to 10 ft) in the CFA landfill wells between 2000 and 2005. In contrast to the steep downward trend from 2000 to 2005, water levels have stabilized with less than a foot of water-level change on average from June 2005 to August 2009 (RPT-714). Water-level trends in CFA wells will be monitored annually.

5.4.3.1.2 Groundwater Sampling Results for the CFA Landfills—Groundwater samples were collected from 11 wells in the vicinity of the CFA landfills with the sampling rationale described in Table 5-5 and the sampling locations shown on Figure 5-2. Since the last 5-year review, Wells CFA-1931 and CFA-1932 were added to the monitoring network in 2005 to address concerns that not all areas of the landfills were covered by the existing well network (LF3-08, LF3-09, LF3-10, and USGS-128 at Landfills I and III and LF2-08, LF2-09, and LF2-11 at Landfill II). Groundwater samples were collected and analyzed for VOCs, anions, metals, and alkalinity. Operational and sampling procedures for the groundwater sampling and soil gas sampling are outlined in DOE-ID (2009). In 2009, all CFA monitoring activities were consolidated into a long-term monitoring plan that incorporated changes to the monitoring strategy based on review of data collected to date (DOE-ID 2009). Annual groundwater sampling data from 2004 through 2009 are summarized below.

5.4.3.1.2.1 Metals—Aluminum, lead, chromium, and manganese have been detected in CFA aquifer monitoring wells. After evaluating the results for both filtered and unfiltered samples collected in 2006 and 2007, the 2007 annual report (RPT-511) recommended that only filtered metals samples should be collected based on the rationale that suspended sediment in the samples was increasing due to the decline in water levels. The sediment in the groundwater samples would partially dissolve in the acid used to preserve the metals samples, yielding spurious elevated metals concentrations. Following Agency approval, only filtered samples for metals were collected in 2008 and 2009. Additionally, lower water levels led to problems of grout affecting the water chemistry in Wells LF2-08 and LF2-09 as evidenced by the very high pH and electrical conductivity in these wells. After 2008, these wells were sampled only for VOCs because metals and anion results were impacted by grout placed beneath the screen interval.

5.4.3.1.2.2 Anions—Nitrate, chloride, and sulfate occurred at levels above background while alkalinity and fluoride were mostly at background levels. Alkalinity was elevated above background in samples from wells that were influenced by grout. Although nitrate, chloride, and sulfate have occurred at concentrations above background, none of these analytes were above their MCLs in the landfill monitoring wells. Concentrations of nitrate, chloride, and sulfate were also above regional background in the upgradient well LF2-11. Elevated concentrations for nitrate, chloride, and sulfate in the CFA landfill wells are consistent with influence from INTEC (located upgradient), as discussed in detail in the 2007 annual report (RPT-511).

5.4.3.1.2.3 Volatile Organic Compounds—A few VOCs were detected in groundwater since the last 5-year review, but the detections were inconsistent and all were below MCLs. The detected VOCs included 1,2,4-trimethylbenzene, 2-butanone, 2-hexanone, acetone, chloroform, toluene, and xylene (total), with toluene detected the most frequently. The toluene source is uncertain, but the absence of other hydrocarbons suggests this is not part of a fuel or other hydrocarbon product. The toluene could originate from non-fuel-related sources (e.g., adhesives, solvents, and paints) that were disposed of in the landfills. However, toluene soil gas concentrations from the landfills were generally low (i.e., maximum concentration of 110 ppbv [2007] and most detections were less than 50 ppbv) and do not provide strong evidence that the landfills pose a source of toluene that is capable of impacting groundwater. In addition, soil gas data do not indicate a significant source in the three landfills for the other VOCs detected in groundwater. Many of the VOC detections were near the detection limit. Like toluene, the other VOCs cannot be linked to a specific source.

5.4.3.1.3 Groundwater Sampling Results for Area South of CFA—As

discussed in Section 5.4.1.2, the OU 4-13 ROD established an RAO requiring groundwater monitoring until nitrate level falls below the MCL of 10 mg/L (DOE-ID 2000b). Four wells, CFA-MON-A-001, -002, -003, and USGS-083, downgradient of CFA are sampled for nitrate and other anions (chloride, sulfate, fluoride) to monitor the nitrate plume south of CFA. Nitrate and chloride occurred at levels above background for the SRPA in Wells CFA-MON-A-002 and -003 while sulfate and fluoride were at background levels. Only nitrate occurs at a concentration above the MCL (10 mg/L as N). The source of the elevated nitrate in groundwater has been attributed to the former CFA-04 mercury pond (ICP 2004). CFA-04 was remediated during 2003 (DOE-ID 2004a), as discussed in the previous 5-year review report (DOE-ID 2007a).

Nitrate concentrations have exceeded the MCL in Well CFA-MON-A-002 since the well was first sampled (RPT-714). Well CFA-MON-A-003 has also occasionally exceeded the nitrate MCL. Since the last 5-year review, nitrate concentrations have ranged from 15.3 to 18.2 mg/L-N in CFA-MON-A-002 and from 8.3 to 24 in CFA-MON-A-003. Nitrate concentrations in CFA-MON-A-001 were less than 2 mg/L, and nitrate concentrations in USGS-083 were at background levels (less than 1 mg/L).

Except for the 2005 spike at CFA-MON-A-003, nitrate concentrations in Wells CFA-MON-A-002 and -003 have been relatively constant since monitoring started in 1995 (Figure 5-4). Historically, nitrate concentrations in Well CFA-MON-A-003 have ranged from 8 to 11 mg/L-N, and concentrations in CFA-MON-A-002 have ranged from 15 to 21 mg/L. During the period since the last 5-year review, groundwater samples from two wells have exceeded the 20-mg/L nitrate level: CFA-MON-A-002 (20.2 mg/L in 2006) and CFA-MON-A-003 (24 mg/L in 2005). As shown on Figure 5-4, nitrate concentrations in these wells do not currently exhibit a distinct trend. If concentration trends do not begin to decline over the next 5-year review period, the Agencies will consider additional steps to re-evaluate the persistence of nitrate in the aquifer. The additional steps may include evaluation of additional nitrate sources and evaluation of the release mechanism of the original source(s) in order to implement an applicable remedy to meet the RAO.

As discussed in the OU 4-13 ROD (DOE-ID 2000b), nitrate levels are predicted to drop below the MCL during the 100-year time period that the Agencies assume DOE will operate the facility. Although the drinking water MCL is 10 mg/L for nitrate (as N), the ROD stated that a higher allowable nitrate level of 20 mg/L would be deemed protective during the DOE operational period. The rationale is that the nitrate MCL was established for a sensitive population (infants) not present during operations at the INL Site.

5.4.3.1.4 Well Maintenance Activities—As

a result of declining regional groundwater levels during 2000–2005, several compliance monitoring wells at the CFA landfills went dry or nearly dry, including Wells LF2-08 and LF2-09. The possibility of deepening Wells LF2-08 and LF2-09 was investigated, but this was determined not to be technically feasible (EDF-9042). Consideration was also given to modifying nearby Well LF2-10 for use as a dual completion well. This well is a deep monitoring well located between and slightly south of CFA Wells LF2-08 and LF2-09. However, the investigation later determined that such an attempt could fail and might preclude the use of Well LF2-10 for its intended purpose. Because LF2-08 and LF2-09 could not be deepened, the wells were cleaned out of sediment accumulated in the bottom of the wells to increase the water column in each well so that each well could be sampled.

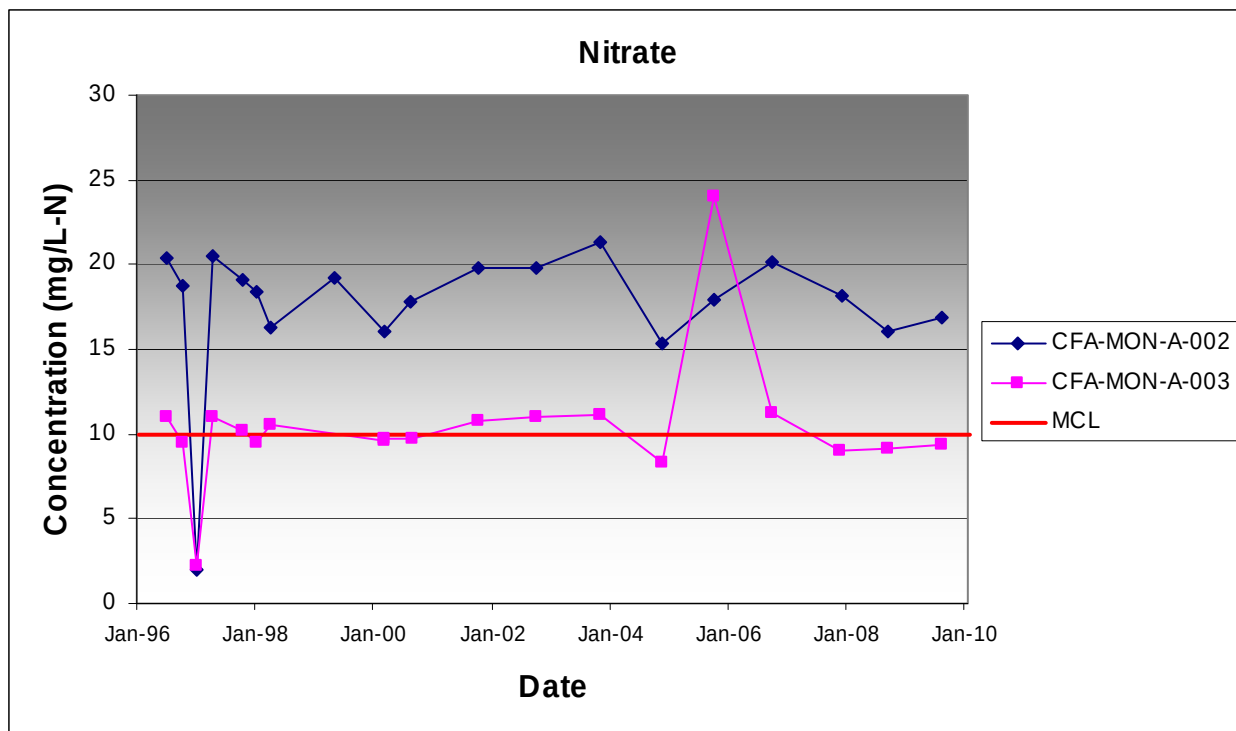


Figure 5-4. Nitrate concentration in aquifer monitoring wells CFA-MON-A-002 and CFA-MON-A-003.

5.4.3.2 Vadose Zone Monitoring

5.4.3.2.1 CFA Landfill Gas Monitoring Results—As part of the remedial action, five soil gas sampling boreholes were installed near the CFA landfills to monitor for soil gas contaminants. One borehole was installed adjacent to Landfill I, two were installed adjacent to Landfill II, and two were installed adjacent to Landfill III (one of which is also proximal to Landfill I). Each borehole had four soil gas-sampling ports, including two above the shallow interbed and two below it. The soil gas samples were collected in August–September in response to an issue raised in the previous 5-year review. In addition to the five boreholes, four gas sampling ports in monitoring wells CFA-1931 and CFA-1932 were also sampled starting in 2005. The rationale and depths of the soil gas ports were provided in the 2009 Annual Monitoring Report (RPT-714).

VOCs detected consistently in soil gas samples include 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene, dichlorodifluoromethane, trichlorofluoromethane, trichloroethene, 1,1,2-trichlorotrifluoroethane (F-113), cis-1,2-dichloroethene, carbon tetrachloride, and tetrachloroethene. These compounds are refrigerants, common solvents, products of solvent degradation, and constituents found in solvents that are used to clean mechanical equipment.

Generally, the upper soil gas locations—from 3 to 4 m (10 to 13 ft) bgs—were low in VOC concentrations, with the highest VOC concentrations at the intermediate sample port depths of 10.7 to 11.6 m (35 to 38 ft) and 21 to 24 m (70 to 78 ft) bgs. VOC concentrations generally decreased in samples collected from the lowermost sampling depths (30 to 33 m [100 to 108 ft] bgs) and decreased further in samples from the deep (greater than 75 m [245 ft]) vapor ports in the two monitoring wells. The primary soil gas contaminants (chlorinated solvents, their degradation products, and Freons) were not detected in the aquifer.

Except for 2005, the compound occurring at the highest soil gas concentration was usually 1,1,1-trichloroethane at concentrations of 4,300 to 7,800 parts per billion by volume (ppbv), with the highest concentration usually at GSP3-1 at Landfill III. In 2005, trifluorochloromethane occurred at the highest concentration (6,200 ppbv) in GSP3-2. The lowest soil gas concentrations were at GSP2-1. The soil gas monitoring showed that most analytes were within their historical ranges. As an example of soil gas trends, 1,1,1-trichloroethane is plotted for GSP1-1 (Figure 5-5), GSP2-2 (Figure 5-6), GSP3-1 (Figure 5-7), and GSP3-2 (Figure 5-8).

The concentrations of detected analytes in the gas sampling ports in Wells CFA-1931 and CFA-1932 were much less than from the shallower soil gas borehole samples discussed above. Concentrations in the CFA-1931 vapor ports were generally greater than for the samples from the CFA-1932 vapor ports. The most notable analytes detected in the deep vapor ports included trichloroethene, trichlorofluoromethane, and 1,1,1-trichloroethane. Except for the 2008 duplicate result, trichloroethene from the deep sample port (145 m [475 ft] bgs) from CFA-1931 shows a general decline (Figure 5-9). Trichloroethene was not detected in any of the groundwater samples. Trichlorofluoromethane and 1,1,1-trichloroethane occurred at higher concentrations in the samples from 90 to 91 m (295 to 300 ft) bgs than in the deeper sampling port (143 to 145 m [470 to 475 ft] bgs) from CFA-1931. Trichlorofluoromethane data for CFA-1931 had a range of 48 to 340 ppbv at a depth of 90 to 91 m (295 to 300 ft) bgs then decreased to 1.7 to 8.9 ppbv in the samples from 143 to 145 m (470 to 475 ft) bgs. 1,1,1-trichloroethane data for CFA-1931 had a range of 96 to 130 ppbv at a depth of 90 to 91 m (295 to 300 ft) bgs then decreased to 1.4 to 83 ppbv in the samples from 143 to 145 m (470 to 475 ft) bgs.

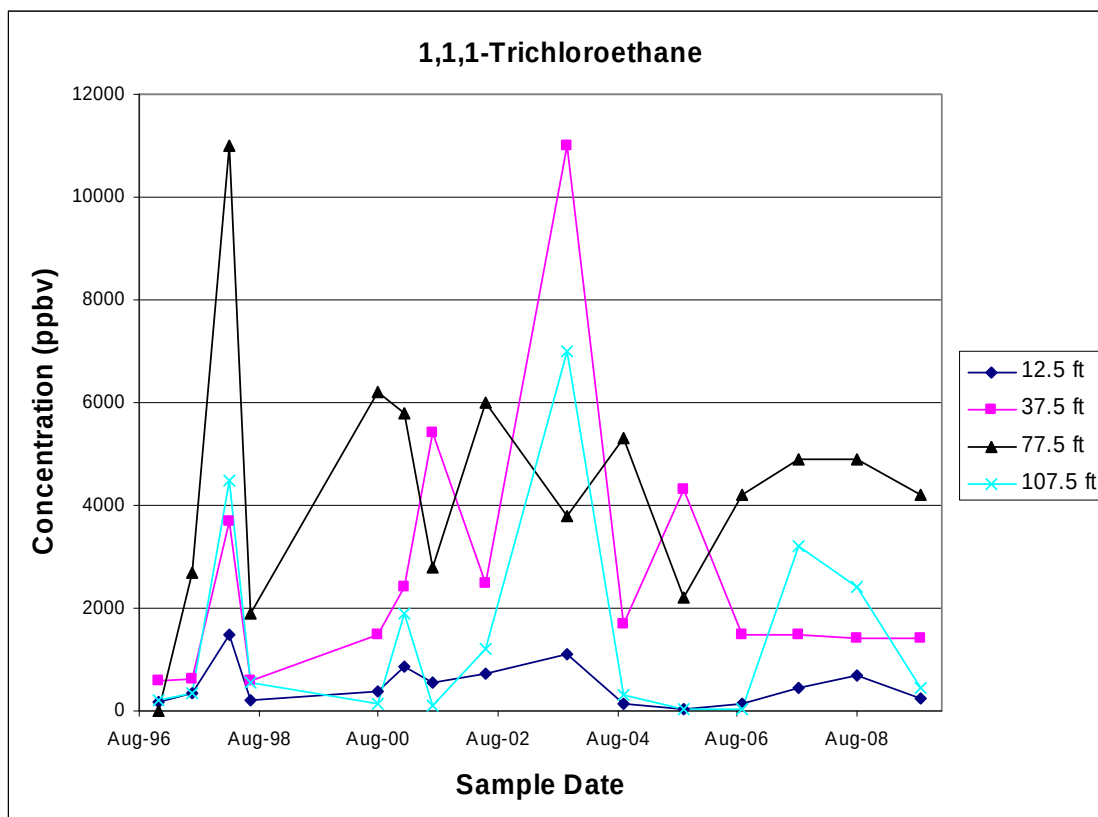


Figure 5-5. Vapor trends for 1,1,1-trichloroethane in Well GSP1-1 (CFA-GAS-V-004) at Landfill I.

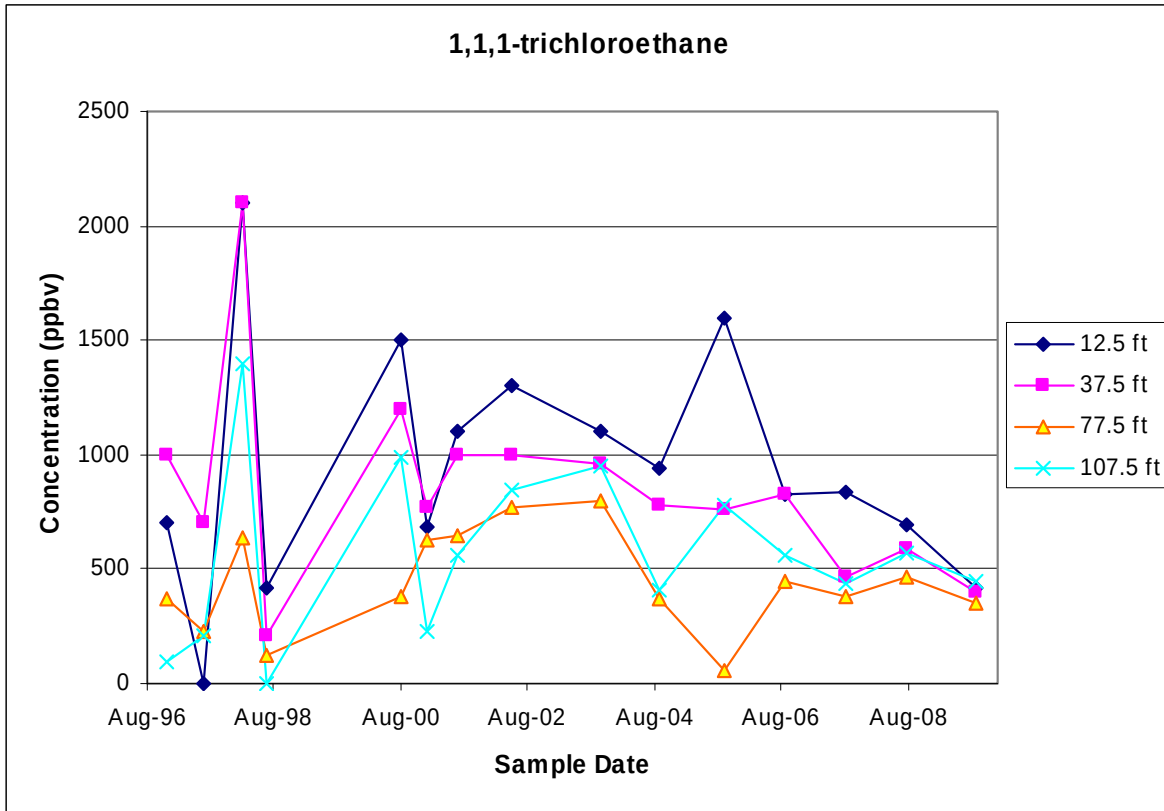


Figure 5-6. Vapor trends for 1,1,1-trichloroethane in Well GSP2-2 (CFA-GAS-V-006) at Landfill II.

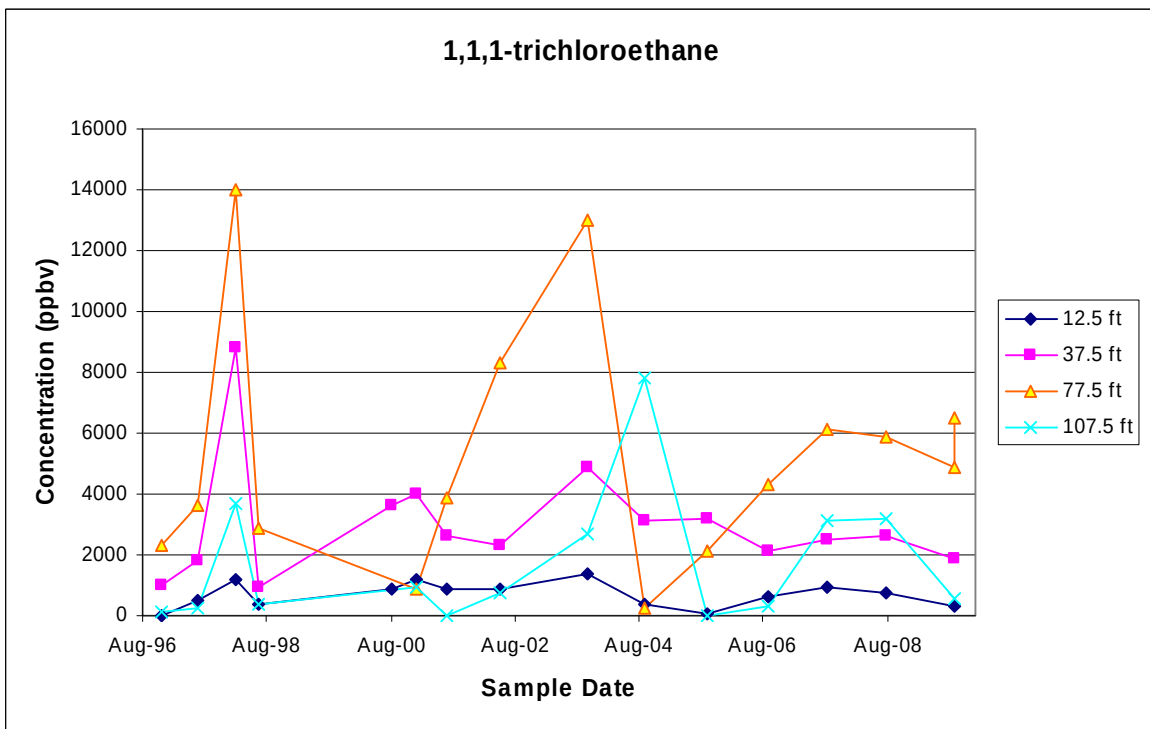


Figure 5-7. Vapor trends for 1,1,1-trichloroethane in Well GSP3-1 (CFA-GAS-007) near Landfill III.

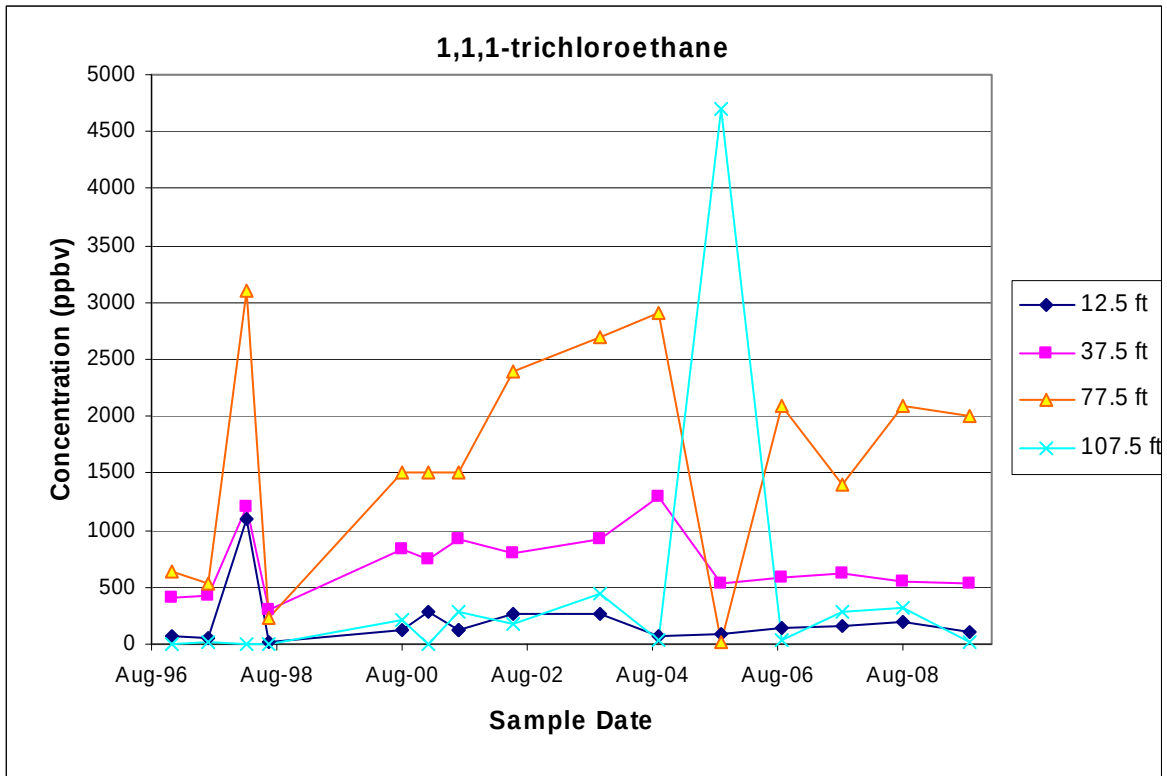


Figure 5-8. Concentration trends for 1,1,1-trichloroethane in Well GSP3-2 (CFA-GAS-V-008) near Landfill III.

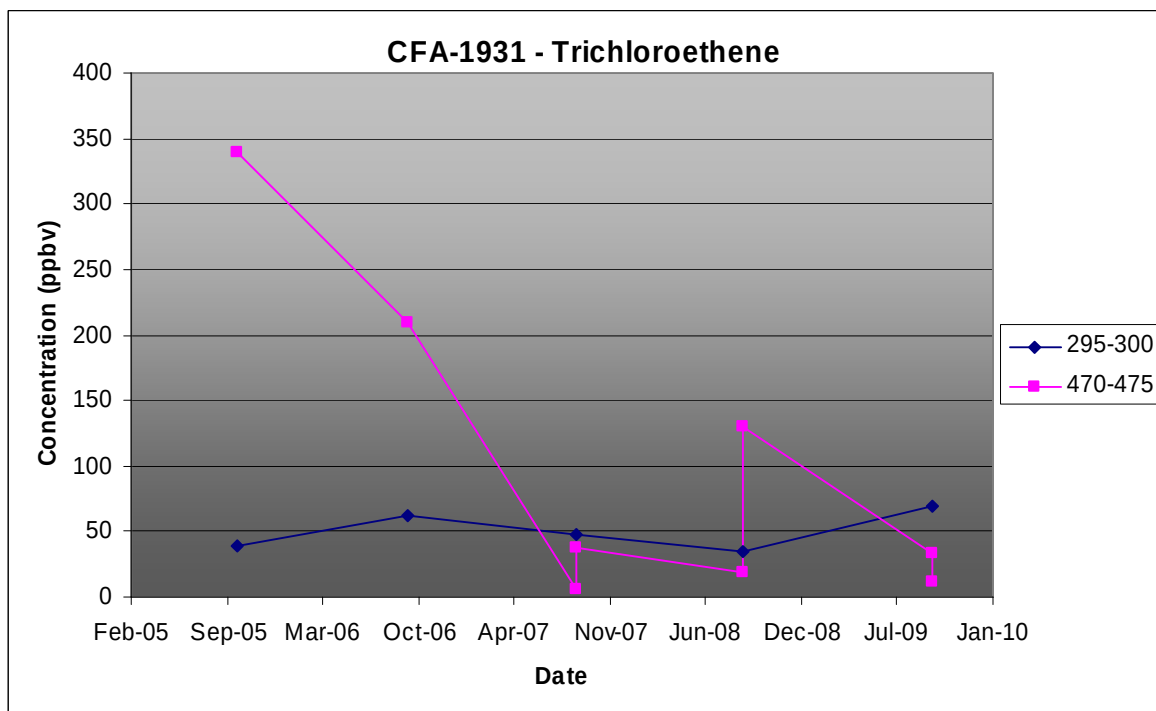


Figure 5-9. Concentration trends for trichloroethene in CFA-1931 near Landfill II.

5.4.3.2.2 Comparison of Landfill Gas Monitoring Results to Trigger

Values—The last 5-year review (DOE-ID 2007a) proposed that the need for additional vadose zone actions be based on soil gas trigger concentrations. The 2005 annual report (RPT-196) presented the basis for the trigger concentrations. Soil gas concentrations at depths greater than 30 m (100 ft) were less than the trigger values every year since the last 5-year review (Table 5-6).

5.4.3.2.3 Soil Moisture Monitoring Results—The overall objective of moisture monitoring at the CFA landfills was to document the effectiveness of the landfill covers in minimizing infiltration into and through the landfill wastes (INEEL 2003). Infiltration was estimated using moisture measurements from time-domain reflectometry and neutron probe instruments. Figure 5-10 gives the locations of the four vertical time-domain reflectometry systems and the five neutron access tubes installed at CFA Landfills II and III. The two vertical time-domain reflectometry arrays on Landfill II are near neutron probe location LF2-07. Neutron-probe location LF2-03 is on the edge of Landfill II. Neutron probe location LF2-04 is near Landfill II and is used for evaluating background conditions. The two vertical time-domain reflectometers on Landfill III are installed through the cover near neutron probe location LF3-05. Neutron probe location LF3-03 is on the edge of Landfill III.

The terms *infiltration* and *recharge* are used for water flux into the soil column and beyond the zone of evapotranspiration depth. Water that moves into the soil is defined as *infiltration*. Water that continues to move downward beyond the evapotranspiration depth and out of the soil profile is termed *recharge*. Infiltration and recharge are represented by an increase in water storage within a system. In addition to recharge, evapotranspiration is an important process that results in decreasing storage in near-surface soils, moving water upward and out of the soil.

Table 5-6. Summary of vapor trigger concentrations and comparisons to maximum measured vapor concentrations since previous 5-year review.

Compound	Trigger Values ^a		Maximum Concentration (since previous 5-year review)	
	107.5 ft bgs (ppbv)	255–475 ft bgs (ppbv)	107.5 ft bgs (ppbv)	255–475 ft bgs (ppbv)
1,1,1-trichloroethane	141,580	52,051	4,700	130
1,1-dichloroethene	13,400	5,160	490	130
Trichloroethene	1,759	647	660	340
Tetrachloroethene	2,567	944	400	99
Carbon tetrachloride	4,842	1,780	51	42
Chloroform	19,610	7,209	54	80
a. Trigger values are based on the Henry's Law value, adjusted for the empirical relationship observed between vapor and groundwater concentrations at the RWMC at the INL Site. See WAG 4 2005 Annual Report (RPT-196) for a detailed discussion of vapor trigger concentrations. bgs below ground surface INL Idaho National Laboratory ppbv parts per billion by volume RWMC Radioactive Waste Management Complex WAG waste area group				

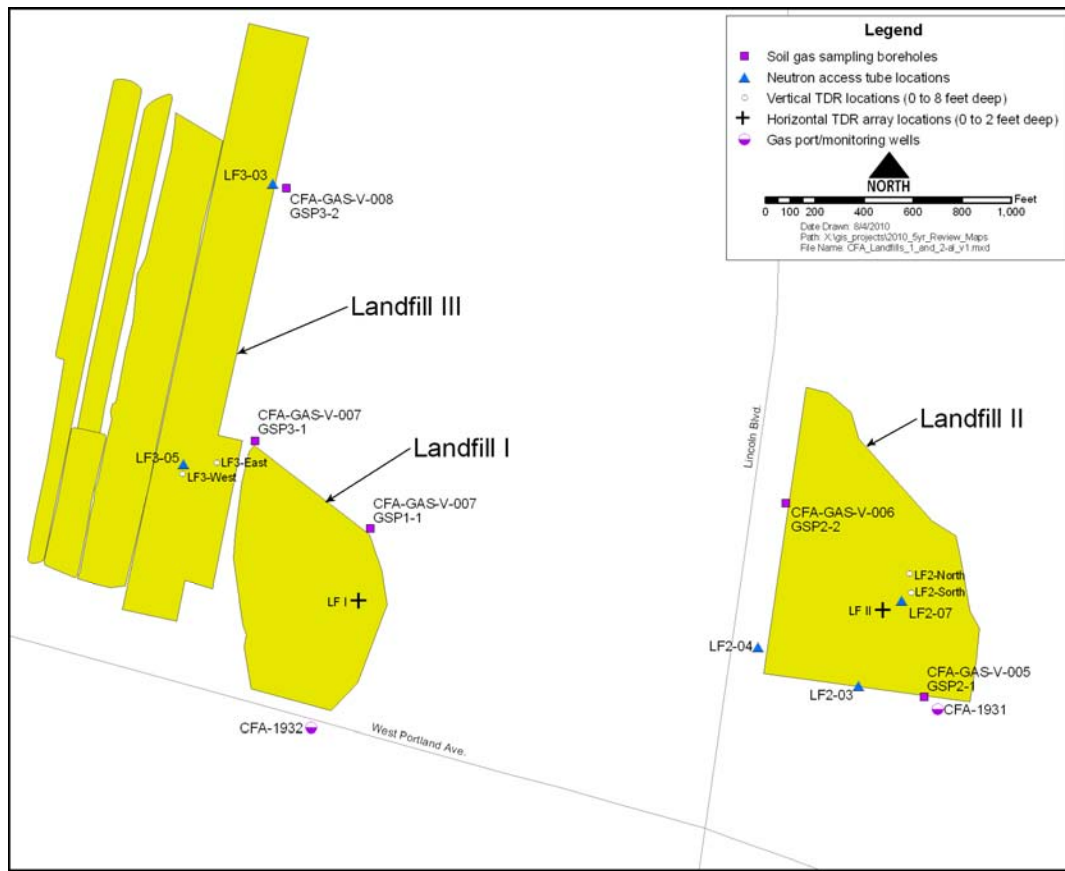


Figure 5-10. Locations of soil gas boreholes, time domain reflectometry arrays, and neutron access tubes.

The moisture monitoring results for 2004 and 2005 indicated little to no recharge. The soil moisture monitoring at Landfills II and III for 2004 indicated no recharge, and no recharge was also indicated for the background location near the edge of Landfill II. The time-domain reflectometry and neutron probe results for 2005 showed slight recharge for CFA Landfill II of 0.44 to 0.65 in. and less than 0.25 in. for Landfill III.

5.4.3.2.4 CFA Landfills Infiltration Modeling—The primary objective of the landfill cover modeling was to quantify recharge rates through the landfill covers using a numerical model of the infiltration process. The CFA landfill covers were designed using the HELP model to reduce infiltration through the CFA landfills and limit the advective transport of contaminants from waste to the underlying aquifer. Since the design of the CFA landfill covers, questions have arisen regarding the use of the HELP model to evaluate landfill covers in arid climates. To evaluate whether the CFA landfill covers are performing as intended, a numerical modeling study was conducted. The HYDRUS 1D code was used for the numerical modeling simulations and the model calibrated to transient observed soil moisture.

The HYDRUS 1D modeling used neutron probe data from locations LF3-05, LF2-04, and LF2-07 because those data are calibrated to in situ conditions, while the time-domain reflectometry instruments were not calibrated. RPT-196 describes the model inputs and simulations.

The modeling indicated that seasonal infiltration pulses were effectively removed by subsequent evapotranspiration at LF3-05 with nearly negligible net recharge. Water content variations were more rapidly damped with depth, compared to the neutron probe locations simulated for Landfill II.

Model-calculated average recharge rates at LF2-04 and LF2-07 were approximately 7 and 3 cm/year, respectively. Although greater than at LF3-05, the simulated recharge at LF2-07 is less than that at LF2-04 (the background location between the landfills). The reduction in recharge at LF2-07 compared to the background location suggests that the cover on Landfill II significantly enhances evapotranspiration over natural conditions.

Based on the landfill cover modeling and neutron probe and time-domain reflectometry moisture monitoring, moisture monitoring at the CFA landfills was discontinued following the recommendation made in the 2005 annual report (RPT-196).

5.4.3.3 Site Inspections. As required by the IC/O&M Plan (DOE-ID 2010), site inspections are conducted annually at WAG 4 IC sites. Site inspections determine if ICs are functioning as intended and identify maintenance needs. They also help determine if implemented remedies are functioning as intended. Site inspectors visually evaluate site conditions and documentation of conditions on inspection checklists, review site information in the IC database, and assess access controls such as signs or markers. Depending on site-specific requirements, inspectors may also evaluate vegetative growth, examine for intrusion and subsidence, or perform radiological surveys. The annual IC/O&M report documents findings of the annual site inspections.

In general, the annual inspections at WAG 4 identified only a few minor deficiencies and tracked the progress of necessary repairs. At the time of this 5-year review, the inspections concluded that site conditions were acceptable and provided evidence that the remedies, including the maintenance aspects of the engineered barriers, are functioning as intended. Significant observations include the following:

- Signs and markers are present and maintained as necessary.
- Excavations, drilling, and other site disturbances have been coordinated through the regulatory Agencies.
- Vegetative cover is growing very well.
- The engineered earthen cap over Landfill III experienced a localized area of subsidence near the south end, which was repaired and monitored for further subsidence. No additional subsidence has been noted since last repaired in 2008. Topographic surveys of all three landfill caps were completed in 2010 in conjunction with this 5-year review. (Figures 5-11 through 5-13). Figure 5-14 shows the subsidence detected in Landfill III.
- Radiological surveys of Site CFA-08 drainfield in 2006 and 2007 indicate that contamination is not spreading, and no unexplained radiological anomalies are present (DOE-ID 2006b, 2007c).

5.4.4 Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

Yes. The technical assessment completed for this review indicates that landfill covers are functioning as intended by limiting the amount of infiltration at the surface of the landfills and remain protective of human health and the environment. ICs are in place as required. Routine inspections identify O&M needs, which are prioritized and addressed. Two wells downgradient of CFA continue to show nitrate concentrations in excess of the MCL. If concentration trends do not begin to decline over the next 5-year review period, the Agencies will consider additional steps to re-evaluate the persistence of nitrate in the aquifer. The additional steps may include evaluation of additional nitrate sources and evaluation of the release mechanism of the original source(s) in order to implement an applicable remedy to meet the RAO. Groundwater monitoring will continue in accordance with requirements to confirm that nitrate concentrations are declining in the SRPA and that RAOs will be met.

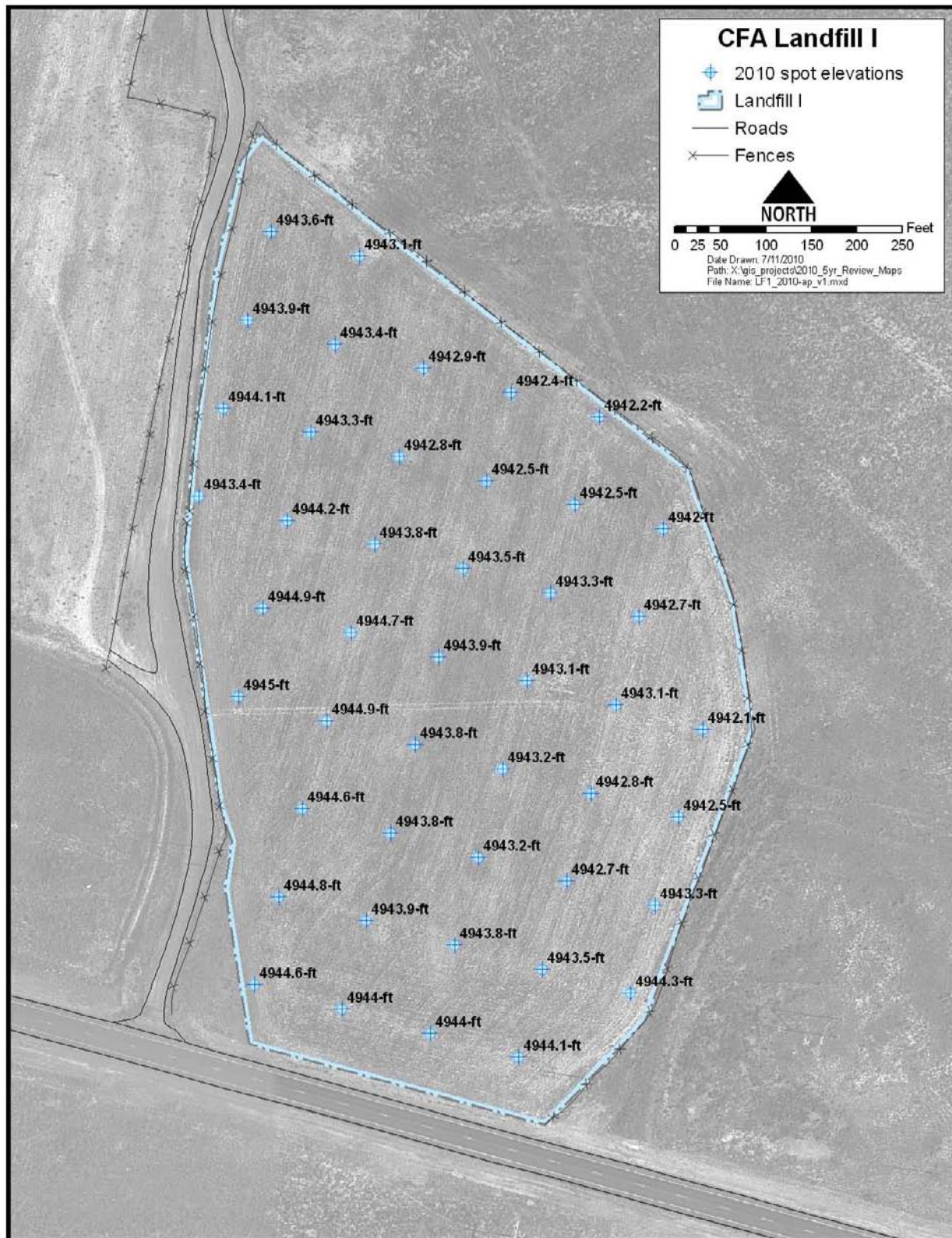


Figure 5-11. Topographic survey results at Landfill I.

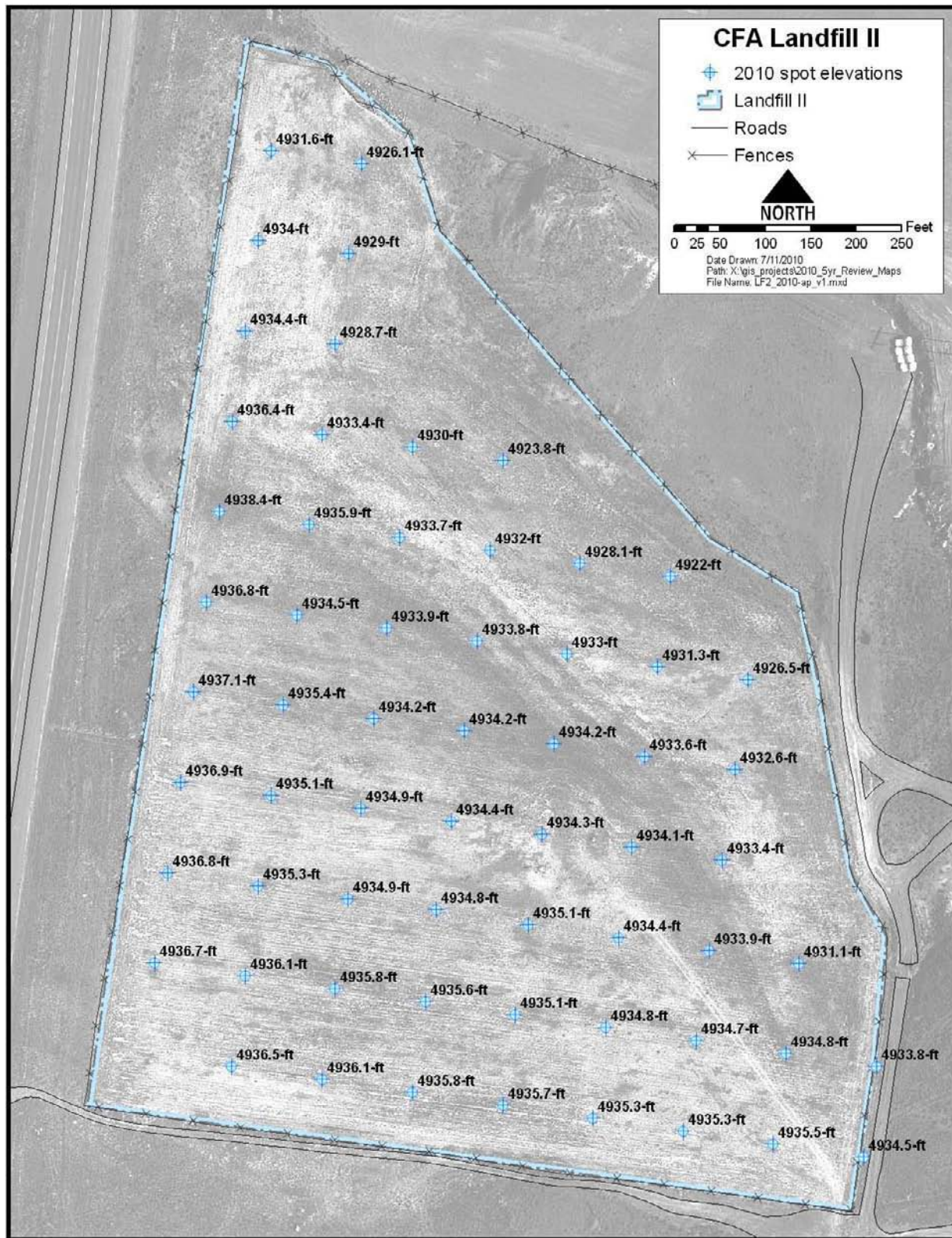


Figure 5-12. Topographic survey results at Landfill II.

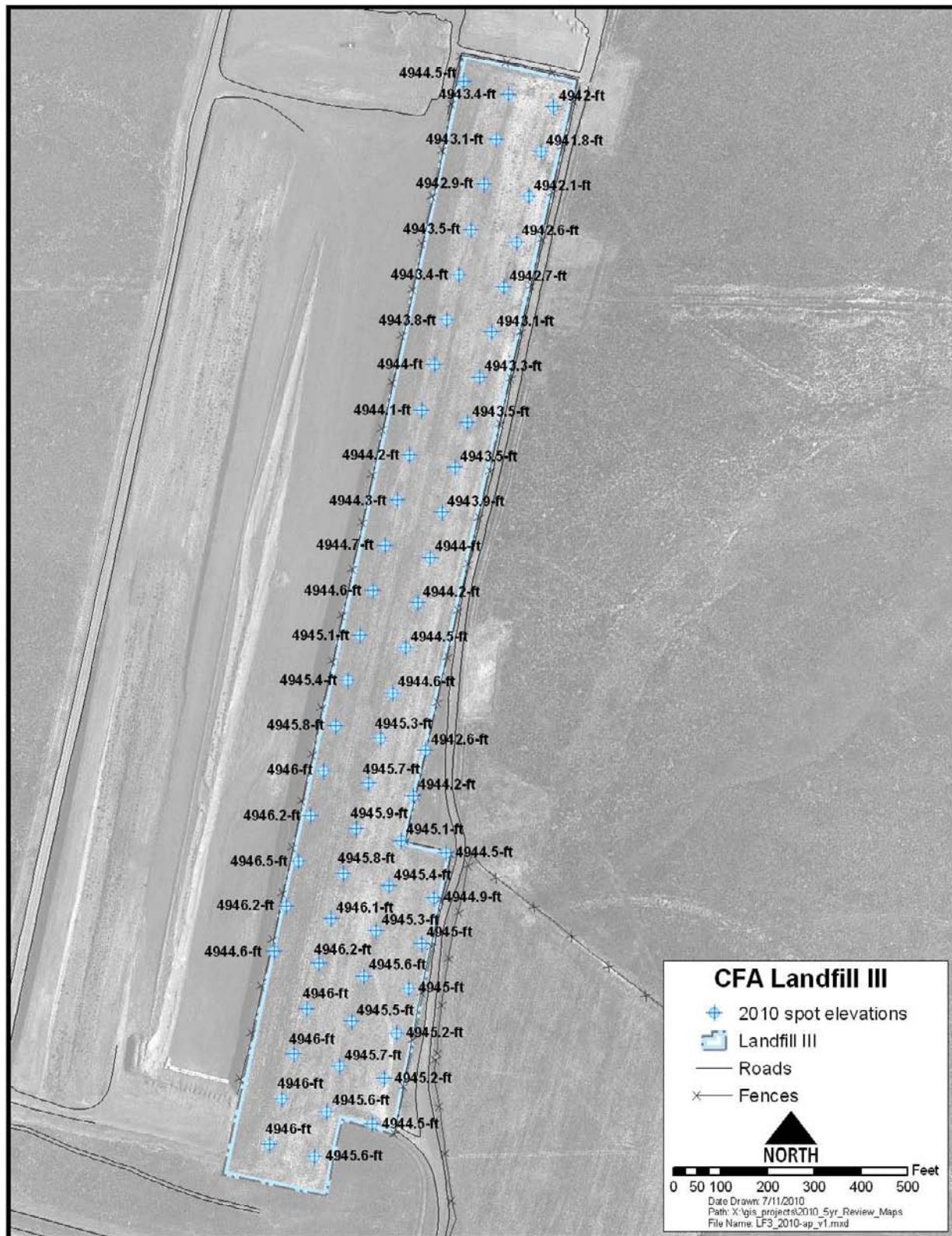


Figure 5-13. Topographic survey results at Landfill III.

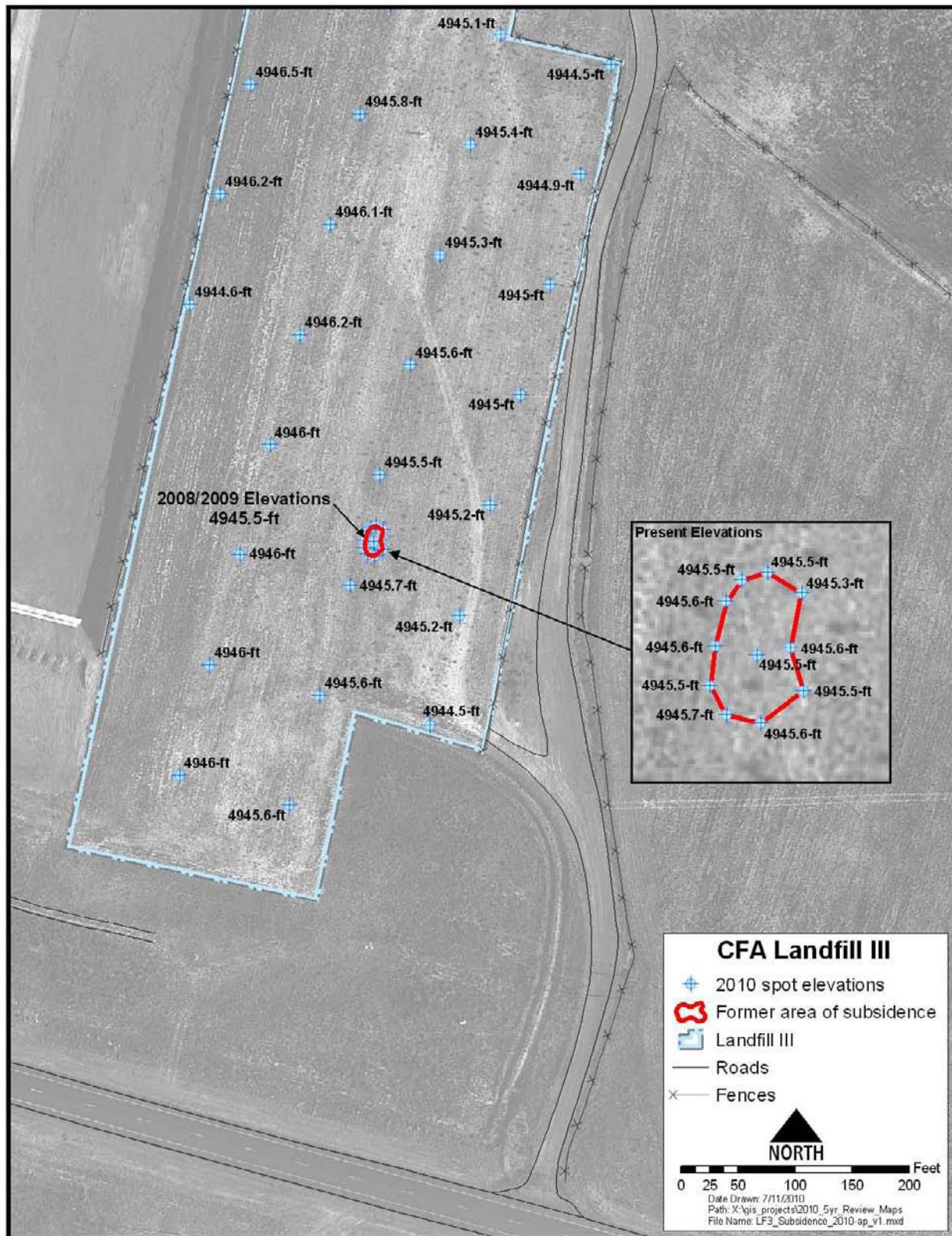


Figure 5-14. Survey data from the past area of subsidence at Landfill III.

5.4.5 Recommendations and Follow-Up Actions

Because the source of nitrate contamination, the CFA-04 mercury pond, was remediated in 2003, no additional action beyond continued monitoring is recommended. Annual monitoring reports should continue to assess nitrate trends. If concentration trends do not begin to decline over the next 5-year review period, the Agencies will consider additional steps to re-evaluate the persistence of nitrate in the aquifer. The additional steps may include evaluation of additional nitrate sources and evaluation of the release mechanism of the original source(s) in order to implement an applicable remedy to meet the RAO.

5.4.6 Protectiveness Statement for Operable Unit 4-13

The remedy at OU 4-13 is expected to be protective of human health and the environment, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled. Based on the review of monitoring data and site inspection reports, the remedies are functioning as intended by the OU 4-13 ROD (DOE-ID 2000b). Previously declining groundwater levels are noted; however, the monitoring network continues to be adequate for assessing the protectiveness of remedies at WAG 4. Nitrate in two downgradient wells continue to exceed the MCL, but the surface soil at the source of contamination was removed in 2003, and groundwater concentrations are expected to respond favorably.

5.5 Summary and Conclusions

CFA, WAG 4, incorporated 13 OUs containing 52 individual release sites. The comprehensive Remedial Investigation/Feasibility Study for WAG 4 was completed in 2000 (DOE-ID 2000a), followed by a ROD (DOE-ID 2000b). Responses identified in the ROD were completed between 2000 and 2005, allowing the previous INL Site-wide 5-year review (DOE-ID 2007a) to eliminate all but five of the 52 WAG 4 sites from further 5-year reviews. Of those five, ICs are the only ongoing response at one site, the french drain site CFA-07, which is addressed under INL Site-wide ICs (see Section 10.5). In addition to ICs, O&M and monitoring are required for the remaining four sites—three landfills (Sites CFA-01, -02, and -03) and the sewage treatment plant drainfield (Site CFA-08).

The technical assessment completed for this review indicates that landfill covers are functioning as intended by limiting the amount of infiltration at the surface of the landfills and remain protective of human health and the environment. ICs are in place as required. Routine inspections identify O&M needs, which are prioritized and addressed. The groundwater nitrate plume downgradient of CFA is expected to gradually dissipate over time because the surface soil in the source (i.e., CFA-04 mercury pond) was removed. Groundwater monitoring will continue in accordance with requirements to confirm that nitrate concentrations are declining in the SRPA and that RAOs will be met.

One previously identified issue persists—nitrate concentrations in two downgradient groundwater monitoring wells exceed the MCL. Table 5-7 identifies the issue and Table 5-8 lists recommendations.

Table 5-7. Issue for Waste Area Group 4.

Issue	Affects Current Protectiveness (Yes/No)	Affects Future Protectiveness (Yes/No)
Nitrate concentrations in the aquifer continue to exceed the maximum contaminant level at two downgradient monitoring wells.	No	Yes

Table 5-8. Recommendations and follow-up actions for Waste Area Group 4.

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Yes/No)	
					Current	Future
Nitrate concentrations in the aquifer continue to exceed the maximum contaminant level at two downgradient monitoring wells.	Continue to monitor and assess nitrate trends annually. If concentration trends do not begin to decline over the next 5-year review period, the Agencies will consider additional steps to re-evaluate the persistence of nitrate in the aquifer. The additional steps may include evaluation of additional nitrate sources and evaluation of the release mechanism of the original source(s) in order to implement an applicable remedy to meet the remedial action objective.	DOE	EPA and DEQ	Annually until the next 5-year review	No	Yes
DEQ	Idaho Department of Environmental Quality					
DOE	U.S. Department of Energy					
EPA	Environmental Protection Agency					

Because remedial actions at all OUs at CFA are protective, WAG 4 is protective of human health and the environment. WAG 4 remedial actions have been completed and are expected to be protective of human health and the environment. Groundwater and landfill gas monitoring is being conducted annually under OU 4-12 in accordance with the Long-Term Monitoring and Field Sampling Plan (DOE-ID 2009). Results indicate that nitrate concentrations in the SRPA are not increasing, and VOC impacts to groundwater from the CFA landfills have not been observed. Subsidence was previously noted near the south end of Landfill III, but the subsidence area was repaired in 2008, and no further subsidence has been noted since that time. Evidence shows that WAG 4 remedial actions will be successful in achieving the RAOs specified in the decision documents.

Remediation of WAG 4 included containment remedies, and the issue relating to nitrate in the aquifer in concentrations that exceed the MCL has not been resolved. Therefore, 5-year statutory reviews will be required until discontinued in the 5-year review process. The next 5-year review is expected to cover the period from 2010 through 2014.

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6. WASTE AREA GROUP 5 – AUXILIARY REACTOR AREA, POWER BURST FACILITY, AND CRITICAL INFRASTRUCTURE TEST RANGE COMPLEX

6.1 Introduction

Waste Area Group (WAG) 5 includes the Auxiliary Reactor Area and the Critical Infrastructure Test Range Complex (CITRC). Historically, CITRC was originally the Special Power Excursion Reactor Test, and then the Power Burst Facility. Figure 1-1 shows the locations of WAG 5 facilities. The FFA/CO divided WAG 5 into 12 OUs, with a total of 55 sites identified (25 at the Auxiliary Reactor Area and 30 at the Power Burst Facility). All of these sites were addressed in the OU 5-12 Comprehensive ROD (DOE-ID 2000a).

6.2 Site Chronology

Table 6-1 provides a chronology of significant documents and events for WAG 5.

Table 6-1. Chronology of significant documents and events for Waste Area Group 5.

Date	Document or Event
September 1992	<i>Power Burst Facility Record of Decision, Power Burst Facility Corrosive Waste Sump and Evaporation Pond, Operable Unit 5-13, Waste Area Group 5, Idaho National Engineering Laboratory</i>
December 1992	<i>Record of Decision Auxiliary Reactor Area-I Chemical Evaporation Pond, Operable Unit 5-10, Idaho National Engineering Laboratory</i>
November 1993	<i>Final Remedial Design/Implementing Remedial Action Work Plan – Power Burst Facility (PBF)-08 Corrosive Waste Sump and PBF-10 Evaporation Pond Remediation – Operable Unit (OU) 5-13</i>
November 1993	Mobilized for the OU 5-13 remedial action
May 1994	<i>Explanation of Significant Difference Power Burst Facility Corrosive Waste Sump and Evaporation Pond Record of Decision at the Idaho National Engineering Laboratory, (DOE-ID 1994a)</i>
December 1994	<i>Explanation of Significant Difference Power Burst Facility Corrosive Waste Sump and Evaporation Pond Record of Decision at the Idaho National Engineering Laboratory (DOE-ID 1994b)</i>
January 1995	Demobilized from the OU 5-13 remedial action
March 1995	<i>Final Remedial Action Report: Power Burst Facility (PBF)-08 Corrosive Waste Sump And PBF-10 Evaporation Pond Interim Action Operable Unit 5-13 (Parsons 1995)</i>
March 1995	<i>Remedial Investigation/Feasibility Study Report for Operable Units 5-05 and 6-01 (SL-1 and BORAX-I Burial Grounds) (INEL 1995)</i>
January 1996	<i>Record of Decision Stationary Low-Power Reactor-1 and Boiling Water Reactor Experimental-I Burial Grounds (Operable Units 5-05 and 6-01), and 10 No Action Sites (Operable Units 5-01, 5-03, 5-04, and 5-11), Idaho National Engineering Laboratory (INEL 1996)</i>
July 1996	Mobilized for the OU 5-05 remedial action
April 1997	Demobilized from the OU 5-05 remedial action

Table 6-1. (continued).

Date	Document or Event
October 1997	<i>Remedial Action Report OU 5-05 Stationary Low-Power Reactor No. 1 and OU 6-01 Boiling Water Reactor Experimental-I Burial Grounds Engineered Barriers</i> (DOE-ID 1997)
1997	Completed decommissioning of the ARA-II facility
January 1999	<i>Waste Area Group 5 Operable Unit 5-12 Comprehensive Remedial Investigation/Feasibility Study</i> (Holdren et al. 1999)
1999	Completed decommissioning of the ARA-III facility
January 2000	<i>Record of Decision Power Burst Facility and Auxiliary Reactor Area Operable Unit 5-12 at the Idaho National Engineering and Environmental Laboratory</i> (DOE-ID 2000a)
June 2000	Mobilized for the OU 5-12 remedial action, Phase I
September 2000	Shut down incinerator operations at WERF
2000	Completed decommissioning of the ARA-I facility
June 2001	<i>Waste Area Group 5 Remedial Design/Remedial Action Work Plan, Phase I</i> (DOE-ID 2001)
August 2001	EPA completed the initial 5-year remedial action review of the SL-1 and BORAX-I burial grounds (OU 5-05 and OU 6-01)
November 2001	Demobilized from the OU 5-12 remedial action, Phase I
January 2002	<i>Remedial Action Report for WAG 5, OU 5-12 Phase I Remedial Action; Sites ARA-02, ARA-16, ARA-25, and Inactive Waste System Sites ARA-07, ARA-08, ARA-13, and ARA-21</i> (DOE-ID 2002)
April 2003	<i>Remedial Design/Remedial Action Work Plan, Phase II, for Waste Area Group 5</i> (DOE-ID 2003)
October 2003	Mobilized for Phase II of the OU 5-12 remedial action
2003	Closed WERF
2004	Converted the mission of WERF to the Large-Scale Development Facility
2004	Closed the Mixed Waste Storage Facility and converted its mission to the Contraband Detection Facility
2004	Converted the mission of the Waste Engineering Development Facility to the Special Programs Facility
September 2004	Completed remedial action activities and post-remediation sampling activities for Phase II of the WAG 5 comprehensive remedial action (OU 5-12)
January 2005	<i>Explanation of Significant Differences for the Record of Decision for the Power Burst Facility and Auxiliary Reactor Area Operable Unit 5-12 at the Idaho National Engineering and Environmental Laboratory</i> (DOE-ID 2005a)
February 2005	<i>Action Memorandum for Phase 1 of the Decommissioning for the Power Burst Facility Reactor Building (PER-620)</i> (DOE-ID 2005b)
July 2005	<i>Remedial Action Report for Operable Unit 5-12 Remedial Action</i> (DOE-ID 2005c)
September 2005	<i>Project Close-Out Report for Waste Area Group 5</i> (ICP 2005a)
October 2006	<i>Action Memorandum for General Decommissioning Activities Under the Idaho Cleanup Project</i> (DOE-ID 2006a)
May 2007	<i>Annual Groundwater Monitoring Status Report for Waste Area Group 5 for Fiscal Year 2007</i> (RPT-382)

Table 6-1. (continued).

Date		Document or Event	
July 2007		<i>Action Memorandum for Power Burst Facility (PER-620) Final End State and PBF Vessel Disposal (DOE-ID 2007a)</i>	
EPA	Environmental Protection Agency	SL-1	Stationary Low-Power Reactor No. 1
OU	operable unit	WAG	waste area group
PBF	Power Burst Facility	WERF	Waste Experimental Reduction Facility

6.3 Background

WAG 5 encompasses areas that were previously occupied by the Auxiliary Reactor Area (see Figure 6-1) and the Power Burst Facility (see Figure 6-2). Beginning in 2005, parts of WAG 5, including all of the Power Burst Facility except the Power Burst Facility Reactor Area and ARA-IV, were incorporated into the mission to support Homeland Security. To that end, the Power Burst Facility area was renamed the CITRC to reflect its new mission.

Historically, the Auxiliary Reactor Area consisted of four separate operational areas (designated as ARA-I, ARA-II, ARA-III, and ARA-IV). ARA-II housed the Stationary Low-Power Reactor No. 1 and numerous minor structures. ARA-I was built to support that reactor. Both of these facilities were built in 1957. In 1961, an accident destroyed the reactor, and ARA-I became the staging area for the emergency response and subsequent decontamination and cleanup.

ARA-III and ARA-IV were built in the late 1950s. ARA-III initially housed the Army Gas-Cooled Reactor Experiment Research Reactor, and ARA-IV was built to accommodate Mobile Low Power Reactor-1. Experiments with the Army Gas-Cooled Reactor were discontinued at ARA-III in 1961. Work on the Mobile Low Power Reactor-1 at ARA-IV continued through 1964. In 1963, ARA-III was modified to support tests at ARA-IV and remained active until 1965. ARA-IV was used to operate the Nuclear Effects Reactor program from 1967 to 1970.

The Power Burst Facility was built in the late 1950s. Initially, it was known as the Special Power Excursion Reactor Test facility and consisted of five separate operational areas: the Control Area and SPERT-I, SPERT-II, SPERT-III, and SPERT-IV. Later, operational areas at the Power Burst Facility consisted of the Power Burst Facility Control Area, the Power Burst Facility Reactor Area (SPERT-I), the Waste Engineering Development Facility (SPERT-II), the Waste Experimental Reduction Facility (SPERT-III), and the Mixed Waste Storage Facility (SPERT-IV). Collectively, the Waste Engineering Development Facility and the Mixed Waste Storage Facility were known as the Waste Reduction Operations Complex.

6.3.1 Physical Characteristics

WAG 5 area is in the south-central portion of the INL Site (Figure 1-1), approximately 1.6 km (1 mile) north of U.S. Highway 20. Depth to groundwater ranges from approximately 139 m (455 ft) to 189 m (620 ft) beneath the area (Holdren et al. 1999). The groundwater hydraulic gradient is to the south-southwest, at approximately 4 ft/mile. No surface water features are in the immediate vicinity of WAG 5; the channel of the Big Lost River (normally dry) lies approximately 4.8 km (3 miles) to the northwest.

6.3.2 Land and Resource Use

WAG 5 is entirely contained within the INL Site. Land use at the site is described in Section 1.3.2.

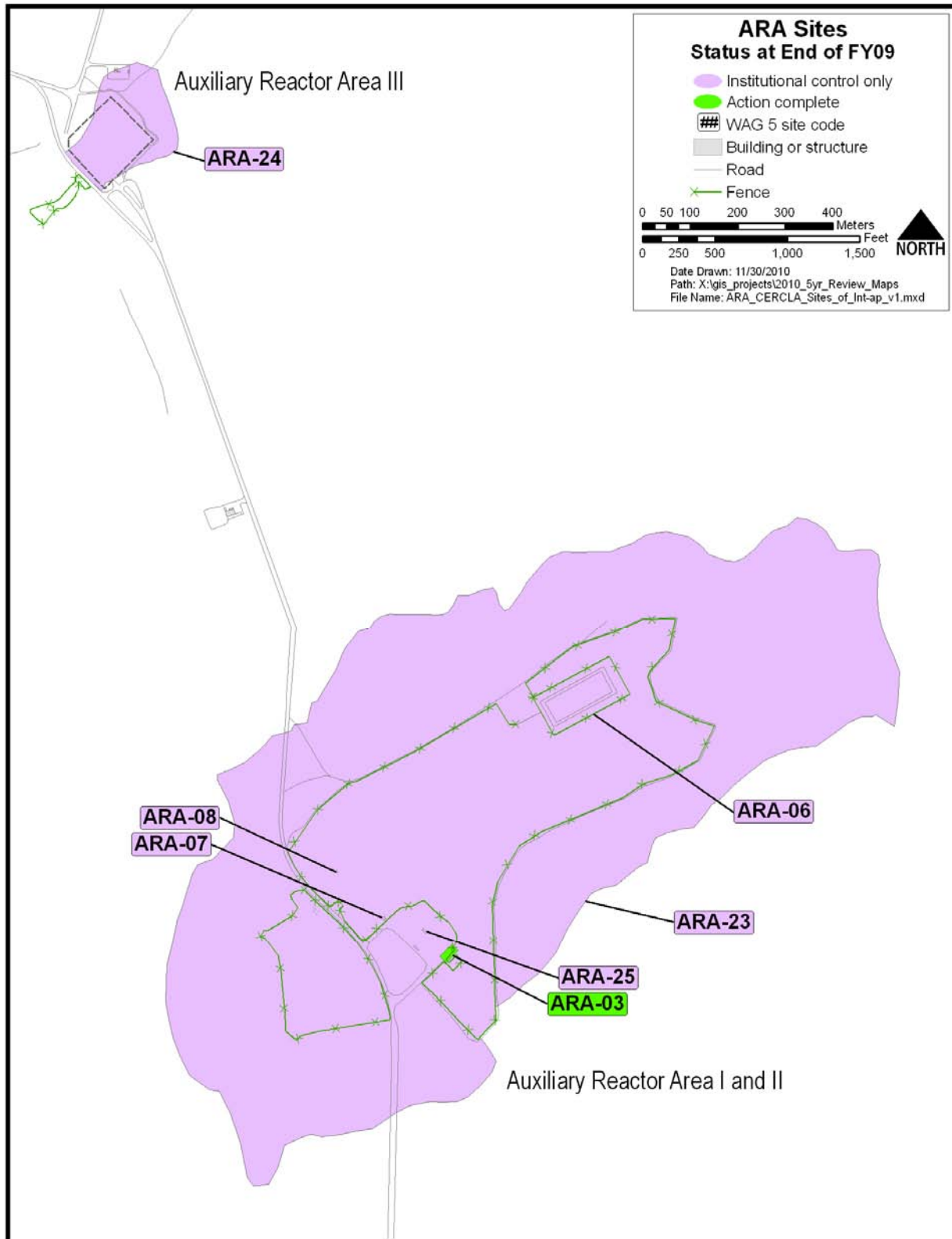


Figure 6-1. Auxiliary Reactor Area sites.

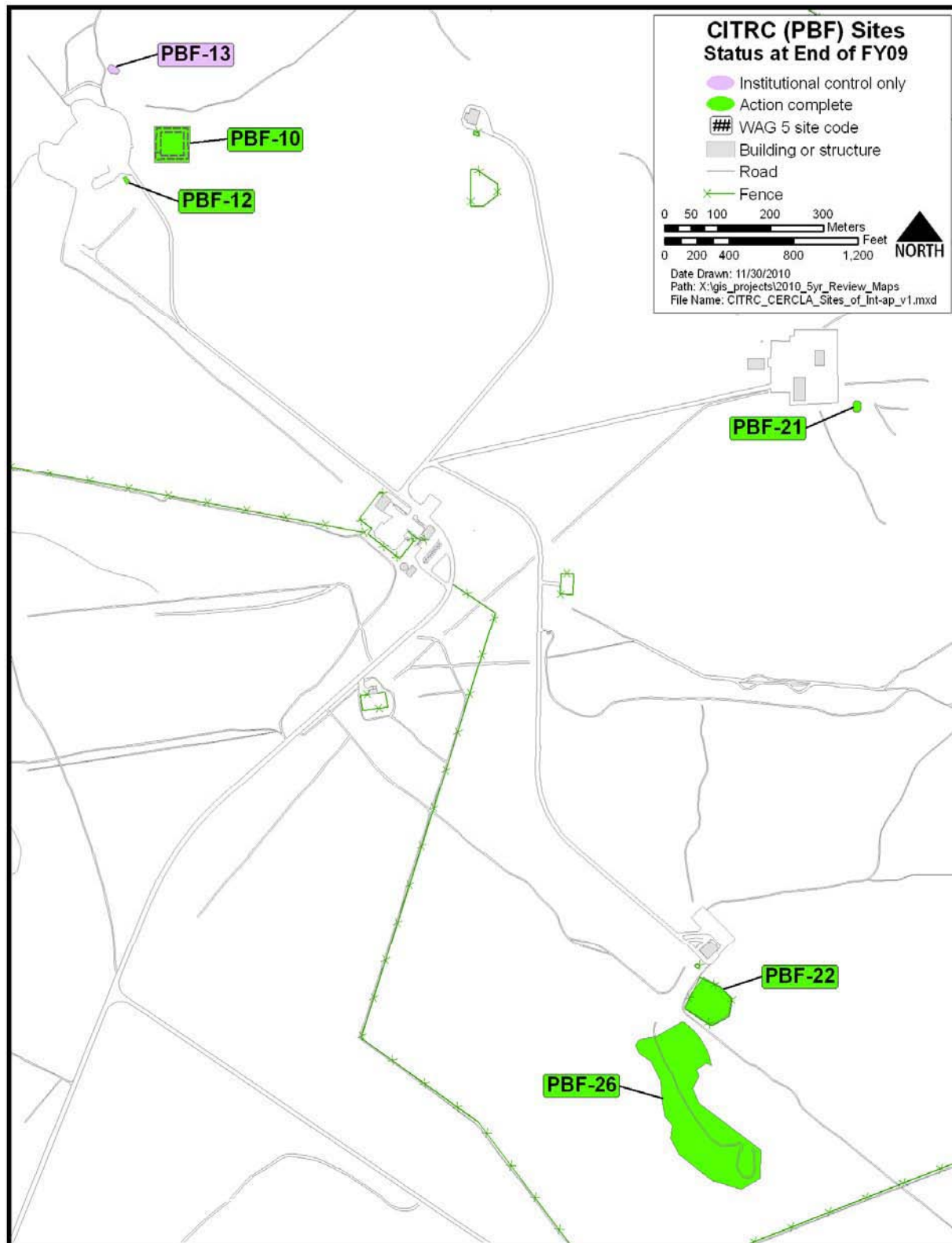


Figure 6-2. Critical Infrastructure Test Range Complex (Power Burst Facility) sites.

6.3.3 History of Contamination

Past operations and support activities at the Auxiliary Reactor Area and the Power Burst Facility released radionuclides and inorganic contaminants to the environment. WAG 5 operations generated primarily surface contamination, with only minimal impacts to groundwater (Holdren et al. 1999). The most significant sources of contamination are summarized below.

The SPERT-I reactor operated from 1955 to 1964 and was decommissioned in 1964 and demolished in 1985. The Power Burst Facility reactor was constructed in 1972 just north of the remains of SPERT-I and operated until 1985. The SPERT-II reactor was operational from 1960 to 1964. After the reactor was removed, the facility was converted for research purposes, including waste treatment development and laboratory operations.

The SPERT-III reactor was operational from 1958 to 1968. The reactor building was decontaminated in 1980, and the building was modified to contain the Waste Experimental Reduction Facility, which began operation in 1982. Operations at the Waste Experimental Reduction Facility involved volume reduction of low-level radioactive waste.

The SPERT-IV reactor was operational from 1961 to 1970. After the reactor was removed, the building was modified slightly and converted to the Mixed Waste Storage Facility. Mixed low-level waste, including radioactively contaminated polychlorinated biphenyl waste, was stored in the former reactor pit.

The Stationary Low-Power Reactor No. 1 was a small nuclear power plant that operated from 1958 until January 3, 1961, when the reactor was accidentally destroyed by a steam explosion that resulted in the deaths of the three operators (INEL 1996). A landfill was constructed at ARA-II approximately 488 m (1,600 ft) northeast of the original reactor site. The entire reactor building, contaminated materials from nearby buildings, and soil and gravel contaminated during cleanup operations were disposed of in the landfill. Cleanup was completed in September 1962. The reactor core (including fuel) was taken to TAN for study, and the fuel was later sent to INTEC (formerly the Idaho Chemical Processing Plant) for reprocessing. The reactor core (without fuel) was disposed of at RWMC. The Stationary Low-Power Reactor No. 1 burial ground was designated as CERCLA Site ARA-06 and was later remediated under OU 5-05.

Other CERCLA sites associated with WAG 5 included various radionuclide tanks, septic tanks, fuel tanks, seepage pits, leach ponds, and contaminated soil sites that remained from previous operations at the Auxiliary Reactor Area and the Power Burst Facility (ICP 2005a). The FFA/CO divided WAG 5 into 12 OUs, with a total of 55 sites identified (25 at the Auxiliary Reactor Area and 30 at the Power Burst Facility). All of these sites were addressed in the OU 5-12 Comprehensive ROD (DOE-ID 2000a).

In addition to the CERCLA sites and actions mentioned above, a diesel fuel leak occurred between 1999 and 2002 at underground storage tank PER-722, which supplied heating fuel to the Power Burst Facility Reactor Building (PBF-620) (DOE-ID 2004a). DEQ issued a letter containing the “Schedule and Criteria for petroleum release from PBF Heating Oil Tank PER-722 reported in 2002” (Frederick 2004) that required investigations to determine the nature and extent of diesel fuel contamination (ICP 2005a).

6.3.4 Initial Response

Four RODs were produced for WAG 5 sites. The first ROD, issued in September 1992 (DOE-ID 1992a), focused on remediation of the Power Burst Facility corrosive waste sump (PBF-08 site) and evaporation pond (PBF-10 site) within OU 5-13 as part of an interim remedial action. The second

ROD (December 1992) (DOE-ID 1992b) focused on the no action declaration for the ARA-I chemical evaporation pond (ARA-01 site). The third ROD was issued in January 1996 under OU 5-07 and focused on remediation of the Stationary Low-Power Reactor No. 1 reactor burial ground (CERCLA site ARA-06) and the identification of 10 no action sites within OUs 5-01, 5-03, 5-04, and 5-11 (INEL 1996). The fourth ROD, known as the Comprehensive ROD for WAG 5 (OU 5-12), was issued in January 2000 and describes the proposed remedial action for WAG 5 sites not covered by the previous RODs (DOE-ID 2000a).

A time-critical removal action was implemented at the ARA-02 Sanitary Waste System (DOE-ID 2000a). Liquid levels inside the system's three tanks were observed and found to vary over time, which indicated possible leakage to the soil below. In September 1996, the contents of all three septic tanks were removed and placed in drums in an approved temporary accumulation area to await final disposition. Seven 55-gal drums of ARA-02 seepage pit sludge (1,436 kg [3,166 lb]) were sent offsite to Envirocare for disposal in December 2000, and nine drums of Septic Tank No. 2 sludge (1,755 kg [3,870 lb]) were sent offsite to the TSCA incinerator for disposal in January 2004 (DOE-ID 2005c, Table 5-1).

A time-critical removal action was recommended for the PBF-26 site because of an historical single high detection of Aroclor-1254 (DOE-ID 2000a). Before the removal action, field tests for polychlorinated biphenyls were used to define the area of contamination. Because analytical results for polychlorinated biphenyls were below the field-screening level, the planned removal action was not performed, and further evaluation of the site was not required.

6.3.5 Basis for Taking Action

A Baseline Risk Assessment performed for the OU 5-12 Remedial Investigation/Feasibility Study (Holdren et al. 1999) evaluated 55 potential release sites and determined that 48 of those sites posed no unacceptable risk to human health or the environment, so they were designated as no action sites. The Baseline Risk Assessment also concluded that, without further action, seven WAG 5 sites posed unacceptable risk to human health or the environment. The sites requiring remedial action included six sites at the Auxiliary Reactor Area and one site at the Power Burst Facility.

A human health risk of $1\text{E-}04$ at the contaminated soil sites was posed primarily by external exposure to ionizing radiation. The radioactive COCs were Ag-108m, Cs-137, and Ra-226. Dermal adsorption of arsenic and ingestion of Ra-226, arsenic, and lead posed secondary human health risks. Ecological hazard quotients greater than 10 were from exposure to selenium, thallium, copper, mercury, and lead in the soil.

Groundwater monitoring showed elevated lead concentrations in monitoring wells at the site.

6.4 Operable Unit 5-12 – Waste Area Group 5 Comprehensive Remedial Investigation/Feasibility Study

The OU 5-12 Comprehensive ROD (DOE-ID 2000a) is based on the Comprehensive Remedial Investigation/Feasibility Study for WAG 5 (Holdren et al. 1999) and represents the final selected remedy for the Auxiliary Reactor Area and the Power Burst Facility. The ROD encompassed previous decisions for portions of WAG 5 and incorporated ongoing monitoring, O&M, and ICs. Therefore, this 5-year review evaluates protectiveness for all of WAG 5 as a whole; individual OUs are no longer assessed separately. Subsections that follow describe the comprehensive selected remedy for OU 5-12, implementation of the remedy to date, and current O&M requirements.

6.4.1 Remedy Selection

The OU 5-12 ROD for the Power Burst Facility and the Auxiliary Reactor Area evaluated 55 individual sites that were identified in the Comprehensive Remedial Investigation/Feasibility Study for WAG 5. Of the 55 sites, the OU 5-12 ROD provided information to support remedial actions for six sites at the Auxiliary Reactor Area (i.e., ARA-01, -02, -12, -16, -23, and -25) and one at the Power Burst Facility (i.e., PBF-16) where contamination presented an unacceptable risk to human health and the environment. The selected remedy for all seven sites was removal. The previously implemented remedial action for the Stationary Low-Power Reactor No. 1 burial ground (ARA-06) was containment by capping with an engineered barrier (DOE-ID 1997). The OU 5-12 ROD upheld IC and O&M requirements for the Stationary Low-Power Reactor No. 1. It also established that groundwater monitoring was to be conducted at WAG 5 until results of a 5-year review warranted discontinuation of the monitoring. The selected remedy also included limited action (i.e., ICs) at nine sites. Those sites where ICs comprise the only ongoing response are addressed in Section 10.5.

Remedial actions were completed at all WAG 5 sites prior to the last 5-year review (ICP 2005a; DOE-ID 2007b). Only those sites where ongoing O&M activities are required are discussed further in subsections that follow.

6.4.1.1 Remedial Action Objectives. The following RAOs were developed for OU 5-12:

- Inhibit direct exposure to radionuclide COCs that would result in a total excess cancer risk greater than or equal to 1 in 10,000 for current and future workers and future residents
- Inhibit dermal adsorption of COCs that would result in a total excess cancer risk greater than or equal to 1 in 10,000 or a hazard index of 2 or greater for current and future workers and future residents
- Inhibit ecological receptor exposures to contaminated soil with concentrations of contaminants greater than or equal to 10 times background values and that result in a hazard quotient greater than or equal to 10.

Remedial action objectives for remediation of the Stationary Low-Power Reactor No. 1 burial ground are:

- Inhibit exposure to radioactive materials that would result in a total excess cancer risk (for all contaminants) of greater than 1 in 10,000 to 1 in 1,000,000
- Inhibit ingestion of radioactive materials that would result in a total excess cancer risk (for all contaminants) of greater than 1 in 10,000 to 1 in 1,000,000
- Inhibit inhalation of suspended radioactive materials that would result in a total excess cancer risk (for all contaminants) of greater than 1 in 10,000 to 1 in 1,000,000
- Inhibit degradation of the landfills that could result in exposure of buried waste or migration of contaminants to the surface that would pose a total excess cancer risk (for all contaminants) of greater than 1 in 10,000 to 1 in 1,000,000.

6.4.1.2 Cleanup Levels. Table 6-2 lists the remediation goals for the WAG 5 sites discussed in this 5-year review.

Table 6-2. Contaminants of concern at Waste Area Group 5.^a

Site (Site Code)	Contaminants of Concern	Remediation Goal
ARA-II/SL-1 burial ground (ARA-06)	Fission products, including Cs-137	Inhibit exposure to radionuclides ^b
Radiologically contaminated surface soils and subsurface structures associated with ARA-I and -II (ARA-23)	Cs-137	23 pCi/g
ARA-I soil beneath the ARA-626 hot cells (ARA-25)	Cs-137 Ra-226	23 pCi/g 2.1 or 1.2 pCi/g ^c
	Arsenic	5.8 mg/kg
	Lead	400 mg/kg
	Copper	220 mg/kg

a. Source: Table 16 of the OU 5-12 Comprehensive ROD (DOE-ID 2000a).

b. Numerical cleanup levels were not established for the SL-1 containment remedy. Refer to text for performance objectives.

c. The remediation goal is the average INL Site background value for Ra-226 reported by Giles (1998) because the 1E-04 risk-based concentration derived from Fromm (1996) (i.e., 0.55 pCi/g) is below the INL Site average background concentration. A goal of 2.1 pCi/g will be used for comparison of sample results that may include interference from U-235. Otherwise, a goal of 1.2 pCi/g will be used.

INL Idaho National Laboratory
OU operable unit
ROD Record of Decision
SL-1 Stationary Low Power Reactor No. 1

For the Stationary Low-Power Reactor No. 1 burial ground, the ROD specified containment as the selected remedy (INEL 1996). Therefore, performance objectives were defined for the remedy, but not numerical cleanup levels. The performance standards identified in the ROD for the containment remedy at the Stationary Low-Power Reactor No. 1 were:

- Installation of a cap designed to remain in existence for at least 400 years to discourage any individual from inadvertently intruding into the buried waste or from contacting the waste at any time after active ICs over the disposal sites are removed up to the design life of the cap
- Application of maintenance and surface monitoring programs for the containment system capable of providing early warning of releases of radionuclides from the disposal site before they leave the site boundary
- Institution of restrictions limiting land use to industrial applications for at least 100 years
- Implementation of surface water controls to direct surface water away from the disposed waste
- Elimination, to the extent practicable, of the need for ongoing active maintenance of the disposal sites after closure so that only surveillance, monitoring, or minor custodial care are required
- Placement of adequate cover to inhibit erosion by natural processes for the specified design lives of the caps
- Incorporation of features to inhibit biotic intrusion into the waste disposal pits and trench at the Stationary Low-Power Reactor No. 1 burial ground.

6.4.2 Remedy Implementation

Remedial actions for OU 5-12 were conducted in two phases (DOE-ID 2005c). During Phase I, the following sites were remediated: the ARA-02 sanitary waste system, the ARA-16 radionuclide tank and

associated piping, and the ARA-25 soil beneath the ARA-626 hot cells. In addition, four inactive waste systems were closed, including the ARA-07 seepage pit, the ARA-08 seepage pit, the ARA-13 sanitary sewer distribution box and septic tank, and the ARA-21 septic tank and Leach Pit No. 2. Remediation included removing the contaminated materials, thereby reducing contamination levels below the remedial action goals. As part of the Phase I remedial action, the four inactive waste systems were closed to further reduce the hazards within OU 5-12.

During Phase II remedial action, remediated sites included the ARA-01 chemical evaporation pond, the ARA-12 radioactive waste leach pond, and the ARA-23 radiologically contaminated surface soil and subsurface structures associated with ARA-I and ARA-II. As with Phase I, the contaminated materials were removed, reducing contamination levels below the remedial action goals.

The groundwater monitoring requirement resulted from a concern about elevated lead concentrations that had been detected in selected monitoring wells at the site. The occurrence of lead in the groundwater samples was later attributed to corrosion of galvanized steel riser pipes used in these monitoring wells and was not the result of releases of lead from prior WAG 5 operations (ICP 2005a). Following this discovery, the Agencies agreed that groundwater monitoring would be discontinued after 2006 (DOE-ID 2007c).

6.4.2.1 ARA-II Stationary Low-Power Reactor No. 1 Burial Ground (ARA-06 Site). The Stationary Low-Power Reactor No. 1 burial ground was remediated in 1996 and 1997. A 56-cm (22-in.) -thick biotic barrier consisting of pea gravel and cobble was placed over the area, followed by a human intrusion barrier of large angular basalt boulders. Next, fences, gates, and four granite monuments were placed at the Stationary Low-Power Reactor No. 1 site. The area around the cap was contoured and seeded. Details of the burial ground remedial action are contained in the OU 5-05 Remedial Action Report (DOE-ID 1997). Cleanup was evaluated in previous 5-year reviews. This review focuses on the ongoing IC/O&M requirements for the Stationary Low-Power Reactor No. 1.

6.4.2.2 Radiologically Contaminated Surface Soil and Subsurface Structures Associated with ARA-I and ARA-II (ARA-23 Site). The ARA-23 site is a 240-acre, windblown-contamination area that includes both residual subsurface structures from ARA-I and ARA-II and the areas surrounding ARA-I and ARA-II. Of the 240 acres, 42 acres exceeded risk-based concentrations and required remediation. The site also contained subsurface structures remaining after decommissioning activities within ARA-I and ARA-II. Radioactive contamination in the windblown soil was primarily due to contamination released from the 1961 Stationary Low-Power Reactor No. 1 accident and its subsequent cleanup. However, minor amounts of contamination might have been added by other Auxiliary Reactor Area operations. Over time, winds dispersed the contamination over an area of roughly 240 acres, but most of this windblown contamination is significantly less than risk-based remediation goals. The long axis of the roughly oval-shaped site is consistent with the generally southwest–northeast winds common at the INL Site.

Contaminated soil was removed from the ARA-23 site in accordance with requirements delineated in the OU 5-12 Comprehensive ROD (DOE-ID 2000a). Soil contaminated with Cs-137 was removed and disposed of in a manner that mitigated the human health risk associated with this site. In 2003, excavation activities were concentrated in the soil contamination area next to Fillmore Boulevard at ARA-I and the area between the fence outside of the ARA-II facility and the windblown area. In 2004, excavation was performed in the windblown contamination area, the contaminated soil area near the haul road, the area near the Stationary Low-Power Reactor No. 1 burial ground, the turnaround area, areas on top of the burial ground, the area north of ARA-II, the washdown area across Fillmore Boulevard, and the bermed area next to ARA-I. In general, excavation was performed using 2.5- to 15.2-cm (1- to 6-in.) excavation cuts over the entire contaminated soil area, followed by spot excavations in the more contaminated soil

areas. A total of 62.9 million kg (69,336 tons) of soil with some debris from ARA-23 was disposed of at ICDF from October 2003 through December 2004 (DOE-ID 2005c, Table 5-1). In addition, the fence surrounding ARA-II was removed and disposed of at ICDF in 2004.

Details of the ARA-23 remedial action are contained in the OU 5-05 Remedial Action Report (DOE-ID 1997) and the OU 5-12 Remedial Action Report (DOE-ID 2005c). Cleanup was evaluated in previous 5-year reviews. This review focuses on the ongoing IC/O&M requirements. Because of the size of the ARA-23 site excavation, the post-remediation evaluation activities (through sampling) were separated into five zones. The various zones of the excavation were as follows:

- Area near ARA-I
- Area near ARA-II
- Equipment washdown area
- Haul road and turnaround area
- Windblown area.

A review of the contamination profiles for both in situ measurements and confirmation samples found that the contamination profiles generally followed a log-normal distribution rather than a normal distribution. The only exceptions to this were the confirmation samples in the washdown area and the in situ measurements in the haul road and turnaround area.

Residual sampling results for the ARA-I area of the ARA-23 site after remediation showed 95% upper confidence limit Cs-137 concentrations of 8.5 pCi/g for the in situ measurements (based on a gamma distribution, in accordance with EPA guidelines) and 22.3 pCi/g for the confirmation samples (based on a nonparametric Chebyshev distribution). Both calculated values were below the remedial action goal of 23 pCi/g for Cs-137. Therefore, remediation of the ARA-I excavation site within the ARA-23 site was considered complete.

For purposes of evaluating the ARA-II portion of the ARA-23 site, the data had to be split into samples collected from the basalt surface where excavation was to that surface and from samples collected from excavated soil areas. This was because the RAOs were to either excavate to basalt or excavate enough of the soil to meet the remedial action goal of 23 pCi/g for Cs-137. In situ measurements, post-remediation, for the ARA-II areas in the ARA-23 site that were not excavated to basalt, showed a 95% upper confidence limit Cs-137 concentration of 8.6 pCi/g (based on a normal distribution, in accordance with EPA guidelines), which was below the remedial action goal of 23 pCi/g for Cs-137. Confirmation sample data for the ARA-II site projected a 95% upper confidence limit (based on a normal distribution, in accordance with EPA guidelines) of 11.1 pCi/g, also below the remedial action goal of 23 pCi/g for Cs-137. As a result, remedial actions for the ARA-II portion of the ARA-23 site were judged to be complete because the residual soil surface at ARA-II met the remediation goals for Cs-137.

Residual sampling results for the equipment washdown area of the ARA-23 site, after remediation, showed 95% upper confidence limit concentrations of 8.4 pCi/g for Cs-137 for the in situ measurements (based on a gamma distribution, in accordance with EPA guidelines) and 12.9 pCi/g for the confirmation samples (based on a normal distribution). Both calculated values were below the remedial action level of 23 pCi/g, indicating that remediation was complete.

In situ measurements and confirmation sample results for the haul road and turnaround area of the ARA-23 site followed a gamma distribution, in accordance with EPA guidelines. The calculated 95% upper confidence limit Cs-137 concentrations of the residual soil surfaces were 7.4 pCi/g for the in

situ measurements and 24.9 pCi/g for the confirmation samples. While the in situ measurements were below the remediation goal for Cs-137 (23 pCi/g), the confirmation sample results were just above the remediation goal. The reason for this was that one of these 10 samples had a Cs-137 concentration above the remediation goal of 23 pCi/g (ARA-23H-20 was 56.3 pCi/g). The same sample location provided an in situ Cs-137 concentration of 11.7 pCi/g. The high Cs-137 concentration in this single confirmation sample was attributed to a “hot particle” that incorrectly skewed the 95% upper confidence limit calculation to a level above the remediation goal and could be screened from the confirmation sample evaluation. The new 95% upper confidence limit that was calculated for Cs-137 from the other nine confirmation samples (under a normal distribution, in accordance with EPA guidance) was only 9.5 pCi/g, below the remedial action goal of 23 pCi/g. Therefore, remediation of the haul road and turnaround area of the ARA-23 site was considered complete.

In situ measurements for the windblown area of the ARA-23 site, post-remediation, had a 95% upper confidence limit Cs-137 concentration of 9.3 pCi/g based on a normal distribution. Confirmation samples of the windblown area based on a gamma distribution provided a 95% upper confidence limit of 9.6 pCi/g for Cs-137. Both 95% upper confidence limits were below the remediation goal for Cs-137 (23 pCi/g). As a result, remediation of the windblown area of the ARA-23 site was considered complete.

Table 6-3 summarizes information on residual concentrations in the excavated soil (and basalt) areas of each portion of the ARA-23 site. Based on the comparison of the post-remediation concentrations to the remediation goal, the remediation of the ARA-23 site was determined to be successful. However, the presence of Cs-137 contamination in excess of the free-release concentration of 2.4 pCi/g requires that ICs remain in place.

Table 6-3. ARA-23 site Cs-137 data summary by area.

Area	In Situ Measurements Cs-137 (pCi/g)	Confirmation Sampling Cs-137 (pCi/g)
ARA-I	8.5 ^a	22.3 ^b
ARA-II	8.6 ^c (soil) 52.1 ^a (basalt)	11.1 ^c (soil) 83.8 ^a (basalt)
Equipment washdown area	8.4 ^a	12.9 ^c
Haul road and turnaround	7.4 ^a	9.5 ^{c,d}
Windblown	9.3 ^c	9.6 ^a

a. 95% UCL, determined under a gamma distribution, in accordance with EPA guidelines.

b. 95% UCL, determined under a nonparametric Chebyshev distribution, in accordance with EPA guidelines.

c. 95% UCL, determined under a normal distribution, in accordance with EPA guidelines.

d. With single outlier sample removed.

EPA Environmental Protection Agency

UCL upper confidence limit

6.4.2.3 ARA-I Soil Beneath the ARA-626 Hot Cells (ARA-25 Site). The ARA-25 site comprised contaminated soil that was discovered beneath the ARA-626 hot cells during decommissioning at ARA-I in 1998. The contamination was found near the hot cell floor drains. The contaminated area immediately around the drains measured approximately 2.4 × 3.7 m (8 × 12 ft). However, other isolated hot spots beneath the building also were discovered. Therefore, a cumulative size of 4.9 × 7.3 m (16 × 24 ft) was estimated for the site. The ARA-I hot cells were constructed in 1959 and used until the facility was shut down in 1988. Stainless steel piping connected the floor drains to the ARA-729

radionuclide tank (ARA-16 site). The pipes were included in remediation of the ARA-16 site and were not a component of the ARA-25 site.

The contaminated soils at the ARA-25 site were removed in accordance with requirements of the OU 5-12 Comprehensive ROD (DOE-ID 2000a). The hot cell foundation was initially removed to allow for excavation of the underlying and immediately surrounding soil. The contaminated soil area was then removed to the basalt sublayer. Details of the ARA-25 remedial action are contained in the OU 5-05 Remedial Action Report (DOE-ID 1997). Cleanup was evaluated in previous 5-year reviews. This review focuses on the ongoing IC/O&M requirements.

In situ measurements of the exposed basalt layer at the ARA-25 site showed a maximum Cs-137 concentration of 398 pCi/g in the basalt—higher than the 23-pCi/g remediation goal. The measured Cs-137 concentrations were used to calculate concentrations of the remaining COCs. The concentration of Cs-137 and those concentrations derived for the other COCs are provided in Table 6-4. Though all the remaining contaminant concentrations (except copper) exceeded their remediation goals, the OU 5-12 Comprehensive ROD (DOE-ID 2000a) stated that remediation goals can be satisfied by either cleaning up to the identified contaminant concentration or by removing all soil down to the basalt interface. Because the contaminated soil was removed down to the basalt interface, the remediation of the ARA-25 site was successful. However, the presence of high levels of Cs-137 within the basalt required the use of ICs at the ARA-25 site. Because the residual contamination was higher than remediation goals, ICs will be needed at the ARA-25 site longer than the assumed 100 years. As a result, monuments were placed on top of the site as were sign postings and personnel access restrictions that commonly accompany ICs.

Table 6-4. ARA-25 site contaminant concentrations before and after remediation.

Contaminant of Concern	Maximum Concentration Before Remediation	Maximum Post-Remediation Concentration	Remediation Goal
Cs-137	449 pCi/g	398 pCi/g	23 pCi/g
Ra-226	29.7 pCi/g	26.3 pCi/g	1.2 or 2.1 pCi/g ^a
Arsenic	40.6 mg/kg	36.0 mg/kg	5.8 mg/kg
Lead	1,430 mg/kg	1,266 mg/kg	400 mg/kg
Copper	227 mg/kg	201 mg/kg	220 mg/kg

a. A goal of 2.1 pCi/g was used for comparison of sample results that might have included interference from U-235; otherwise, a goal of 1.2 pCi/g was used. Regardless of which remediation goal concentration was used for comparison, the post-remediation concentration clearly exceeds either one.

6.4.2.4 WAG 5 Removal Actions. Although the general decommissioning of buildings and structures is not specifically addressed in previous RODs at the INL Site, NTCRAs are consistent with the RAOs of previous RODs and support the overall cleanup objectives established through the FFA/CO (DOE-ID 1991).

6.4.2.4.1 Minor WAG 5 Facilities Decommissioned Under the General Decommissioning Action Memorandum—At WAG 5, three facilities or structures were decommissioned as NTCRAs under the General Decommissioning Action Memorandum from October 1, 2004, until September 30, 2009 (Table 6-5, Figure 6-3). These structures were removed and the area was graded to match surrounding contours. Based on specific requirements, the waste from these facilities was shipped to an appropriate treatment or disposal facility. Mixed waste was shipped to a permitted facility

(e.g., Energy Solutions). Radioactive waste was shipped to ICDF. Nonradioactive friable asbestos was shipped to the CFA landfill. Other types of waste would have been sent to the CERCLA Demolition Waste Landfill at INTEC. Some residual contamination remained in the basement sump of PER-609, the Waste Experimental Reduction Facility Incinerator Building; however, the residual risk was less than the RAOs established by the OU 5-12 Comprehensive ROD (DOE-ID 2000a), and the RAOs established in Section 4.2 of the Action Memorandum for General Decommissioning (DOE-ID 2009). No residual contamination precluding release for unrestricted future use remained for PER-756 and PER-761.

Table 6-5. Waste Area Group 5 non-time-critical removal actions completed under the General Decommissioning Action Memorandum.

Facility ID	Facility Name	Completion Date
PER-609	WERF Incinerator Building	9/28/2009
PER-756	WERF Exhaust Stack	9/28/2009
PER-761	WERF Spray Dryer Absorber	9/28/2009

ID identifier
WERF Waste Experimental Reduction Facility



PBF-761, Spray Dryer Absorber



PBF-756, WERF Exhaust Stack



PBF-609, WERF Incinerator Building, before and during demolition

Figure 6-3. Minor Waste Area Group 5 facilities decommissioned under the General Decommissioning Action Memorandum.

6.4.2.4.2 Major WAG 5 Facilities Decommissioned Under Facility-Specific Action Memoranda—At WAG 5, one facility was decommissioned as a NTCRA under a facility-specific action memorandum from October 1, 2004 to September 30, 2009 (Table 6-6, Figure 6-4).

Decommissioning of the PER-620 Power Burst Facility Reactor Building is described in the Action Memorandum for Phase 1 of the Decommissioning of PER-620 (DOE-ID 2005b) and the Action Memorandum for Power Burst Facility End State and Power Burst Facility Vessel Disposal (DOE-ID 2007a). Phase 1 activities involved removal of lead and some radiologically contaminated equipment. The selected end-state alternative included removal and disposal of the Power Burst Facility vessel at ICDF and demolishing the aboveground portions of the PER-620 building to ground surface. Risks from residual contamination after the decommissioning were evaluated in the Engineering Evaluation/Cost Analysis for the Power Burst Facility (PER-620) (DOE-ID 2007e).

Hazardous waste (e.g., lead, circuit boards, and mercury switches) was sent to off-INL Site hazardous waste disposal facilities. The resultant uncontaminated demolition material was used as backfill. Radiologically contaminated debris and asbestos were disposed of at ICDF, and uncontaminated debris and asbestos were disposed of at the CERCLA Demolition Waste Landfill at INTEC. Materials left in place included inert, nonputrescible material located below the ground surface (e.g., piping, equipment, electrical conduit, utility systems, structural steel, and other residual clean or contaminated materials that did not present an unacceptable risk) in accordance with the RAOs for the OU 5-12 Comprehensive ROD (DOE-ID 2000a). The area was brought to grade and revegetated with native plant species; no aboveground features remain.

Though contaminated equipment was removed and disposed of, some residual contamination remained in the basement of PER-620 as fixed contamination in experimental cubicles and the warm sump. This residual contamination was accounted for in the risk analysis conducted to support the Engineering Evaluation/Cost Analysis for the Power Burst Facility (PER-620) (DOE-ID 2007e) and was found to not present an unacceptable risk, in accordance with RAOs of the Action Memorandum for the PBF End State and Vessel Disposal (DOE-ID 2007a).

Table 6-6. Waste Area Group 5 non-time-critical removal actions completed under facility-specific action memoranda.

Facility ID	Facility Name	Completion Date	Action Memoranda	Removal Action Report
PER-620	PBF Reactor Building	10/1/2008	<i>Action Memorandum for Phase 1 of the Decommissioning of the Power Burst Reactor Building (PER-620 (DOE-ID 2005b) and Action Memorandum for Power Burst Facility End State and PBF Vessel Disposal (DOE-ID 2007a)</i>	“Final Removal Action Report for the Power Burst Facility and Waste Experimental Reduction Facility” (pending; to be submitted in FY 2011)
ID	identifier			
PBF	Power Burst Facility			



PBF-620, Reactor Building, before NTCRA



PBF-620 reactor vessel being lifted



PBF-620 reactor vessel being moved



PBF-620, Reactor Building, site after revegetation

Figure 6-4. Major Waste Area Group 5 facilities decommissioned under facility-specific action memoranda.

RAOs for this NTCRA comprise performing final decommissioning of the PER-620 consistent with the OU 5-12 RAOs to achieve the following:

- Inhibit direct exposure to radionuclide COCs at the Power Burst Facility that would result in a total excess cancer risk greater than 1 in 10,000 for current workers and future residents.
- Inhibit dermal absorption of COCs remaining at the Power Burst Facility that would result in a total excess cancer risk greater than or equal to 1 in 10,000 or a hazard index of 1 or greater for future residents. To maintain consistency with other CERCLA risk assessments done at the INL Site and ensure conservatism is maintained in the risk evaluations, the hazard index of 1 was used in place of the hazard index of 2 specified in the OU 5-12 ROD.
- Inhibit exposure to contaminated soil that would pose a risk to an ecological receptor.

Further discussion of the PER-620 decommissioning and end state will be included in a final removal action report for the Power Burst Facility and the Waste Experimental Reduction Facility, which is currently being drafted for Agency review. The Waste Experimental Reduction Facility NTCRA was combined with that of the Power Burst Facility reactor Removal Action Report. Decommissioning of the Waste Experimental Reduction Facility was not complete until fall 2009. The removal action report is expected to be submitted in FY 2011.

6.4.3 Operations and Maintenance

O&M requirements are applicable at the following sites:

- ARA-06 – Stationary Low-Power Reactor No. 1 Reactor Burial Ground
- ARA-23 – Radiologically Contaminated Soils and ARA-I/ARA-II Subsurface Structures
- ARA-25 – ARA-I Soil Beneath the ARA-626 Hot Cells.

O&M requirements include inspections for animal intrusions, subsidence, and erosion and radiological surveys. Inspections for the past 5 years show the remedy is working as intended. Results from 2009 are representative of routine inspection observations. Table 6-7 summarizes WAG 5 O&M requirements and the results of the most recent inspections performed in 2009 (RPT-672).

Table 6-7. Waste Area Group 5 operations and maintenance inspection log – 2009.^a

Inspection Activity		Sites			Comments and Recommended Repair
Auxiliary Reactor Area		ARA-06	ARA-23	ARA-25	
Revegetated Areas					
1. Inspect for intrusion.		X	X	X	Minimal small animal burrows noted. No corrective actions required.
2. Inspect vegetative cover.		X	X	X	Vegetation is growing well.
Environmental Monitoring					
1. Radiological survey of site perimeter at 5-year review.		X	X	NA	Radiological surveys performed July 14, 2009, for 5-year review.
Operations and Maintenance Inspection Activity at ARA-06		ARA-06 (SL-1 Burial Ground)			
Biotic Barrier					
1. Inspect for erosion and intrusion.		X			No evidence of intrusion or erosion.
2. Inspect cover for settling and erosion.		X			No evidence of settling or erosion.
Riprap Barrier					
1. Inspect for erosion and intrusion.		X			No evidence of erosion or intrusion.
2. Inspect cover for settling and erosion.		X			No evidence of settling or erosion.
a. Table 11 in RPT-672, Rev. 1.					
NA not applicable					
SL-1 Stationary Low Power Reactor No. 1					
X activity performed					

The 2009 perimeter surveys of ARA-06 and ARA-23 performed on July 14, 2009, indicated radiation activities less than 50 $\mu\text{rem}/\text{hour}$ at all points surveyed. Results ranged between 8 and 15 $\mu\text{rem}/\text{hour}$. These results indicate that the radiological contamination is at acceptable levels, and no corrective actions are required.

In summary, the 2009 inspections showed that the ICs at the Auxiliary Reactor Area and CITRC are functioning as intended. Site coordinates were reviewed in the IC database and found to be complete. Vegetation assessments revealed that the vegetation at ARA-23 and ARA-25 is well established. Perimeter radiation surveys at Sites ARA-06 and ARA-23 indicated that radiation levels are at acceptable levels, and contamination does not appear to be spreading. Corrective actions are not required at WAG 5 sites.

6.5 Progress Since the Last Review

No issues were identified for WAG 5 during the previous 5-year review.

6.6 Data Review and Evaluation

Following completion of the Remedial Action Report for OU 5-12 in July 2005 (DOE-ID 2005c), all remedial actions had been completed, and WAG 5 entered into a monitoring and surveillance mode of operation. Monitoring, maintenance, inspection, and reporting requirements will continue until determined to no longer be necessary during a 5-year review with concurrence of the Agencies. Ongoing WAG 5 activities include:

- Long-term monitoring, surveillance, and reporting associated with the IC sites
- Monitoring and maintenance of the Stationary Low-Power Reactor No. 1 reactor burial ground cap (ARA-06).

Post-2005 activities associated with these requirements are summarized in the following subsections.

6.6.1 Groundwater Monitoring

The OU 5-12 Comprehensive ROD (DOE-ID 2000a) required that nine aquifer wells within WAG 5 be sampled annually to monitor organic, inorganic, and radionuclide contaminant concentrations in groundwater (Figure 6-5). Review of groundwater data collected for the first 5-year review (DOE-ID 2007b) suggested that groundwater monitoring be discontinued at WAG 5 after adequate data were collected to address the issue of elevated lead concentrations in some wells. However, groundwater monitoring for fuel hydrocarbons was still required at monitoring wells PBF-MON-A-001, PBF-MON-A-003, and SPERT-I near the PER-722 diesel fuel release (behind the Power Burst Facility Reactor Building, PER-620).

Groundwater monitoring performed since the last 5-year review (DOE-ID-2007b) is as follows:

- In October 2004, nine wells were sampled for VOCs, inorganics (metals and anions), and radionuclides (ICP 2005b).
- In June 2005, water levels were measured in 21 monitoring wells near WAG 5 (RPT-220). Following a recommendation in the previous 5-year review (DOE-ID 2007b), water-level measurements were discontinued after FY 2005.
- In November–December 2005 (FY 2006), three wells were sampled for VOCs, and eight wells were sampled for nine metals (RPT-220).

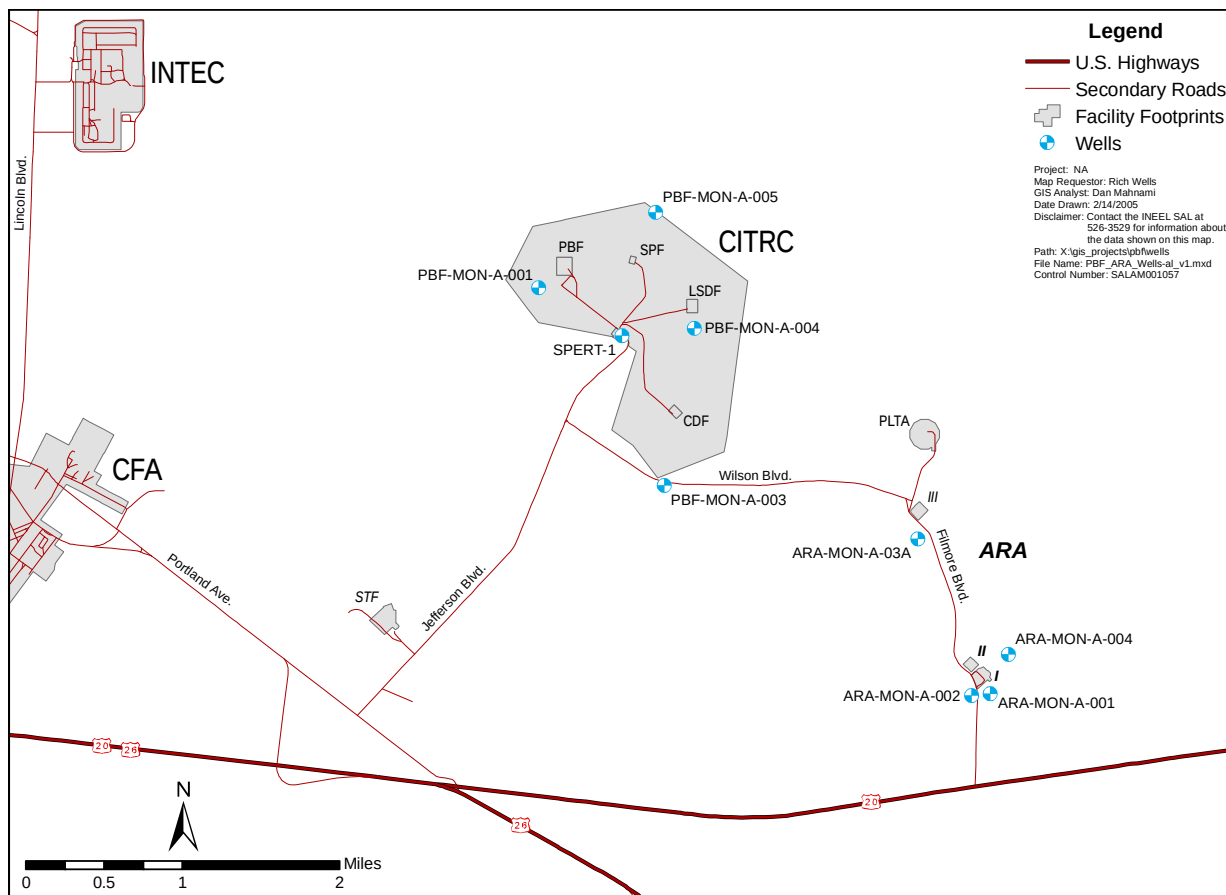


Figure 6-5. Waste Area Group 5 monitoring well locations.

- In late November 2006 (FY 2007), three wells were sampled for VOCs (RPT-382). This was the last groundwater sampling event conducted for WAG 5.

The results of WAG 5 groundwater monitoring performed since the previous 5-year review are summarized in the following subsections.

6.6.1.1 Volatile Organic Compound Results. The FY 2005 sample results for VOCs were below the MCLs for all analytes (ICP 2005b). Toluene was detected in three wells at concentrations less than 1 µg/L up to 76.1 µg/L, with the highest concentration occurring at Well ARA-MON-A-004. Other benzene, toluene, ethyl benzene, and xylene compounds or hydrocarbon tentatively identified compounds were not detected at the three locations where toluene was detected. The source of the toluene detections is uncertain, but the lack of other hydrocarbons at the locations of the toluene detections is not consistent with fuel migration. The occurrence of toluene may be a laboratory artifact. All toluene detections are considerably less than the MCL of 1,000 µg/L.

The FY 2006 and FY 2007 sample results for VOCs were below the MCLs for all analytes (RPT-220; RPT-382). In FY 2006, trichloroethene was detected well below the MCL of 5 µg/L in one well, PBF-MON-A-001 at 0.16 µg/L, but was not detected in the duplicate. In FY 2007, all sample results for target VOCs were below their detection limits; therefore, no analyte was detected at a concentration above its MCL.

In summary, VOC detections have occurred in WAG 5 groundwater samples; however, consistent VOC detections have not occurred, and all results for samples collected since the previous 5-year review were below MCLs.

6.6.1.2 Inorganic Results. Inorganic analyses included metals and anions. Specific metals requested included arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. In previous sampling events, lead had been detected at concentrations slightly above the EPA action level of 15 µg/L in some wells.

The FY 2005 results for metals and anions were below MCLs, secondary MCLs, or action levels. Lead had been detected in previous sampling events at concentrations slightly above the EPA action level of 15 µg/L, but lead concentrations were below both the detection limit (1.73 µg/L) and the lead action level in all samples collected for FY 2005.

The FY 2006 inorganic analytical results for metals were below MCLs, secondary MCLs, or action levels. Lead had been detected in previous sampling events at concentrations slightly above the EPA action level of 15 µg/L, but lead was below the action level in all samples collected for FY 2006. Two wells, PBF-MON-A-001 and PBF-MON-A-005, showed an increase in lead concentration in the FY 2006 sampling event, but the values were below the action level for lead. Similarly, zinc was elevated above background in the same two wells noted for lead, but zinc concentrations were less than the secondary MCL for zinc in both PBF-MON-A-001 and PBF-MON-A-005. The drop in water levels in these two wells may have contributed to increased lead and zinc concentrations due to the uptake of suspended sediments, because the metals samples are unfiltered.

The cause of the previous elevated lead and zinc concentrations was determined to be the result of corrosion of galvanized water-access and riser pipes. Excluding the production well SPERT-I, each of the WAG 5 groundwater monitoring wells was installed with galvanized water-access and discharge pipes. As part of the INL Site routine well maintenance program, pumps were removed and maintained, and galvanized pipes were removed and replaced with stainless steel pipes in all WAG 5 wells except SPERT-I. Galvanized pipe removed from these wells showed evidence of corrosion and rusting. After galvanized pipe was replaced with stainless steel pipe, the concentrations of lead and zinc decreased to background levels.

6.6.1.3 Radionuclide Results. Samples for radionuclide analyses were collected in FY 2005, and included laboratory analyses for gross alpha/beta, gamma spectrometry, tritium, and I-129 (ICP 2005b). Iodine-129 and tritium were not detected in any well (tritium had not been detected since 2000 in any of the WAG 5 groundwater samples). None of the radionuclide analytes exceeded the EPA-defined MCLs for drinking water. Gross alpha and gross beta activities were at background concentrations.

Two analytes, Sb-125 and Ru-106, were detected in the gamma spectroscopy results for the FY 2005 sampling event. These detections were questionable because both were near the minimum detectable activities, both Sb-125 and Ru-106 have relatively short half-lives (2.77 years and 368.2 days, respectively), and no site activities have taken place in either the vicinity of the Auxiliary Reactor Area or CITRC in the last 20 years that could have contributed to the presence of these isotopes in the environment. In addition, neither of these isotopes has been detected historically in samples from these two wells. Following the recommendation made in the first 5-year review, sampling for radionuclides was discontinued after the FY 2005 groundwater sampling event.

6.6.1.4 Water-Level Measurement Results. Water levels were measured in June 2005 for the WAG 5 area (ICP 2005b). Similar to past WAG 5 groundwater level contour maps, the map for June 2005 data shows steep contours in the Power Burst Facility area with the direction of hydraulic

gradient somewhat counter to the regional south–southwest gradient (Figure 6-6). Groundwater-level measurements were discontinued after June 2005, as recommended in the first INL Site-wide 5-year review (DOE-ID 2007b).

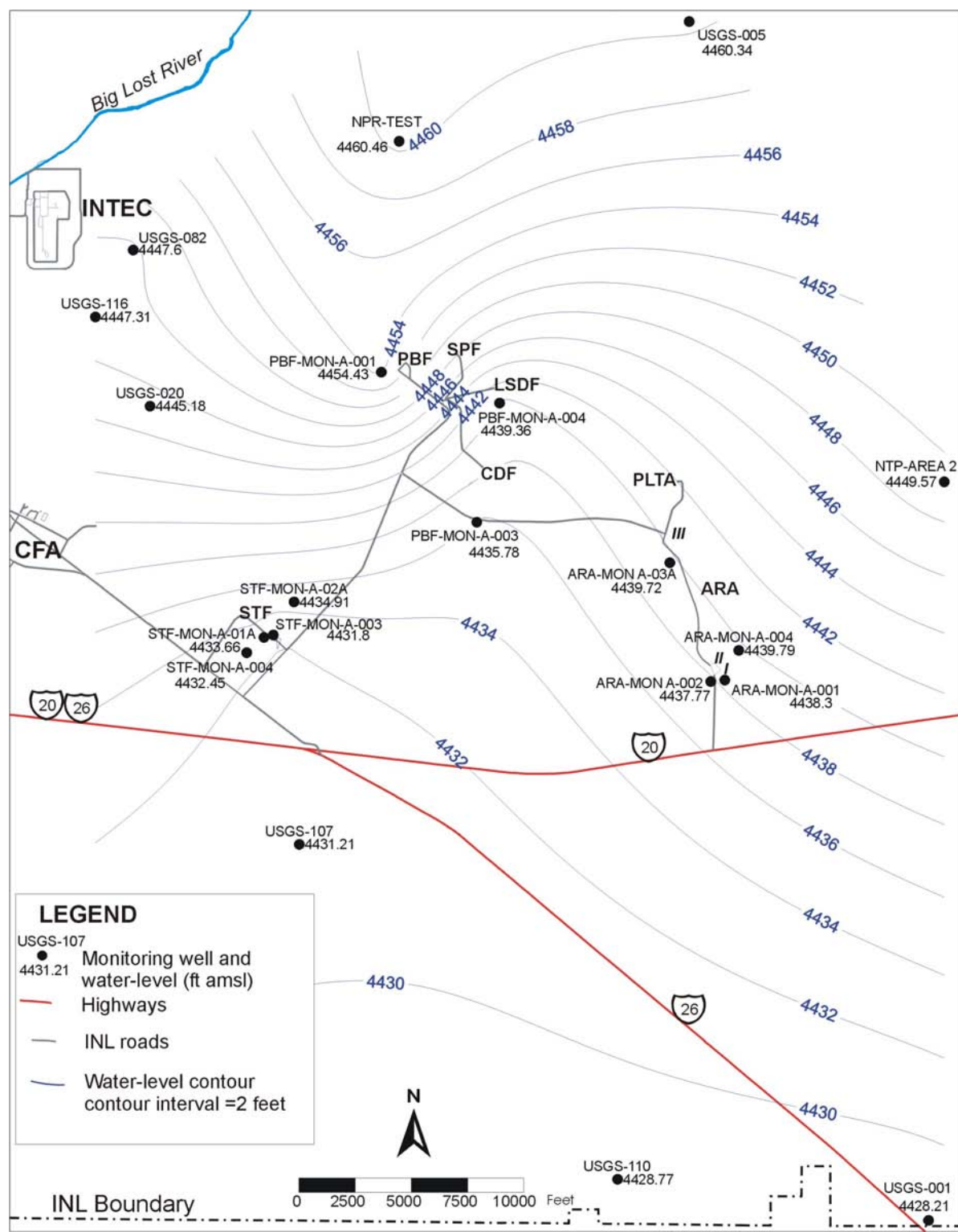


Figure 6-6. Waste Area Group 5 groundwater contour map (June 2005).

6.6.2 Site Inspections

As required by the INL Site-wide IC/O&M Plan (DOE-ID 2010), WAG 5 IC sites are inspected annually. Inspections provide a mechanism for determining whether ICs are functioning as intended and for identifying maintenance needs. They also provide information to aid in determining whether implemented remedies are functioning as intended. Site inspections include visual evaluations of the site conditions and documentation of conditions on inspection checklists, review of the site information in the IC database, and assessment of access controls (e.g., signs, markers, or fences). Depending on site-specific requirements, inspections may also include an evaluation of vegetative growth, examination for intrusion and subsidence, or performance of radiological surveys.

Inspection results are presented in the annual ICs and O&M reports for 2005 (DOE-ID 2005d, e), 2006 (DOE-ID 2006b, c), 2007 (DOE-ID 2007c, d), 2008 (RPT-544), and 2009 (RPT-672). Fourteen institutionally controlled sites are located within WAG 5, one of which (PBF-38) is administratively assigned to WAG 10. In May 2009, the status and condition of ICs were assessed as part of the annual IC reviews.

The 2009 perimeter surveys of ARA-06 and ARA-23 were completed on July 14, 2009. Similar to past surveys, results of the 2009 scan indicate radiation levels less than 50 $\mu\text{rem}/\text{hour}$ at all points surveyed (RPT-672). Results ranged between 8 and 15 $\mu\text{rem}/\text{hour}$. These results indicate that the radiological contamination is at acceptable levels, and no corrective actions are required.

6.7 Technical Assessment

The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. Remedial actions implemented at WAG 5 are functioning as intended. Groundwater monitoring results show that all COC concentrations are below regulatory action levels. The 2009 perimeter radiation survey of Sites ARA-06 and ARA-23 indicates that radiation levels are acceptable, and contamination does not appear to be spreading. At sites where contaminant concentrations prohibit free-release of the site, ICs are in place and effective.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

Yes. Original assumptions, cleanup levels,^a and RAOs used at the time of the remedy selection are still valid.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

Technical Assessment Summary

Remedial actions have been completed at the Auxiliary Reactor Area and the Power Burst Facility CERCLA sites. Based on available data, the remedial actions at the sites were successful, and the remedies are functioning as intended. Exposure assumptions, toxicity data, cleanup levels, and

a. The Cs-137 soil concentration equivalent to a $1\text{E-}4$ risk level changed from 2.3 pCi/g to 6 pCi/g. Therefore, prior remedial actions using the lower soil action level remain conservatively protective.

RAOs used at the time of the remedy selections are still valid, and no new information has come to light that could call into question the protectiveness of the remedies. ICs have been implemented and are functioning as required at the required sites within WAG 5.

6.8 Issues and Recommendations

No issues were identified during this 5-year review of the remedial actions conducted at WAG 5; therefore, recommendations are not necessary.

6.9 Protectiveness Statement for Operable Unit 5-12

The remedy at OU 5-12 is protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled. Remediation has been completed at all WAG 5 sites, and remedies are functioning as intended.

6.10 Summary and Conclusions

WAG 5 includes the Auxiliary Reactor Area and CITRC. Remedial actions have been completed at WAG 5, with the only ongoing response consisting of IC/O&M under the OU 5-12 O&M Plan for the Power Burst Facility and the Auxiliary Reactor Area (DOE-ID 2000b) and the INL Site-wide IC/O&M Plan (DOE-ID 2010). Surveys and annual inspections show that remedies are in place and functioning as intended. No issues were identified.

Because remedial actions at all OUs in WAG 5 are protective, the site is protective of human health and the environment. Remediation has been completed at all WAG 5 sites, and the remedies are functioning as intended.

WAG 5 includes the Stationary Low-Power Reactor No. 1 burial ground (containment remedy) and several other sites that must remain under ICs; therefore, 5-year statutory reviews will be required indefinitely. The next 5-year review is expected to cover the period from 2010 through 2014.

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7. WASTE AREA GROUP 6—BOILING-WATER REACTOR EXPERIMENT AND EXPERIMENTAL BREEDER REACTOR I

7.1 Introduction

Experimental Breeder Reactor I (EBR-I) was established in the early 1950s to test the theory that a reactor could produce more fuel than it uses and became the first reactor to generate electricity. In 1953, tests conducted at EBR-I proved that a reactor could create more fuel than it used, even while it created electricity. In 1963, reactor operations at EBR-I ceased. In 1966, EBR-I was dedicated as a Registered National Historic Landmark, and, since 1975, the facility has been open for guided tours during the summer months.

Less than a mile from EBR-I, at the Boiling-Water Reactor Experiment (BORAX) area, five reactor experiments were conducted between 1953 and 1964. These experiments began with BORAX I, which was used to demonstrate the feasibility of boiling water reactors. The BORAX I reactor was intentionally destroyed in 1954 to determine its inherent safety under extreme conditions. It was then buried in place.

In late 1954, another BORAX facility was constructed a few hundred feet northeast of BORAX I. Over the next 10 years, three reactors (BORAX II, BORAX III, and BORAX IV) shared the same reactor vessel, but the experiments used different fuel designs and core configurations. The BORAX V reactor also shared the same facility but used a new reactor vessel and core system.

Past operations and support activities at the EBR-I and BORAX areas released radioactive contamination. To facilitate cleanup of the contamination, EBR-I and BORAX were designated as WAG 6, in accordance with the FFA/CO (DOE-ID 1991). Because they are located within 1 mile of each other and have similar operational backgrounds and sources of contamination, the WAG 6 boundary encompasses both facilities and the immediately adjacent surface and subsurface areas.

7.2 Site Chronology

EBR-I construction was completed in 1951 and operations ended in 1963. The first BORAX reactor was constructed in 1953, and the last BORAX operations ended in 1964. Table 7-1 provides a chronology of significant documents and events for EBR-I and BORAX.

Table 7-1. Chronology of significant documents and events for Waste Area Group 6.

Date	Document or Event
March 1995	<i>Remedial Investigation/Feasibility Study Report for Operable Units 5-05 and 6-01 (SL-1 and BORAX-I Burial Grounds)</i> (INEL 1995a)
June 1995	<i>Engineering Evaluation/Cost Analysis for Operable Unit 10-06 Radionuclide-Contaminated Soils Removal Action at the Idaho National Engineering Laboratory</i> (INEL 1995b)
September 18, 1995	Completed BORAX-08 NTCRA fieldwork
January 1996	<i>Record of Decision Stationary Low-Power Reactor-1 and Boiling Water Reactor Experiment-I Burial Grounds (Operable Units 5-05 and 6-01), and 10 No Action Sites (Operable Units 5-01, 5-03, 5-04, and 5-11)</i> (INEL 1996a)

Table 7-1. (continued).

Date	Document or Event
March 1996	<i>Stationary Low Power Reactor-1 and Boiling Water Reactor Experiment-I Burial Grounds Engineered Barriers Remedial Design/Remedial Action Scope of Work, Operable Units 5-05 and 6-01 (INEL 1996b)</i>
April 1996	<i>Stationary Low-Power Reactor-1 and Boiling Water Reactor Experiment-I Burial Grounds Engineered Barriers Remedial Design/Remedial Action Work Plan, Operable Unit 5-05/6-01 (DOE-ID 1996)</i>
May 1997	Decommissioned, removed, and contained BORAX V
1997	Completed BORAX I remedial action
October 1997	<i>Remedial Action Report OU 5-05 Stationary Low-Power Reactor No. 1 and OU 6-01 Boiling Water Reactor Experiment-I Burial Grounds Engineered Barriers (DOE-ID 1997)</i>
August 2001	<i>Comprehensive Remedial Investigation/Feasibility Study for Waste Area Groups 6 and 10 Operable Unit 10-04 (DOE-ID 2001)</i>
November 2002	<i>Record of Decision Experimental Breeder Reactor-I/Boiling Water Reactor Experiment Area and Miscellaneous Sites, Operable Units 6-05 and 10-04 (DOE-ID 2002)</i>
February 2003	<i>Operable Units 6-05 and 10-04, Experimental Breeder Reactor-I/Boiling Water Reactor Experiment Area and Miscellaneous Sites, Remedial Design/Remedial Action Scope of Work (DOE-ID 2003)</i>
February 2004	<i>Remedial Design/Remedial Action Work Plan for Operable Units 6-05 and 10-04, Phase I (DOE-ID 2004a)</i>
June 2004	<i>INEEL Sitewide Institutional Controls Plan (DOE-ID 2004b)</i>
January 2005	<i>Remedial Action Report for Operable Units 6-05 and 10-04, Phase I (DOE-ID 2005a)</i>
October 2005	<i>Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory (DOE-ID 2007a)^a</i>
a. Revision 0 of the 5-year review was completed in October 2005. Subsequent revisions did not affect analysis of WAG 6.	
BORAX Boiling-Water Reactor Experiment NTCRA non-time-critical removal action	

7.3 Background

The EBR-I and BORAX areas are located close together and have similar operational histories and sources of contamination (Figure 1-1 and Figure 7-1). Therefore, EBR-I and BORAX areas were consolidated into one WAG (WAG 6) for comprehensive evaluation (DOE-ID 1991).

7.3.1 Physical Characteristics

The EBR-I reactor building and the sites of the former BORAX reactors are located in the southwestern portion of the INL Site. The WAG 6 area is located on the Eastern Snake River Plain and is underlain by Big Lost River alluvial sediments overlying basalt bedrock. The depth to basalt beneath the area ranges from 18 to 40 m (60 to 130 ft), and the depth to groundwater is approximately 163 to 183 m (550 to 600 ft). In addition to the surficial alluvium, the vadose zone includes thick sequences of interfingering basalt flows and thinner sedimentary interbeds. The SRPA underlies the entire area. The SRPA consists of a series of water-saturated basalt flows and interlayered pyroclastic and sedimentary

deposits. Groundwater flows to the south–southwest. No surface water features lie in the immediate vicinity of WAG 6; the channel of the Big Lost River (normally dry) lies approximately 2.4 km (1.5 miles) to the northwest of the area.



Figure 7-1. Aerial photographs of Experimental Breeder Reactor I before and after decommissioning and the Boiling-Water Reactor Experiment area after decommissioning.

7.3.2 Land and Resource Use

WAG 6 is entirely contained within the INL Site. Land use at the site is described in Section 1.3.2. Land at the former BORAX reactor sites and associated WAG 6 areas is a restricted use area (DOE-ID 2010). The EBR-I reactor building is designated as a Registered National Historic Landmark open for public tours during the summer months.

7.3.3 History of Contamination

The intentional destruction of the BORAX I reactor in 1954 contaminated soil over an area 61×128 m (200×420 ft) extending southeast of the reactor (INEL 1996a). During decommissioning in 1955, the remaining aboveground structures were removed, and the reactor was buried in place. Following the initial cleanup, the area was covered with 15 cm (6 in.) of clean gravel. Subsequent soil sampling and radiation surveys showed radionuclides were present at activities above background levels, with Cs-137 being the predominant COC. Later in 1991, the FFA/CO designated this area as CERCLA Site BORAX-02 under OU 6-01 (DOE-ID 1991).

The BORAX II-V experiments were conducted from 1953 to 1964 at a newer facility located approximately 152 m (500 ft) northeast of the BORAX I site. The former BORAX II-V reactor site was designated as Site BORAX-09 under OU 6-01. In addition to the two former reactor sites, other CERCLA sites included underground storage tanks, septic systems, a leach pond, a ditch, and a trash dump that were associated with the BORAX reactor facilities (DOE-ID 2002).

The BORAX ditch (BORAX-08) was associated with the BORAX II-V Reactor Program that began in 1953. It was an unlined ditch approximately 477 m (1,565 ft) long and up to 15 m (50 ft) wide that received cooling water effluent from the BORAX II-V reactors (INEL 1995a). Radiological surveys indicated the soils in the ditch contained radioactive contamination up to 1,900 cpm, with levels decreasing with distance away from the reactors. The BORAX-08 and -09 sites, the BORAX ditch and the BORAX V reactor building, respectively, were added to WAG 6 after the FFA/CO was signed.

7.3.4 Initial Response

Prior to signing of the first ROD in 1996, several remedial actions had been performed. The BORAX I, II, III, and IV reactor fuels and vessel components were dispositioned by Argonne National Laboratory-West (now the Materials and Fuels Complex) personnel at the completion of each respective experiment. At the completion of the BORAX V experiments, all the reactor fuel and portions of the internal reactor were removed by Argonne National Laboratory-West personnel for dispositioning. Later, decommissioning actions removed the BORAX V aboveground facility structures, stabilized the remaining underground structures, filled the basement with soil, and replaced concrete foundation blocks over the basement. In 1985, the BORAX leach pond was filled with clean dirt, and all waste material was removed from the BORAX trash dump. Removal actions included remediating radionuclide-contaminated soil in the BORAX ditch and radionuclide-contaminated soil outside the EBR-I building in 1995. Other than fences, none of the aboveground structures related to BORAX remain, and all the underground storage tanks and septic systems have been removed (DOE ID 2002).

A 1995 NTRCA addressed radionuclide-contaminated soil under OU 10-06 at the EBR-15 site and the BORAX-08 ditch (Figure 7-2), as outlined in the *Engineering Evaluation/Cost Analysis for Operable Unit 10-06 Radionuclide-Contaminated Soils Removal Action at the Idaho National Engineering Laboratory* (INEL 1995b).

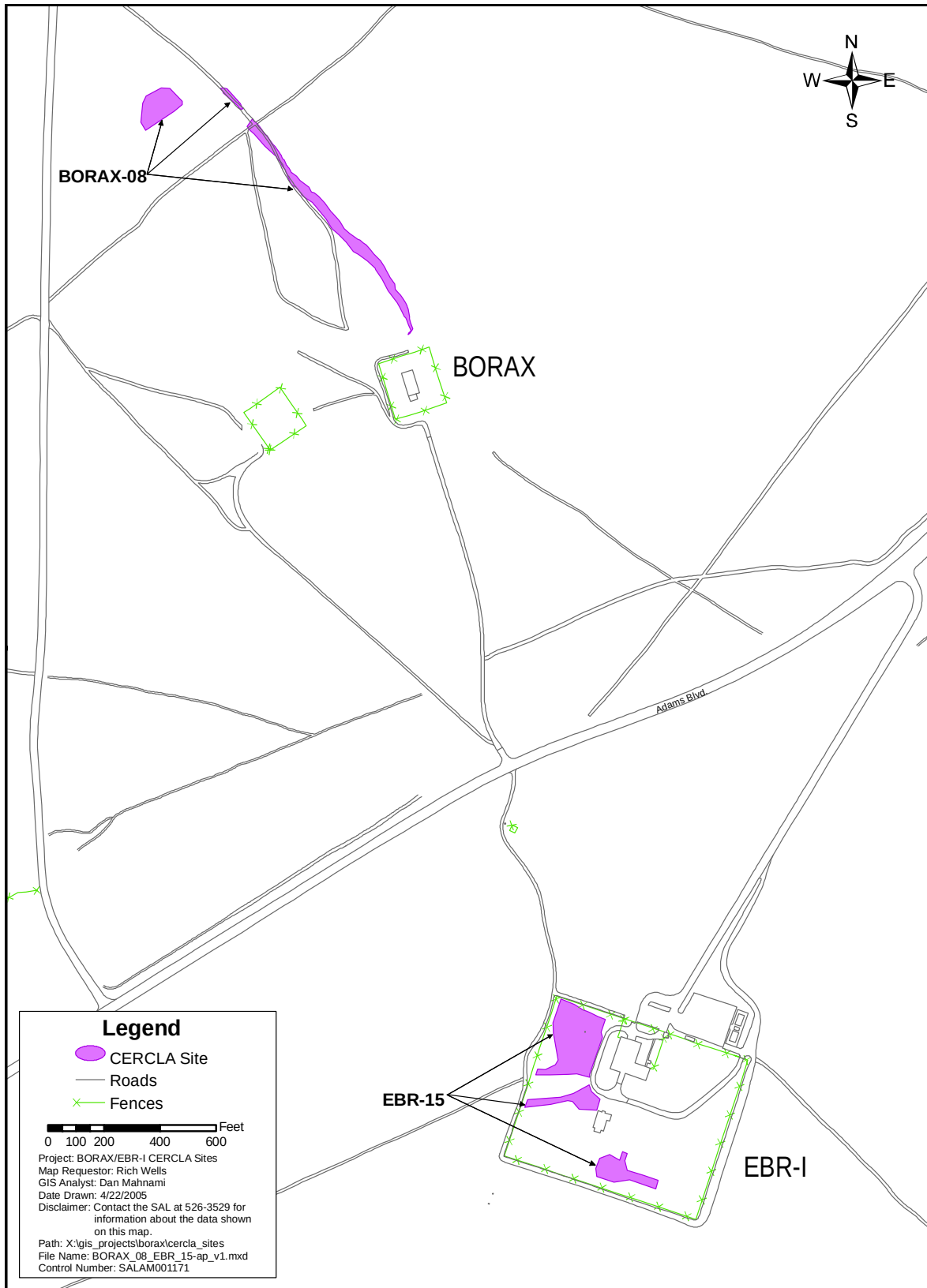


Figure 7-2. BORAX-08 and EBR-15.

7.3.5 Basis for Taking Action

The CERCLA sites related to BORAX include underground storage tanks, septic systems, a leach pond, a ditch, a trash dump, and two former reactor sites. The FFA/CO stated that the WAG 6 Comprehensive Remedial Investigation/Feasibility Study would be incorporated into the OU 10-04 Remedial Investigation/Feasibility Study (DOE-ID 1991). The Agencies issued two RODs for remedial actions at WAG 6 sites: one for OU 6-01 in January 1996 (INEL 1996a) and one for OU 6-05 and 10-04 in November 2002 (DOE-ID 2002).

The OU 6-01 ROD (INEL 1996a) focused on remediation of the BORAX I burial ground (designated as CERCLA site BORAX-02). This ROD required the consolidation of contaminated materials at the site of the original BORAX I reactor burial ground and construction of a human intrusion barrier over the site.

The second ROD for OUs 6-05 and 10-04 (DOE-ID 2002) provided for implementation of ICs at selected no further action sites at WAG 6. A Baseline Risk Assessment performed for OU 6-01 concluded that the BORAX I site posed an unacceptable risk to human health and the environment. Radionuclides were determined to be the only COCs, with external exposure to Cs-137 being the primary risk driver (DOE-ID 1996). The risk assessment assumed industrial land use for 100 years, after which time residential use was assumed to be possible. The OU 6-01 ROD selected containment and emplacement of an engineered cover as the preferred remedy for the BORAX I reactor burial ground (DOE-ID 1996). The ROD stated that the cover would need to remain in place for approximately 320 years to allow Cs-137 to decay away in place and further required that DOE would be responsible for establishing and maintaining land use and access restrictions for at least 100 years. In addition, associated contaminated surface soils that posed risk in excess of 1 in 10,000 were to be consolidated soils beneath the BORAX I engineered cover.

Following completion of the BORAX I remedial action in 1997, another risk assessment for WAG 6 sites was performed under OU 6-05 (DOE-ID 2003). The OU 6-01 Remedial Investigation/Feasibility Study had evaluated the human health risk at BORAX-02 only (reactor burial grounds) and did not evaluate the other associated BORAX release sites. As a result, the cumulative risk from all of the BORAX release sites had not been evaluated. In addition, the selected remedy for the site (i.e., the engineered barrier/cover) had not been completely evaluated for its protection of ecological receptors. Therefore, BORAX-02 was retained for evaluation in the OU 10-04 Remedial Investigation/Feasibility Study to support cumulative human health and ecological risk assessments for the entire BORAX facility.

7.4 Remedial Action

The OU 10-04 Comprehensive Remedial Investigation/Feasibility Study assessed cumulative risks from all the BORAX sites (DOE-ID 2001). This evaluation concluded that no action was necessary at most of the WAG 6 sites (BORAX-03 through -07, EBR-02 through -07, and EBR-09 through -15) but that Sites BORAX-01, -02, -08, -09, and EBR-08 required ICs to prevent potential external exposure to Cs-137. Because they are closely interrelated, remedial actions performed under OUs 6-01, 6-05, and 10-04 are discussed together below. Those sites where ICs are the only ongoing response are addressed in Section 10.5.

7.4.1 Remedy Selection

The *Comprehensive Remedial Investigation/Feasibility Study for Waste Area Groups 6 and 10 Operable Unit 10-04* (DOE-ID 2001) was incorporated into OU 10-04 in accordance with the FFA/CO (DOE-ID 1991). The OU 10-04 Remedial Investigation/Feasibility Study (DOE-ID 2001) evaluated 50 potential release sites, including 22 sites at WAG 6 (14 at EBR-I and 8 at BORAX). Figure 7-3 shows WAG 6 CERCLA sites. Except for the active septic system that supports the EBR-I National Historic Landmark, all tanks and inactive septic systems have been removed from the EBR-I area.

In December 1995, the Agencies signed the *Record of Decision Stationary Low-Power Reactor-1 and Boiling Water Reactor Experiment-I Burial Grounds (Operable Units 5-05 and 6-01), and 10 No Action Sites (Operable Units 5-01, 5-03, 5-04, and 5-11)* (INEL 1996a). The ROD required a selected remedy calling for containment by capping with an engineered, long-term barrier composed primarily of natural material. The ROD also established action levels for Cs-137 (16.7 pCi/g), U-235 (13.2 pCi/g), and Sr-90 (10.8 pCi/g).

The 1995 CERCLA NTCRA addressed radionuclide-contaminated soil under OU 10-06 at the radioactive soil contamination site (EBR-15 site) and the BORAX ditch (BORAX-08 site), as outlined in the Engineering Evaluation/Cost Analysis for OU 10-06 (INEL 1995b). Cleanup was based on a preliminary remediation goal concentration of 16.7 pCi/g for Cs-137 (INEL 1995b).

7.4.1.1 Remedial Action Objectives

7.4.1.1.1 BORAX I Burial Ground (BORAX-02 Site)—Results of the Remedial Investigation/Baseline Risk Assessment indicated that exposure to penetrating radiation from contaminated soils and materials within the burial ground presented the most significant future risk to human health. Therefore, the primary RAOs and the focus of the remedial action alternative development were to inhibit exposure to radioactive materials. The RAOs established for protection of human health were as follows:

- Inhibit exposure to radioactive materials that would result in a total excess cancer risk (for all contaminants) of greater than 1 in 10,000 to 1 in 1,000,000 (1E-04 to 1E-06)
- Inhibit ingestion of radioactive materials that would result in a total excess cancer risk (for all contaminants) of greater than 1 in 10,000 to 1 in 1,000,000 (1E-04 to 1E-06)
- Inhibit inhalation of suspended radioactive materials that would result in a total excess cancer risk (for all contaminants) of greater than 1 in 10,000 to 1 in 1,000,000 (1E-04 to 1E-06)
- Inhibit degradation of the burial ground that could result in exposure of buried waste or migration of contaminants to the surface that would pose a total excess cancer risk (for all contaminants) of greater than 1 in 10,000 to 1 in 1,000,000 (1E-04 to 1E-06).

The RAO for protection of the environment focuses on preservation of the local ecology by inhibiting the potential for contaminant migration. The RAO established for protection of the environment was to inhibit adverse effects to resident species from exposure to contaminants at the burial ground.

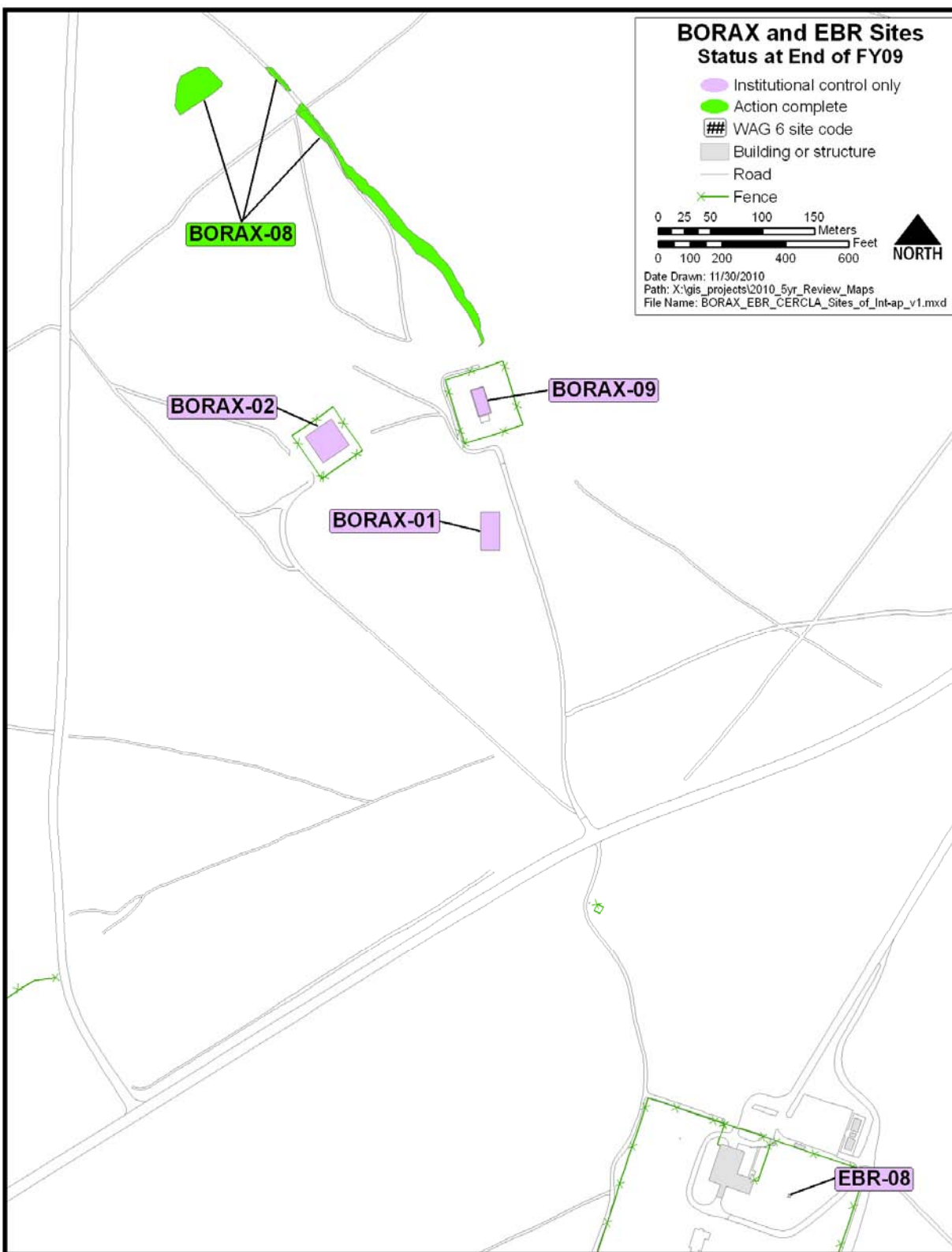


Figure 7-3. Waste Area Group 6 sites.

7.4.1.1.2 BORAX Ditch (BORAX-08 Site) and Radioactive Soil

Contamination at EBR-I (EBR-15 Site)—The RAOs for these sites were based on the results of the human health and ecological Baseline Risk Assessments and were specific to the COCs and exposure pathways identified for the sites. The RAOs for protecting the environment were not required for the radioactive soil contamination at EBR-I, because the area was found to be protective of the environment. The recommended RAOs are presented in Table 7-2.

Table 7-2. Remedial action objectives for the Boiling Water Reactor Experiment and Experimental Breeder Reactor non-time-critical removal action.

Site	Environmental Media	Remedial Action Objective
BORAX-08	Soil	Prevent direct exposure to radiation posing excess cancer risk levels of 1E-04 Prevent adverse effects to resident populations (as determined by the ecological risk assessment) from soil or air containing COCs from the BORAX ditch Limit release of metals from the site by migration caused by infiltrating precipitation Prevent erosion that might result in the release of contaminated soils Limit biotic intrusion into contaminated ditch soils that could facilitate erosion or the release of contaminated soil
	Groundwater	Prevent ingestion of groundwater in excess of maximum contaminant levels and a total cancer risk of 1E-04 for metals only
EBR-15	Soil	Prevent direct exposure to radiation posing excess cancer risk levels of 1E-04
	Groundwater	Prevent ingestion of groundwater posing excess cancer risk levels of 1E-04 to 1E-06
	Food crops	Prevent ingestion of contaminated food crops posing excess cancer risks of 1E-04 (Areas B, 7, 8, 9, 11a, and 11b)
BORAX COC	Boiling Water Reactor Experiment contaminant of concern	

7.4.1.2 Cleanup Levels. Table 7-3 summarizes the COCs and remediation goals for the WAG 6 sites where a remedial action was performed.

Table 7-3. Contaminants of concern at Waste Area Group 6.

Site (Site Code)	Contaminant of Concern	Concentration	Remediation Goal
BORAX I Burial Ground (BORAX-02)	Cs-137	95% UCL—1,817 pCi/g	16.7 pCi/g
	Sr-90	95% UCL—2.0 pCi/g	10.8 pCi/g
	U-235	95% UCL—68.6 pCi/g	13.2 pCi/g
BORAX Ditch (BORAX-08)	Cs-137	Maximum—2,130 pCi/g	16.7 pCi/g
Radioactive Soil Contamination at EBR-I (EBR-15)	Cs-137	Maximum—14,600 pCi/g	16.7 pCi/g
BORAX EBR UCL	Boiling-Water Reactor Experiment Experimental Breeder Reactor upper confidence limit		

7.4.2 Remedy Implementation

7.4.2.1 BORAX I Burial Ground (BORAX-02 Site). The remedial action for the burial ground was performed in accordance with the requirements delineated in the Stationary Low-Power Reactor-1 and Boiling Water Reactor Experiment-I Burial Grounds Engineered Barriers Project Remedial Design/Remedial Action Work Plan, Operable Unit 5-05/6-01 (DOE-ID 1996). The remedial action began in July 1996 with the removal of all shrubs, roots, signs, fencing, and other debris from the contaminated area for consolidation on top of the original 30- × 30-m (100- × 100-ft) burial ground and included the following additional actions:

- Excavated soil areas with radionuclide contamination exceeding the action levels to a depth of 1 ft
- Placed clean fill over the original burial ground in 6-in. lifts
- Constructed a human intrusion barrier consisting of basalt riprap over the consolidated soils
- Installed a chain-link fence around the burial ground with “Keep Out” and CERCLA identification signs
- Installed two granite monuments to warn potential future intruders.

Remedial Action Report OU 5-05 Stationary Low-Power Reactor No. 1 and OU 6-01 Boiling Water Reactor Experiment-I Burial Grounds Engineered Barriers (DOE-ID 1997) documents results of the remedial action.

The Cs-137 analytical results for the excavated areas had a mean of 1.43 pCi/g with a 95% upper confidence limit of 7.2 pCi/g based on a gamma distribution of the data. Only one of the zones requiring excavation exceeded the remediation goal for U-235 with a concentration of 15 pCi/g. After excavation, the maximum concentration was 8.2 pCi/g. The Sr-90 concentrations for the excavated areas ranged from 0.9 to 85 pCi/g with an average of 12.4 pCi/g and a median of 1.3 pCi/g. The 95% Chebyshev upper confidence limit for the Sr-90 data set is 52.2 pCi/g, which exceeds the remediation goal. The data set is largely skewed because of the single high data point of 85 pCi/g. If this point is omitted from consideration, the minimum remains 0.9 pCi/g with a maximum of 8.1 pCi/g, an average of 3.35 pCi/g, and a median of 1.25 pCi/g. The 95% Chebyshev upper confidence limit for this modified data set is 8.23 pCi/g, which is within the specified remediation goal.

7.4.2.2 BORAX Ditch (BORAX-08 Site) and Radioactive Soil Contamination at EBR-I (EBR-15 Site). The total volume of soil excavated from the EBR-15 site was 1,280 yd³ with an average excavation depth of 12.5 in. The radionuclide-contaminated soil was transported in covered dump trucks to the ATR Complex (formerly the Test Reactor Area) warm waste pond for disposal. The total volume excavated from the BORAX-08 site was 1,180 yd³, focusing on Cs-137 as the COC with a preliminary remediation goal of 16.7 pCi/g. This radionuclide-contaminated soil was also disposed of in the ATR Complex warm waste pond.

The verification sampling data provided in the *Comprehensive Remedial Investigation/Feasibility Study for Waste Area Groups 6 and 10 Operable Unit 10-04* (DOE-ID 2001) showed the residual Cs-137 concentrations at the BORAX-08 site ranged from 0.1 to 8.1 pCi/g, with an average concentration of 1.2 pCi/g and a 95% upper confidence limit concentration of 2.75 pCi/g based on a gamma distribution for the data set. Analyses were completed in September 1995; therefore, the decay-corrected 95% upper confidence limit concentration for Cs-137 is 1.99 pCi/g. The revised preliminary remediation goals as provided by the EPA and presented in Appendix F give the latest Cs-137 concentration required for free-release as 6 pCi/g, suggesting ICs may be terminated at BORAX-08.

For the EBR-15 site, the residual Cs-137 concentrations ranged from less than the 0.1-pCi/g detection limit to a maximum of 11.3 pCi/g, with an average concentration of 1.65 pCi/g and a 95% upper confidence limit concentration of 3.34 pCi/g based on a gamma distribution for the data set. Analyses were completed in October 1995; therefore, the decay-corrected concentration for Cs-137 is 2.42 pCi/g. Similar to the BORAX-08 site, the 95% upper confidence limit Cs-137 of 3.34 pCi/g is less than the free-release concentration of 6 pCi/g, suggesting ICs may be terminated at EBR-15.

7.4.3 Operations and Maintenance

Personnel maintain monuments and signage per the INL Site-wide IC/O&M Plan (DOE-ID 2010). Annual inspections are conducted, and the INL Site-wide ICs and O&M annual reports discuss results (DOE-ID 2005b, 2006a, 2007b; RPT-544; RPT-672). O&M requirements include inspections for animal intrusions, subsidence, erosion, and vegetative growth.

O&M requirements are applicable at five WAG 6 sites: BORAX-01, BORAX-02, BORAX-08, BORAX-09, and EBR-08. The 2009 inspections revealed the ICs at the BORAX and EBR-I sites to be functioning as intended. Warning signs at IC sites were all present, in good condition, and posted as required.

At BORAX-01 and BORAX-02 sites, permanent markers are present as required. Markers are in good condition, clearly legible, and correctly located. Site coordinates were reviewed and found to be complete (RPT-672). No deficiencies were noted, and no corrective actions are required.

7.5 Progress Since the Last Review

The previous 5-year review identified no issues for WAG 6.

7.6 Data Review and Evaluation

7.6.1 Groundwater Monitoring

Groundwater monitoring in the vicinity of WAG 6 is conducted in accordance with the WAG 10 Site-wide monitoring requirements, as discussed in Section 10. Independent groundwater monitoring is not performed for WAG 6.

7.6.2 Site Inspections

As required by the Site-Wide IC/O&M Plan (DOE-ID 2010), personnel conduct annual site inspections at WAG 6 IC sites. Inspections determine if ICs are functioning as intended and identify maintenance needs. They also help determine if implemented remedies are functioning as intended. Site inspections include visually evaluating site conditions and documenting conditions on inspection checklists, reviewing site information in the IC database, evaluating wellhead security measures, and assessing access controls, such as signs and markers. Annual ICs and O&M reports document findings of the annual site inspections as follows: 2004 (DOE-ID 2004c, 2005c), 2005 (DOE-ID 2005b, d), 2006 (DOE-ID 2006a, b), 2007 (DOE-ID 2007b, c), 2008 (RPT-544), and 2009 (RPT-672).

Five IC sites are located within BORAX/EBR-I and assigned to WAG 6 for administrative control. WAG 6 annual inspections found site conditions to be acceptable, and the engineered covers and ICs are functioning as intended.

7.7 Technical Assessment

The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. The engineered cover is intended to provide shielding from ionizing radiation, prevent human intrusion, and contain the contaminated surface soils. The annual inspections validated the structural integrity of the cover. The remedy and protective measures implemented at the BORAX I burial ground (CERCLA site BORAX-02) are functioning as intended. The ICs required in the OU 6-05 ROD (DOE-ID 2002) are functioning as required at Sites BORAX-01, BORAX-02, BORAX-08, BORAX-09, and EBR-08.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?

Yes.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

Technical Assessment Summary

Remedial actions have been completed at the BORAX I burial ground, the BORAX ditch, and the radioactive soil contamination area at EBR-I. Based on the available data, the remedial actions at the sites were successful, and the remedies are functioning as intended. The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selections are still valid, and no new information has come to light that could call into question the protectiveness of the remedies. ICs have been implemented and are functioning as required at the five required sites within WAG 6.

7.8 Issues

No issues were identified during the 5-year review of the remedial actions conducted at WAG 6.

7.9 Recommendations and Follow-Up Actions

This review did not identify any issues; therefore, there are no recommendations or follow-up actions.

7.10 Protectiveness Statement for Waste Area Group 6

Because the remedial actions at all OUs in WAG 6 are protective, the site is protective of human health and the environment. Those sites with containment remedies or that require ICs are maintained and managed in accordance with the INL Site-wide IC/O&M Plan (DOE-ID 2010).

7.11 Summary and Conclusions

Past operations and support activities at the EBR-I and BORAX areas released radioactive contamination. To facilitate cleanup of the contamination, EBR-I and BORAX were designated as WAG 6, in accordance with the FFA/CO (DOE-ID 1991). Because they are located within 1 mile of each other and have similar operational backgrounds and sources of contamination, the WAG 6 boundary encompasses both facilities and the immediately adjacent surface and subsurface areas.

The OU 10-04 Comprehensive Remedial Investigation/Feasibility Study assessed cumulative risks from all the BORAX sites (DOE-ID 2001). This evaluation concluded that no actions were necessary at most of the WAG 6 sites (BORAX-03 through -07, EBR-02 through -07, and EBR-09 through -15) but that Sites BORAX-01, -02, -08, -09, and EBR-08 required ICs to prevent potential external exposure to Cs-137.

Remedial actions have been completed at the BORAX I burial ground, the BORAX ditch, and the radioactive soil contamination area at EBR-I. Based on the available data, the remedial actions at the sites were successful, and the remedies are functioning as intended.

No issues were identified in this evaluation or in the previous 5-year review; therefore, there are no recommendations for follow-up actions.

Because the remedial actions at all OUs in WAG 6 are protective, the site is protective of human health and the environment. Remediation has been completed at all WAG 6 sites. The remedies are functioning as intended and are expected to be protective of human health and the environment. Those sites that do not qualify for unrestricted land use are managed under the INL Site-wide IC/O&M Plan (DOE-ID 2010) in accordance with requirements.

Because WAG 6 includes sites with containment remedies, 5-year statutory reviews will be required indefinitely. The next 5-year review is expected to cover the period from 2010 through 2014.

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8. WASTE AREA GROUP 7—RADIOACTIVE WASTE MANAGEMENT COMPLEX

8.1 Introduction

The FFA/CO (DOE-ID 1991) defines WAG 7 as the Radioactive Waste Management Complex (RWMC). WAG 7 originally contained 14 OUs. This is the first 5-year review since the ROD for RWMC OU 7-13/14 (DOE-ID 2008a) was published. Because the OU 7-13/14 ROD either eliminated or incorporated all OUs for WAG 7, evaluation of protectiveness in this 5-year review considers all of WAG 7 as OU 7-13/14; individual OUs are no longer assessed separately.

Construction of the OU 7-13/14 selected remedy will culminate in approximately 2028 with completion of an evapotranspiration surface barrier over the SDA (see Figure 8-1). Long-term management and controls will be established and maintained following construction to ensure that the remedy remains protective. Subsections that follow address ongoing components of the selected remedy and show that remedial actions at RWMC are functional and effective.

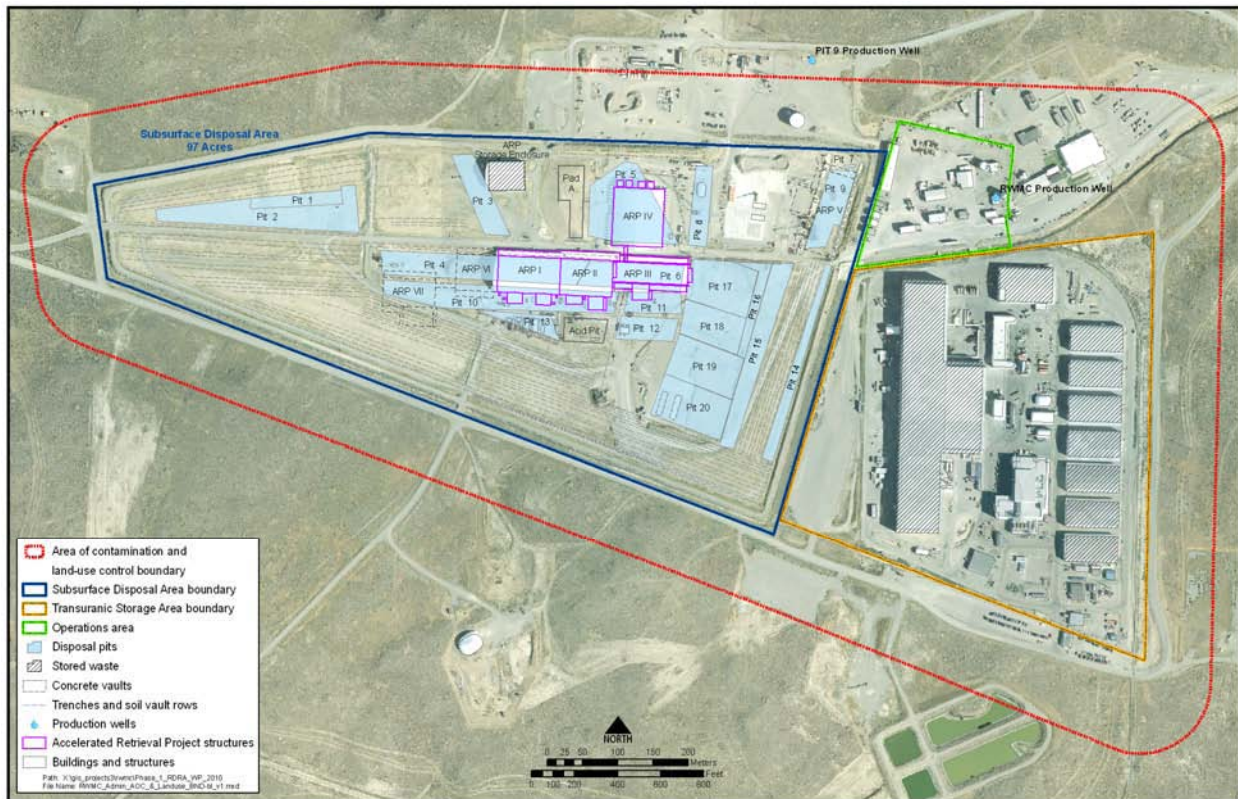


Figure 8-1. Photograph of the Radioactive Waste Management Complex.

8.2 Site Chronology

WAG 7 has been the subject of many investigations and cleanup actions. This extensive body of information is summarized and referenced in the Remedial Investigation/Baseline Risk Assessment for OU 7-13/14 (Holdren et al. 2006) and the Feasibility Study for OU 7-13/14 (Holdren, Bechtold, and Preussner 2007), which are available in the Administrative Record. Several cleanup actions were initiated

under earlier RODs and NTCRA. The previous INL Site-wide 5-Year Review of CERCLA Response Actions (DOE-ID 2007a) evaluated three earlier RODs for WAG 7. Though the OU 7-13/14 ROD superseded those RODs, the selected remedy was founded on the earlier work. Table 8-1 highlights the chronology of significant documents and events relating to major components of the selected remedy in the OU 7-13/14 ROD (DOE-ID 2008a). Previous 5-year reviews listed in Table 8-1 provide more complete chronologies of work performed under the three now-obsolete RODs.

Table 8-1. Chronology of significant documents and events for Waste Area Group 7.

Date	Document or Event
October 1993	<i>Record of Decision Declaration for Pit 9 at the Radioactive Waste Management Complex Subsurface Disposal Area at the Idaho National Engineering Laboratory (DOE-ID 1993)</i>
January 1994	<i>Record of Decision Declaration for Pad A at the Radioactive Waste Management Complex Subsurface Disposal Area at the Idaho National Engineering Laboratory (DOE-ID 1994a)</i>
December 1994	<i>Record of Decision Declaration for Organic Contamination in the Vadose Zone Operable Unit 7-08 Idaho National Engineering Laboratory Radioactive Waste Management Complex Subsurface Disposal Area (DOE-ID 1994b)</i>
January 1995	<i>Explanation of Significant Differences for the Pit 9 Interim Action Record of Decision at the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory (DOE-ID 1995)</i>
August 1995	<i>Scope of Work for Operable Unit 7-13/14 Waste Area Group 7 Comprehensive Remedial Investigation/Feasibility Study (Huntley and Burns 1995)</i>
October 1995	<i>Settlement Agreement, State of Idaho, Department of Energy, and Department of the Navy, to resolve all issues in Public Service Co. of Colorado v. Batt (U.S. District Court 1995)</i>
January 1996	Began OCVZ operations
May 1996	<i>Work Plan for Operable Unit 7-13/14 Waste Area Group 7 Comprehensive Remedial Investigation/Feasibility Study (Becker et al. 1996)</i>
September 1997	<i>Revised Scope of Work for Operable Unit 7-13/14 Waste Area Group 7 Comprehensive Remedial Investigation/Feasibility Study (INEEL 1997)</i>
December 1997	“Two-Year Review, Idaho National Engineering Laboratory, Pad A, Subsurface Disposal Area, Operable Unit 7-12” (Wilkening 1997; Koch 1997)
August 1998	<i>Addendum to the Work Plan for the Operable Unit 7-13/14 Waste Area Group 7 Comprehensive Remedial Investigation/Feasibility Study (DOE-ID 1998a)</i>
August 1998	<i>Interim Risk Assessment and Contaminant Screening for the Waste Area Group 7 Remedial Investigation (Becker et al. 1998)</i>
September 1998	<i>Explanation of Significant Differences for the Pit 9 Interim Action Record of Decision at the Radioactive Waste Management Complex at the Idaho National Engineering and Environmental Laboratory, (DOE-ID 1998b)</i>
April 2002	<i>Agreement to Resolve Disputes, the State of Idaho, United States Environmental Protection Agency, United States Department of Energy (DOE 2002)</i>
September 2002	<i>Ancillary Basis for Risk Analysis of the Subsurface Disposal Area (Holdren et al. 2002)</i>

Table 8-1. (continued).

Date	Document or Event
December 2002	<i>Preliminary Evaluation of Remedial Alternatives for the Subsurface Disposal Area</i> , (Zitnik et al. 2002)
February 2003	<i>Second Revision to the Scope of Work for Operable Unit 7-13/14 Waste Area Group 7 Comprehensive Remedial Investigation/Feasibility Study</i> (Holdren and Broomfield 2003)
August 2003	<i>U.S. Environmental Protection Agency Region 10 Office of Environmental Cleanup Five Year Review—Idaho National Engineering and Environmental Laboratory Subsurface Disposal Area Organic Contamination in the Vadose Zone Operable Unit 7-08</i> , (Gearheard 2003)
September 2003	<i>Five-Year Review Report for OU 7-12 (Pad A) Idaho National Engineering and Environmental Laboratory</i> (Poeton 2003)
February 2004	Completed Glovebox Excavator Method retrieval
March 2004	Started construction of Retrieval Enclosure 1 (WMF-697)
April 2004	Completed replacing the three original OCVZ treatment units
July 2004	<i>Action Memorandum for the OU 7-13/14 Early Actions Beryllium Encapsulation Project</i> (Lopez 2004)
August 2004	<i>Action Memorandum for Accelerated Retrieval of a Described Area within Pit 4</i> (DOE-ID 2004a)
August 2004	<i>Second Addendum to the Work Plan for OU 7-13/14 Waste Area Group 7 Comprehensive Remedial Investigation/Feasibility Study</i> (Holdren and Broomfield 2004)
September 2004	Completed construction of Retrieval Enclosure 1 (WMF-697)
September 2004	<i>Action Memorandum for the OU 7-13/14 Early Actions Beryllium Encapsulation Project</i> (Lopez et al. 2005)
January 2005	Started ARP I retrieval operations
March 2005	Started construction of Retrieval Enclosure 2 (WMF-1612)
October 2005 ^a	<i>Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory</i> (DOE-ID 2007a) ^a
April 2006	<i>Action Memorandum for the Accelerated Retrieval Project II within Pits 4 and 6 of the Subsurface Disposal Area</i> (DOE-ID 2006a)
May 2006	<i>Remedial Investigation and Baseline Risk Assessment for Operable Unit 7-13/14</i> (Holdren et al. 2006)
May 2007	<i>Feasibility Study for Operable Unit 7-13/14</i> (Holdren, Bechtold, and Preussner 2007)
May 2007	Started construction of Retrieval Enclosure 3 (WMF-1614)
June 2007	Completed construction of Retrieval Enclosure 2 (WMF-1612)
August 2007	Started ARP II retrieval operations
October 2007	<i>Proposed Plan for Radioactive Waste Management Complex Operable Unit 7-13/14</i> (DOE-ID 2007b)

Table 8-1. (continued).

Date	Document or Event
May 2008	Completed ARP I targeted waste retrieval
July 2008	<i>Agreement to Implement U.S. District Court Order Dated May 25, 2006</i> (U.S. District Court 2008)
July 2008	<i>Action Memorandum for the Accelerated Retrieval Project III within Pit 6 of the Subsurface Disposal Area</i> (DOE-ID 2008b)
September 2008	<i>Record of Decision for Radioactive Waste Management Complex Operable Unit 7-13/14</i> (DOE-ID 2008a)
December 2008	<i>Remedial Design/Remedial Action Scope of Work for Radioactive Waste Management Complex Operable Unit 7-13/14</i> (DOE-ID 2008c)
December 2008	Started ARP III retrieval operations
August 2009	Completed ARP II targeted waste retrieval
August 2009	<i>Phase 1 Remedial Design/Remedial Action Work Plan for Operable Unit 7-13/14</i> (DOE-ID 2010a)
November 2009	<i>Operable Unit 7-13/14 Operations and Maintenance Plan</i> (Lopez et al. 2009)
March 2010	<i>Phase 1 Interim Remedial Action Report for Operable Unit 7-13/14 Targeted Waste Retrievals</i> (DOE-ID 2010b) ^b
a. Revision 0 of the 5-year review was completed in October 2005. Subsequent revisions did not affect analysis of WAG 7. b. The first version (i.e., Rev. 0) of the Interim Remedial Action Report addresses completion of ARPs I and II, which were completed within the timeframe addressed in this 5-year review. The report will be revised following completion of each subsequent retrieval area. ARP Accelerated Retrieval Project OCVZ organic contamination in the vadose zone WAG waste area group	

8.3 Background

RWMC occupies about 177 acres divided into three areas: the Transuranic Storage Area, the SDA, and an administrative and operational support area (Figure 8-1). The Transuranic Storage Area is a 58-acre facility used since 1970 for management of retrievably stored transuranic waste. Current operations include examining, preparing, and shipping transuranic waste for disposal outside the State of Idaho. The SDA is a 97-acre shallow landfill for disposal of radioactive waste. Landfill operations began in 1952; current waste disposal operations are limited to remote-handled low-level waste in a set of concrete vaults. The administrative and operational support area occupies an additional 22 acres. In addition to the surface area occupied by RWMC, WAG 7 includes underlying media (i.e., vadose zone and aquifer) to the extent that those media are affected by RWMC and its sources of contamination.

Background information for the INL Site and RWMC is taken from the OU 7-13/14 ROD (DOE-ID 2008a). Sections 8.3.1 through 8.3.3 summarize physical characteristics, land and resource use, and the history of contamination associated with waste buried in the SDA; Section 8.3.4 describes initial response actions completed under CERCLA to date; and Section 8.3.5 summarizes the basis for taking action at WAG 7.

8.3.1 Physical Characteristics

The INL Site region is classified as arid to semiarid because of its low average rainfall of 22 cm (8.7 in.) per year. The Big Lost River, which flows intermittently, depending on weather and the amount of water diverted for irrigation, traverses the western part of the INL Site. RWMC has no permanent surface water features, and local surface water conditions are not influenced by the Big Lost River.

The relatively dry region between the surface and the aquifer, referred to as the vadose zone, is a thick sequence of basalt flows and layers of sediment called interbeds. The vadose zone and its interbeds are important features because they tend to filter contaminants and inhibit transport to the underlying aquifer. Seven major interbeds underlie RWMC. The three uppermost interbeds, known as the A-B, B-C, and C-D interbeds (Figure 8-2), are the best defined and used to define sampling zones for the purpose of interpreting monitoring data. Each interbed contains gaps, though no gaps have been identified in the C-D interbed under RWMC or the immediate vicinity outside RWMC. Perched water—moisture that accumulates (i.e., perches) above a low-permeability layer (e.g., an interbed) in the vadose zone—is observed rarely in three wells at the B-C interbed and consistently in two locations at the C-D interbed.

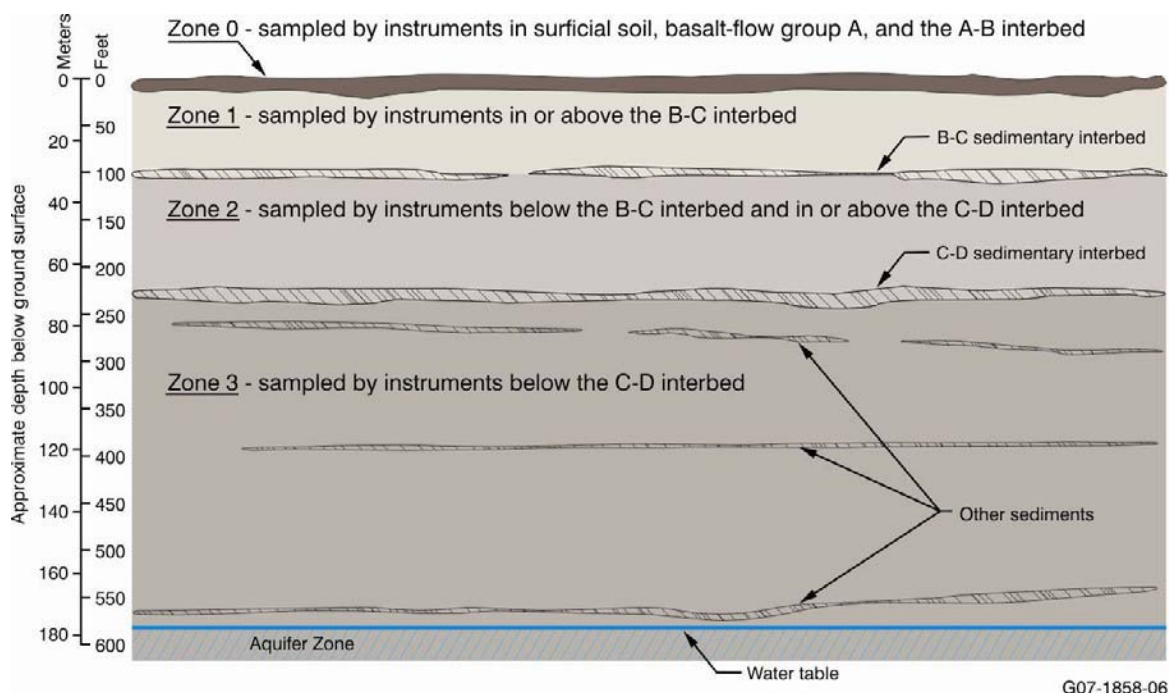


Figure 8-2. Generalized lithology beneath the Radioactive Waste Management Complex.

Beneath the vadose zone at RWMC, at approximately 177 m (580 ft) bgs, the SRPA flows generally from northeast to southwest. Like the vadose zone, the aquifer also consists of a series of basalt layers and sediment. Regionally, the aquifer is bounded on the north and south by the edge of the Snake River Plain, on the west by surface discharge into the Snake River between King Hill and Twin Falls, Idaho, and on the northeast by the Yellowstone basin. Flow paths in the aquifer from beneath the INL Site discharge miles to the west of Twin Falls at the western terminus of the aquifer (DOE-ID 2008a). According to the U.S. Geological Survey, flow rates equate to a travel time of about 70–700 years for water beneath the INL Site to travel to springs that discharge at the terminus of the aquifer (Bartholomay and Twining 2010).

8.3.2 Land and Resource Use

Current land use at RWMC is limited to industrial applications (i.e., remediation, waste management, and associated support). Waste is received at RWMC for storage, examination, or disposal. Once accepted, waste is transferred to the Transuranic Storage Area or the SDA, as appropriate.

The Advanced Mixed Waste Treatment Project operates the Transuranic Storage Area. The project is contracted to retrieve and treat stored transuranic and alpha low-level waste. Operations are expected to be completed no later than December 2018, after which, the facility may undergo closure under the Hazardous Waste Management Act (Idaho Code § 39-4401 et seq.)—which is the implementation of RCRA (42 USC § 6901 et seq.) in the State of Idaho—and deactivation, decontamination, and decommissioning.

Several thousand cubic meters of low-level radioactive waste were disposed of in the SDA each year during active operations. Disposal of contact-handled low-level waste was discontinued in 2008. Disposal of remote-handled low-level waste is ongoing and, according to the ROD, likely will continue until the facility is full or until 2015, when it must be closed in preparation for final remediation of the SDA. Subsequently, DOE-ID extended the planning date for closing the remote-handled disposal vaults to September 30, 2017 (Hamel 2010).

Because RWMC does not have a long-term mission, RWMC buildings and infrastructure are anticipated to be removed before the year 2035. However, after the surface barrier is complete and the remedy is certified as operational and functional (approximately 2029), long-term management and control will be required at RWMC to continue extracting organic vapors from the vadose zone, periodically inspect and maintain the surface barrier, monitor the site, restrict access to residual contamination, and maintain ICs. Figure 8-1 shows the projected land-use control boundary around RWMC. Residential development near RWMC in the future is not expected, and the Agencies agree that it is reasonable to assume that the federal government will maintain control and restrict access in the future (DOE-ID 2008a).

8.3.3 History of Contamination

The SDA is the focus of remedial actions because buried waste is the primary source of contamination at RWMC. Therefore, operational history of the SDA is emphasized in the discussion that follows. Section 3 of the Remedial Investigation/Baseline Risk Assessment (Holdren et al. 2006) provides a more complete summary of the operational history of the entire RWMC.

The SDA encompasses 97 acres, and waste is buried in approximately 35 of the 97 acres (Figure 8-1). Within the SDA, waste was disposed of in 21 unlined pits, 58 trenches, 21 soil vault rows, and on Pad A, an abovegrade disposal area. Disposal requirements have changed over time in accordance with laws and practices current at the time of disposal.

Initial operations were limited to shallow, landfill disposal of waste generated at the INL Site. In keeping with technology of the day, disposal restrictions focused on worker safety (e.g., minimizing exposure while handling waste). Concern about long-term environmental damage had not yet been recognized, and classifications for types of radioactive waste (e.g., low-level, transuranic, and mixed waste) did not yet exist. Hence, there were few restrictions on landfill disposal. Most of the waste was industrial trash contaminated with radioactivity—paper, metal, dirt, construction debris, and other garbage—generated by INL Site reactor research. Some waste contained hazardous chemicals in addition to radioactivity.

Beginning in 1954, the Rocky Flats Plant near Boulder, Colorado, was authorized to send waste to RWMC for disposal. The Rocky Flats Plant was a nuclear weapons production facility with peak operations during the Cold War era. A variety of radioactive waste streams were disposed of, including process waste (e.g., sludge, graphite molds and fines, roaster oxides, and evaporator salts), equipment, and other waste incidental to production (e.g., contaminated gloves, paper, clothing, and other industrial trash). Much of the Rocky Flats Plant waste was contaminated with transuranic isotopes and solvents (e.g., carbon tetrachloride).

In 1970, burial of transuranic waste was prohibited. Transuranic waste was defined as waste contaminated with transuranic radionuclides in concentrations greater than 10 nCi/g. Transuranic waste was placed in segregated, retrievable storage in the Transuranic Storage Area and no longer accepted for landfill disposal in the SDA. In 1982, transuranic waste was redefined as waste material containing an alpha-emitting radionuclide with an atomic number greater than 92, a half-life longer than 20 years, and a concentration greater than 100 nCi/g at the time of assay (DOE O 5820.1).

In 1984, disposal practices were modified to eliminate disposal of mixed waste. Since 1984, only low-level waste has been disposed of in the SDA. Disposal of waste from offsite generators was discontinued in the early 1990s. Contact-handled low-level waste disposal terminated in 2008. Contemporary disposal operations within the SDA are limited to disposal of remote-handled, low-level waste received from onsite waste generators.

The Remedial Investigation/Baseline Risk Assessment evaluated the nature and extent of contamination associated with waste buried in the SDA. Tens of thousands of samples of perched water, soil moisture, sediment, aquifer water, and vadose zone vapor have been collected near RWMC over the past three decades, and more than 100,000 analyses have been performed. Except for background sites, monitoring locations have been chosen to maximize the likelihood of finding contamination. Despite this bias, detections are generally sparse and sporadic, typically near detection limits, and show few trends. Those contaminants that are detected in the vadose zone and aquifer are attributed to waste buried in the SDA. Vadose zone detections are typically in the interval above the B-C interbed. The most frequently detected contaminants in the vadose zone, from most to least, are VOCs, uranium isotopes, nitrate, Tc-99, and C-14. In addition, Sr-90, Cl-36, Pu-238, Am-241, I-99-129, and Pu-239/240 have been detected sporadically at concentrations near detection limits. VOCs, particularly carbon tetrachloride, are the only widespread contaminants from RWMC in the environment. Carbon tetrachloride is detected routinely in the vadose zone and aquifer. Historically, concentrations slightly above the carbon tetrachloride MCL of 5 µg/L have been detected in seven aquifer wells.

8.3.4 Initial Response

WAG 7 has been the subject of many investigations and cleanup actions. Site investigations include literature searches, laboratory analysis, bench-scale and field-scale treatability studies, field surveys, waste zone probing, environmental monitoring, reconstructing disposal history, technology demonstrations, and much more. This extensive body of information is summarized and referenced in the Remedial Investigation/Baseline Risk Assessment and the Feasibility Study (Holdren, Bechtold, and Preussner 2007) and is available in the Administrative Record. Initial responses pre-dating the OU 7-13/14 ROD include an interim action and four NTCRAs.

The FFA/CO identified an interim action for OU 7-10, Pit 9 Process Demonstration (DOE-ID 1993). Work under the interim action culminated with the Glovebox Excavator Method Project (DOE-ID 2004b), which demonstrated retrieval of buried waste. This project provided a basis for the targeted waste retrieval methodology applied in subsequent NTCRAs and included in the selected remedy for OU 7-13/14.

DOE, with concurrence from DEQ and EPA (i.e., the Agencies), deployed NTCRAs to grout beryllium blocks and retrieve targeted waste from discrete areas of the SDA. The Agencies selected these CERCLA removal actions to expedite the overall remedy for RWMC.

In situ grouting with a paraffin-based grout was safely executed as a NTCRA at 15 locations within the SDA to reduce migration of C-14 from buried beryllium blocks into the subsurface and aquifer. This waste form was the source of a significant portion of overall C-14 being released into the environment. The NTCRA to grout beryllium blocks was completed in 2004 (Lopez et al. 2005) and was factored into analysis of OU 7-13/14 by modeling. Experience from this action was used to evaluate in situ grouting of other waste types (e.g., waste containing mobile fission products) in the SDA.

Retrieval of specified waste from portions of SDA Pits 4 and 6 was initiated under action memoranda for Accelerated Retrieval Projects (ARPs) I, II, and III (DOE-ID 2004a, 2006a, 2008b). These NTCRAs exhumed specified waste for disposal at the Waste Isolation Pilot Plant in New Mexico or other appropriate facility. The OU 7-13/14 ROD incorporates ARPs I, II, and III and specifically identifies all retrieval locations included in the final remedy.

The OU 7-13/14 ROD, as the comprehensive remedial decision for the entire RWMC, also supersedes three existing RODs addressing portions of RWMC: OU 7-08, Organic Contamination in the Vadose Zone (DOE-ID 1994b); OU 7-12, Pad A (DOE-ID 1994a); and the interim action ROD for OU 7-10, Pit 9 (DOE-ID 1993). As the comprehensive remedy for all operable units under WAG 7, the OU 7-13/14 ROD includes all requirements (e.g., ARARs) and remedial activities (e.g., unexecuted or incomplete activities) of these earlier RODs.

8.3.5 Basis for Taking Action

Risk analysis concluded that RWMC and its sources of contamination (e.g., the SDA) pose risk to human health and the environment. In total, the ROD for OU 7-13/14 (DOE-ID 2008a) identified 18 primary COCs based on human health risk estimates or potential to exceed MCLs in the aquifer. Tables 8-2, 8-3, and 8-4 list primary COCs that must be addressed through remedial action and risk management at WAG 7. Tables 8-2 and 8-3 identify COCs based on risk and list the following information:

- Radionuclides and chemicals that could pose risk that exceeds threshold values
- Peak (i.e., highest) risk estimates and hazard indexes
- Years the peaks are predicted to occur
- Types of exposure that pose the most risk.

Table 8-4 identifies COCs based on the potential to exceed MCLs in groundwater and lists peak simulated groundwater concentrations, years the peak concentrations are predicted to occur, and MCLs.

Table 8-2. Radionuclide contaminants of concern based on 1,000-year future residential scenario peak risk estimates outside the boundary of the Subsurface Disposal Area in the absence of remedial action.

Radionuclide	Peak Risk ^a	Year	Primary Exposure Pathways ^a
Americium-241	3E-03	2594	External exposure, soil ingestion, and inhalation
Carbon-14	1E-05	2110	Groundwater ingestion and inhalation of volatiles (at the surface)
Cs-137	2E-03	2110	External exposure and crop ingestion
Lead-210	3E-05	3010	Crop and soil ingestion
Pu-239	3E-03	3010	Soil ingestion, crop ingestion, and inhalation
Pu-240	6E-04	3010	Soil ingestion, crop ingestion, and inhalation
Radium-226	7E-04	3010	External exposure and crop ingestion
Radium-228	3E-05	3010	External exposure
Sr-90	1E-03	2110	Crop ingestion, external exposure, and soil ingestion
Technetium-99	5E-05	2858	Groundwater ingestion and crop ingestion (crops irrigated with contaminated groundwater)

a. All exposure pathways that could pose risk are assessed in the Remedial Investigation and Baseline Risk Assessment (Holdren et al. 2006); those contributing most to risk are listed as primary exposure pathways.

Table 8-3. Chemical contaminants of concern based on 1,000-year future residential scenario peak risk estimates outside the boundary of the Subsurface Disposal Area in the absence of remedial action.

Chemical	Peak Risk ^a	Year	Peak Hazard Index ^a	Year	Primary Exposure Pathways ^a
Carbon tetrachloride ^b	4E-04	2117	10	2119	Inhalation of volatiles (at the surface) and groundwater ingestion
1,4-Dioxane ^b	2E-05	2110	NA	NA	Groundwater ingestion
Tetrachloroethene ^b	4E-04	2136	<1	2136	Groundwater ingestion and dermal exposure
Trichloroethene ^b	2E-05	2141	NA	NA	Groundwater ingestion

a. All exposure pathways that could pose risk are assessed in the Remedial Investigation and Baseline Risk Assessment (Holdren et al. 2006); those contributing most to risk are listed as primary exposure pathways.

b. Chemicals contained in organic solvent waste.

NA not applicable

Table 8-4. Contaminants of concern based on simulated peak groundwater concentrations that exceed maximum contaminant levels within 1,000 years outside the boundary of the Subsurface Disposal Area in the absence of remedial action.

Contaminant of Concern	Peak Modeled Groundwater Concentration	Year	Maximum Contaminant Level
I-129	2.9 pCi/L	2870	1 pCi/L
Carbon tetrachloride	0.28 mg/L	2133	0.005 mg/L
1,4-Dioxane	0.17 mg/L	2120	0.003 mg/L ^a
Methylene chloride	0.058 mg/L	2245	0.005 mg/L
Nitrate	49 mg/L	2295	10 mg/L
Tetrachloroethene	0.067 mg/L	2145	0.005 mg/L
Trichloroethene	0.12 mg/L	2145	0.005 mg/L

a. A maximum contaminant level is not established, but a health advisory level is available.

8.4 Remedial Action

The OU 7-13/14 ROD is based on the comprehensive Remedial Investigation/Feasibility Study for WAG 7, and represents the final selected remedy for the entire RWMC. The ROD supersedes previous decision documents for portions of WAG 7 and incorporates ongoing remedial actions into an integrated remediation strategy. Because the OU 7-13/14 ROD either eliminated or incorporated all WAG 7 OUs, this 5-year review evaluates protectiveness for all of WAG 7 as a whole; individual OUs are no longer assessed separately. Subsections that follow describe the comprehensive selected remedy for OU 7-13/14, implementation of the remedy to date, and current O&M requirements. Those sites where ICs are the only ongoing response are addressed in Section 10.5.

8.4.1 Remedy Selection

The five major components of the selected remedy for OU 7-13/14, the comprehensive remedy for WAG 7, are described in the ROD (DOE-ID 2008a) as follows:

- **Vadose zone vapor vacuum extraction and treatment**—Operate and maintain the existing extraction and treatment system throughout construction phases and beyond, if necessary, until remediation goals are met for vadose zone vapor concentrations.
- **Targeted waste retrieval**—Retrieve 6,238 m³ (8,159 yd³) of targeted waste and high-concentration organic solvent waste from a minimum of 5.69 acres of pit areas.
- **In situ grouting**—In situ grout specified soil vault and trench areas with a cumulative area ranging from 0.13 to 0.2 acres (Arenaz 2009).
- **Evapotranspiration surface barrier**—Prepare the site for a cap, then construct an infiltration-reducing evapotranspiration surface barrier over the entire SDA.
- **Long-term institutional controls**—Establish and maintain long-term surveillance, maintenance, monitoring, and ICs to operate and maintain post-construction components of the remedy, limit access, and enforce land-use restrictions.

In the interim before the surface barrier is completed (approximately 2028), the ROD requires that existing programs remain in place to restrict access to RWMC, operate and maintain the organic contamination in the vadose zone system, maintain the cover on Pad A, and monitor the environment.

The ROD provides RAOs and cleanup levels for RWMC, as summarized in the subsections below. Subsequent subsections describe and assess major components of the selected remedy.

8.4.1.1 Remedial Action Objectives. The ROD provides RAOs that describe what site cleanup must accomplish. RAOs for OU 7-13/14 are listed below:

1. Limit cumulative human health cancer risk for all exposure pathways to 10⁻⁴ or less.
2. Limit noncancer risk for all exposure pathways to a cumulative hazard index of less than 1 for current and future workers and future resident.
3. Inhibit migration of COCs into the vadose zone and the underlying aquifer.
4. Prevent unacceptable exposure to biota from soil.
5. Inhibit transport of COCs to the surface by plants and animals.

8.4.1.2 Cleanup Levels. Cleanup levels (remediation goals) are measurable quantities used to demonstrate that RAOs are satisfied. Because the selected remedy for the SDA primarily is a source-control action, performance objectives, rather than contaminant-specific concentrations, are defined as cleanup levels. To protect groundwater, vadose zone cleanup levels for organics are expressed as carbon tetrachloride vapor concentration in two intervals in the subsurface (Figure 8-3). Cleanup levels for OU 7-13/14 are:

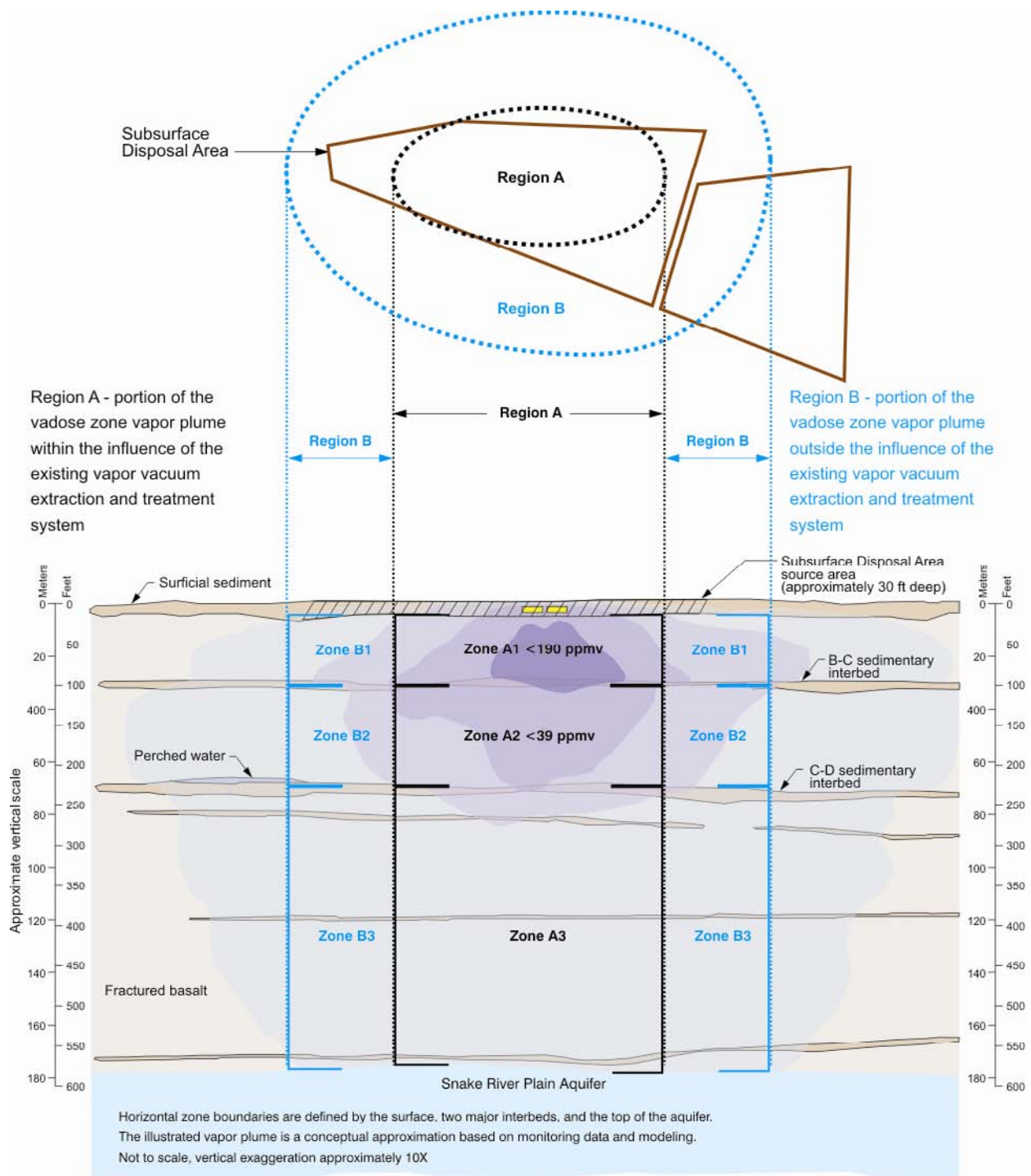
1. Reduce carcinogenic risk at the surface to less than 10^{-4} by maintaining an effective dose equivalent rate at the surface of less than 15 mrem/year as a measurable performance objective.
2. Reduce infiltration such that concentrations of COCs in the aquifer are less than MCLs (40 CFR 141) before 2110.
3. Maintain concentrations of carbon tetrachloride in vadose zone soil vapor above the B-C interbed (i.e., Zone A1, approximately the 9- to 30-m [30- to 100-ft] -depth interval) to less than 190 ppmv.
4. Maintain concentrations of carbon tetrachloride in vadose zone soil vapor between the B-C and C-D interbeds (i.e., Zone A2, approximately the 30- to 73-m [100- to 240-ft] -depth interval) to less than 39 ppmv.

In addition, the ROD provided action-specific performance measures to assess completion of targeted waste retrieval and in situ grouting. Performance of targeted waste retrieval is based on the total volume of retrieved waste and cannot be assessed until retrievals are complete. A minimum of 6,238 m³ (8,159 yd³) of targeted waste must be retrieved from a minimum of 5.69 acres, with additional retrieval areas, if necessary to meet the minimum volume requirement, to be determined pursuant to CERCLA. For in situ grouting, performance will be based on volumes of grout applied to specified areas within the SDA.

8.4.2 Remedy Implementation

Remediation will occur over approximately 20 years in three overlapping construction phases followed by a final phase invoking long-term IC (DOE-ID 2008c). Phase 1 includes the first two major components of the comprehensive selected remedy—vadose zone vapor vacuum extraction with treatment of organic contamination in the vadose zone (Section 8.4.2.1) and targeted waste retrieval (Section 8.4.2.2). In addition, Phase 1 encompasses ongoing miscellaneous activities at RWMC, specifically, maintaining the cover on Pad A (Section 8.4.2.3), monitoring the environment (Section 8.4.2.4), and restricting access and controlling land use through ICs (Section 8.4.2.5). Phase 1 is well underway. In situ grouting comprises Phase 2 (Section 8.4.2.6). Preliminary work on Phase 2 began within this 5-year review period. Phase 3 involves preparing the site, constructing the evapotranspiration surface barrier, and transferring the site to the final phase. Work has not begun for Phase 3. This 5-year review focuses on ongoing activities under Phase 1 and briefly describes initial Phase 2 tasks and post-ROD removal actions to remove structures.

8.4.2.1 Organic Contamination in the Vadose Zone. From 1954 to 1970, drums of radioactive and organic waste from the Rocky Flats Plant in Colorado were buried in the SDA. Containers were breached at disposal or have since failed, releasing VOCs to the environment. These VOCs primarily are in the form of organic vapors that have migrated from the buried waste.



G08-2122-17

Figure 8-3. Cleanup levels for carbon tetrachloride vapors in the vadose zone to reduce concentrations in the aquifer to less than the maximum contaminant level of 5 µg/L.

Cleanup of organic contamination in the vadose zone at RWMC began under the OU 7-08 ROD (DOE-ID 1994b). The selected remedy was vapor vacuum extraction with treatment. Since 1996, treatment units have been used to destroy contaminants in vapor extracted from various wells in the vadose zone. The original treatment units (i.e., units A, B, and C) used recuperative flameless thermal oxidation to destroy VOCs. The original units were subsequently replaced with more dependable catalytic oxidation treatment units (i.e., units D, E, and F) in 2001 and 2004, and the vapor vacuum extraction with treatment system has since operated reliably. During this reporting period, all units were running more than 93% of the time. Occasional brief shutdowns were performed to maintain equipment or to modify the system to accommodate construction.

One of the performance measures used to gauge effectiveness of operations is the mass of VOCs removed from the vadose zone. Detected contaminant concentrations are used in conjunction with system flow rates and operational run time to estimate cumulative VOC mass removal. Figure 8-4 shows mass removed for the entire vapor vacuum extraction with treatment system through December 2009, and Figure 8-5 shows mass removed per year (Cresap 2009, 2010). Figure 8-6 depicts the analyte mass contribution to total VOC mass from all operational cycles through December 31 2009,^a for five analytes, chloroform and four COCs (carbon tetrachloride, trichloroethane, tetrachloroethene, and TCE).

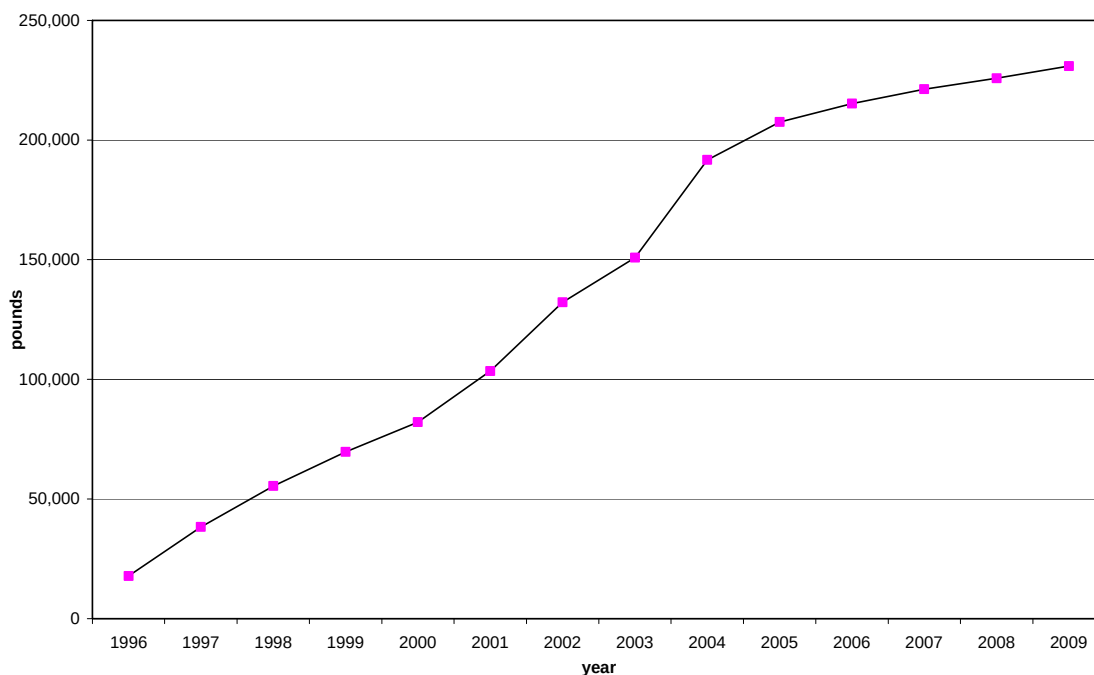


Figure 8-4. Cumulative volatile organic contaminant mass removed through 2009 by the vapor vacuum extraction with treatment system.

a. Though the scope of this 5-year review is through FY 2009 (i.e., September 30, 2009), this report summarizes information for OCVZ through December 30, 2009, consistent with the recent reference for OCVZ progress and status (i.e., Cresap 2010).

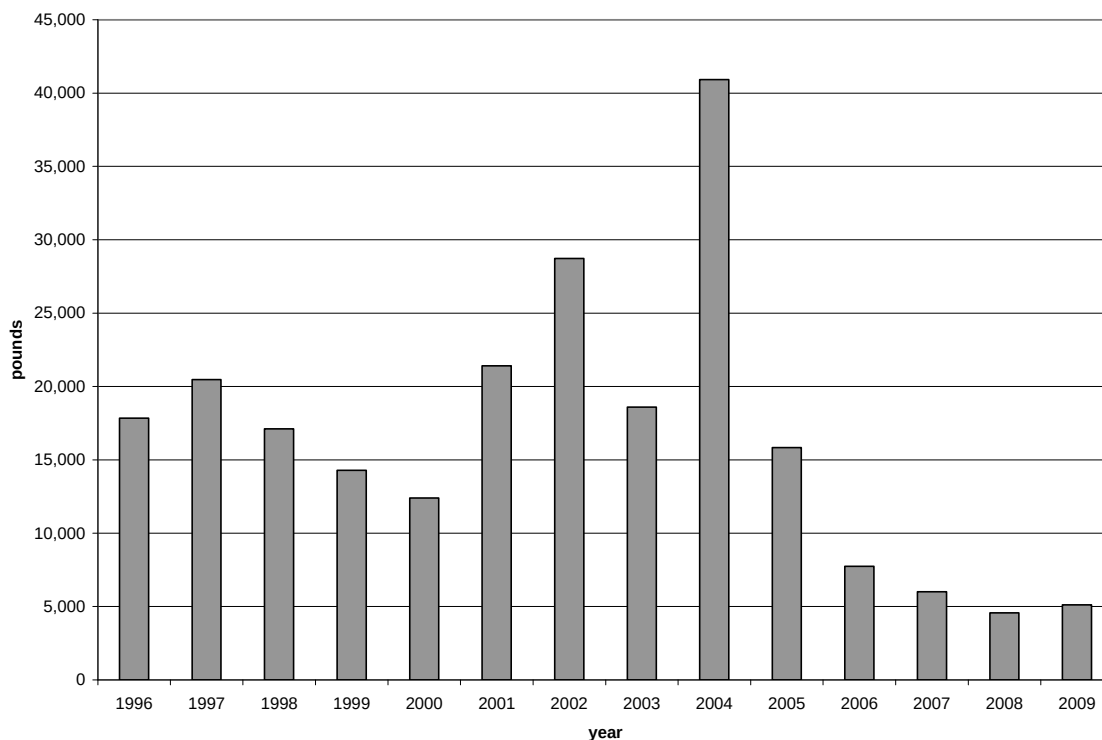


Figure 8-5. Annual volatile organic compound removal in pounds.

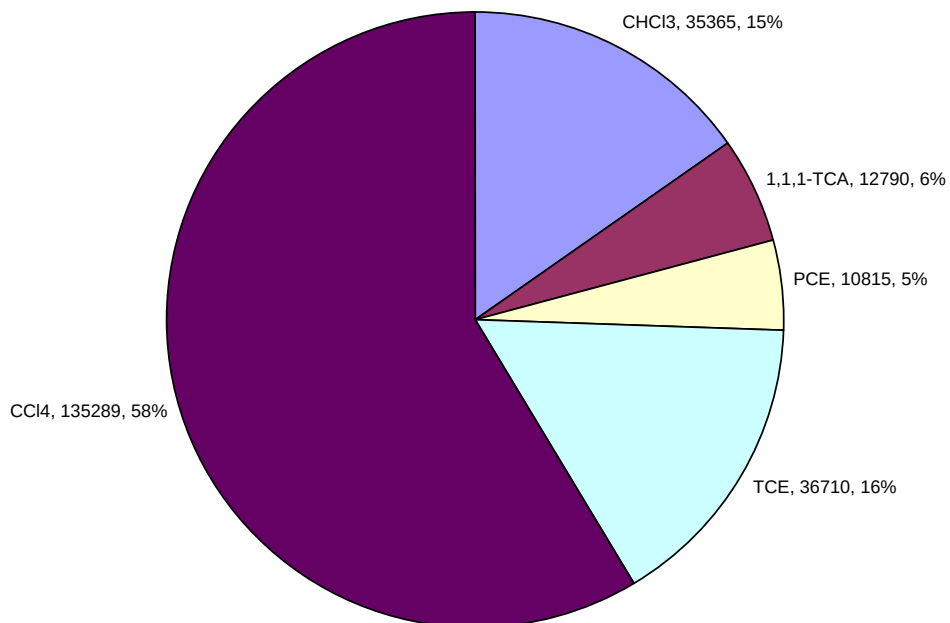


Figure 8-6. Analyte mass contribution to total volatile organic compound mass from 1996 through 2009.

8.4.2.2 Targeted Waste Retrieval. The OU 7-10 (Pit 9) retrieval demonstration (i.e., the Glovebox Excavator Method Project [DOE-ID 2004c]), addressed in the previous 5-year review, contributed directly to ARP remedial design (e.g., visual waste identification criteria). Targeted waste retrieval at the SDA (i.e., ARP) was initiated under action memoranda (DOE-ID 2004a, 2006a, 2008b) as NTCRA for ARPs I, II, and III. The OU 7-13/14 ROD (DOE-ID 2008a) superseded the three action memoranda and integrated targeted waste retrieval into a comprehensive remedy for OU 7-13/14, as described further in the Phase 1 Work Plan (DOE-ID 2010a).

The focused objective of targeted waste retrieval is to remove specific waste forms from the SDA that are highly contaminated with VOCs, transuranics, and uranium. Over 99% of the waste containing VOCs and transuranics was received from the Rocky Flats Plant. Targeted waste streams are Rocky Flats Plant Series 741 sludge, Series 742 sludge, Series 743 sludge, graphite, filters, roaster oxides, and other waste streams mutually agreed to by the Agencies to be routinely transuranic. If a waste stream is not identified as targeted, it is nontargeted waste, by definition.

Ten locations within the SDA, comprising 5.69 acres, are identified as primary targeted waste retrieval areas (Figure 8-7 and Table 8-5). These areas contain the highest concentrations of VOC-containing and transuranic waste in the SDA, based on acceptable knowledge and waste disposal records (DOE-ID 2008a).

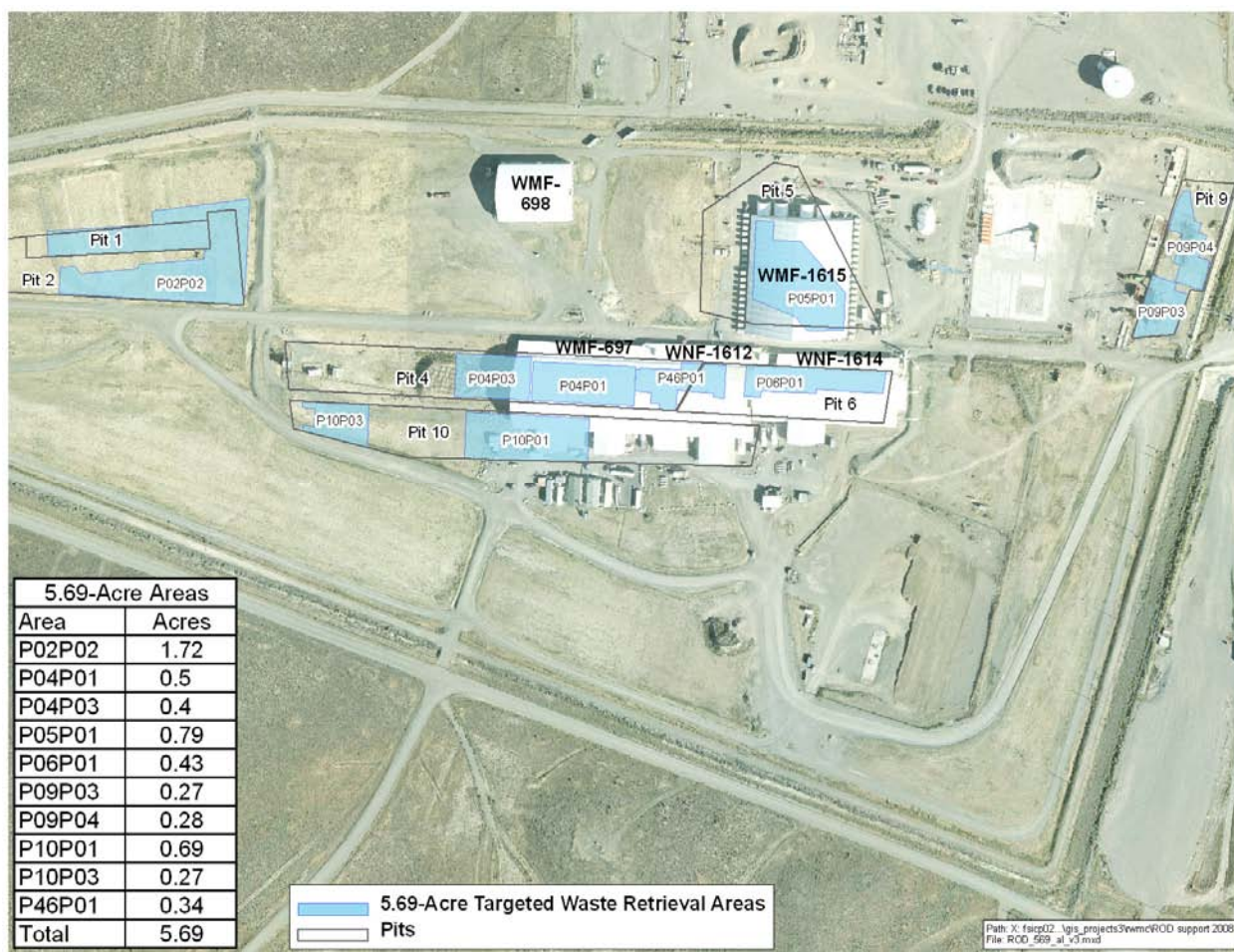


Figure 8-7. Locations of primary retrieval areas.

Table 8-5. Waste volumes for primary and secondary targeted waste retrieval areas.

Area ^a	Common Name(s)	Acres	Targeted Waste Volume ^b		Nontargeted Waste Volume ^b	
			(yd ³)	(m ³)	(yd ³)	(m ³)
P02P02	ARP TBD, ^c Pits 1 and 2	1.72	2,657	2,031	12,008	9,181
P04P01	ARP I, Pit 4 East	0.50	1,156	884	3,096	2,367
P04P03	ARP VI, Pit 4 West	0.40	338	258	2,375	1,816
P05P01	ARP IV, Pit 5	0.79	942	720	6,270	4,794
P06P01	ARP III, Pit 6	0.43	650	497	2,233	1,707
P09P03	ARP V, ^d Pit 9 South	0.27	223	170	753	576
P09P04	ARP V, ^d Pit 9 North	0.28	443	339	1,863	1,424
P10P01	ARP TBD, ^c Pit 10 East	0.69	761	582	6,876	5,257
P10P03	ARP VII, Pit 10 West	0.27	313	239	704	538
P46P01	ARP II, Pits 4 and 6	0.34	1,583	1,210	2,499	1,911
Total		5.69	9,066	6,930	38,677	29,571

a. Figure 8-7 illustrates primary targeted waste retrieval areas within the SDA.

b. Buried Waste Information System as-disposed-of volumes.

c. Sequence for the last two primary targeted waste retrieval areas (i.e., P02P02 and P10P01) has not been determined.

d. The ARP V retrieval enclosure encompasses both primary targeted waste retrieval areas in Pit 9.

ARP Accelerated Retrieval Project

SDA Subsurface Disposal Area

TBD to be determined

ARPs I and II experienced two significant delays because of off-normal events (i.e., a drum fire and subsidence). Subsequent engineering and procedure adaptations were successfully implemented, and ARPs I and II were safely completed within the interval addressed in this 5-year review. Of the 5.69-acre-minimum area to be retrieved under the ROD, 0.84 acres composed of ARPs I and II were completed.

Completion of targeted waste retrieval will be measured by the cumulative volume of targeted waste retrieved. A minimum of 6,238 m³ (8,159 yd³) of targeted waste (original disposal volume) must be retrieved from a minimum of 5.69 acres. The OU 7-13/14 ROD (DOE-ID 2008a) does not establish interim milestones for volumes of retrieved targeted waste from individual retrieval areas; rather, compliance will be measured as a total of 7,485 m³ (9,790 yd³) of packaged waste (approximately 35,986 55-gal drums) shipped out of Idaho. This review evaluates information on waste packaged during ARPs I and II—that is, final waste packages from retrieval areas P04P01 and P46P01 as of December 31, 2009.^b Table 8-6 summarizes data on final waste packages produced during the ARP I

- b. ARP I and ARP II were both completed by FY 2009 and ARP III was under way. Though the scope of this 5-year review is through FY 2009 (i.e., September 30, 2009), this report summarizes information through December 30, 2009, for ARPs I and II, consistent with the primary reference for completed targeted waste retrievals (i.e., the Interim Remedial Action Report [DOE-ID 2010a]).

and II retrieval efforts, effective December 31, 2009. Table 8-6 also identifies the number of final waste packages shipped out of Idaho for disposal and the number that remained in onsite storage. Appendix G of the Interim Remedial Action Report (DOE-ID 2010b) provides detailed information on individual waste packages.

8.4.2.3 Pad A. Pad A is an aboveground, earth-covered disposal site at the SDA where approximately 10,168 m³ (13,300 yd³) of containerized waste was placed on an asphalt pad from September 1972 to August 1978. The waste is composed primarily of nitrate salts, depleted uranium, and sewer sludge received from the Rocky Flats Plant. In 1994, the Agencies selected limited action for Pad A under OU 7-12 (DOE-ID 1994a). The Pad A ROD prescribed improving the soil cover (e.g., recontouring, correcting the slope, and adding rock armor to a portion of the cover), maintaining the cover, monitoring, and ICs. Remediation of Pad A was completed in 1995 (Parsons 1995) and transitioned to monitoring and maintenance. The OU 7-13/14 ROD (DOE-ID 2008) superseded the OU 7-12 ROD and concluded that Pad A ultimately will be incorporated into the evapotranspiration cover that will be constructed over the entire SDA. In the interim, the existing cover over Pad A is maintained in accordance with OU 7-13/14 O&M requirements (Lopez et al. 2009).

8.4.2.4 Monitoring. The OU 7-13/14 ROD specified that existing monitoring programs remain in place to monitor the environment in the interim before the surface barrier is completed (i.e., in Phase 3). OU 7-13/14 maintains the existing monitoring network (i.e., groundwater monitoring wells, lysimeters and suction bailers, vapor ports, and advanced tensiometers) and collects samples of the aquifer, vadose zone soil moisture and perched water, and vadose zone vapors in accordance with Field Sampling Plans. Scope (e.g., sampling frequencies, analytes, analytical priorities, and reporting requirements) can be adjusted, if needed, with regulatory review and approval of revised Field Sampling Plans.

8.4.2.5 Institutional Controls. The Phase 1 Work Plan (DOE-ID 2010a) invokes INL Site-wide programs for ICs and 5-year reviews under CERCLA throughout all phases of OU 7-13/14 remediation and long-term control and management. During Phase 1, ICs are required to control access to RWMC and maintain land-use and groundwater-use restrictions. Land and groundwater within the land-use control boundary (Figure 8-8) are restricted to industrial applications. These restrictions are expected to endure indefinitely because long-lived radionuclides are present in concentrations that preclude unrestricted land use. ICs are implemented through the INL Site-wide IC/O&M Plan (DOE-ID 2010c). Future revisions to the IC/O&M Plan will adopt changes required at RWMC as remediation proceeds.

8.4.2.6 In Situ Grouting. In situ grouting comprises Phase 2 of the selected remedy for OU 7-13/14 (DOE-ID 2008b). The Phase 2 Work Plan (DOE-ID 2010d) provides remedial design and planning for treating 21 discrete locations totaling 0.13 to 0.2 acres in the SDA (Figure 8-9) to reduce mobility of Tc-99 and I-129. In situ grouting will provide relatively near-term isolation of selected waste forms pending completion of targeted waste retrieval and construction of the surface barrier over the SDA.

After the OU 7-13/14 ROD and Scope of Work were finalized, DOE-ID accelerated in situ grouting by funding Phase 2 through the American Recovery and Reinvestment Act (Public Law 111-5). Work has proceeded at pace with publication of the Phase 2 Work Plan (DOE-ID 2010d), award of a subcontract to a qualified vendor, and preparation for an optional management self-assessment. The goal is to complete fieldwork by September 2010.

Table 8-6. Number and status of final waste packages produced by Accelerated Retrieval Projects I and II as of December 31, 2009.

Status Type	Accelerated Retrieval Project I					Accelerated Retrieval Project II			Combined
Waste	Targeted Waste P04P01	P04P01 Adjacent ^a	P04P03 ^b	Secondary Waste	Total	Targeted Waste P46P01	Secondary Waste	Total	Total
Targeted final waste packages	3,901	165	328	None	4,394	9,998	None	9,998	14,392
Nontargeted ^c final waste packages	55	0	2	20	77	0	12	12	89
Total	3,956	165	330	20	4,471	9,998	12	10,010	14,481
Disposition									
Interim onsite storage	1,702	110	177	8	1,997	2,916	10	2,926	4,923
Shipped out of Idaho	2,254	55	153	12	2,474	7,082	2	7,084	9,558
Total	3,956	165	330	20	4,471	9,998	12	10,010	14,481

a. P04P01 Adjacent comprises four grid blocks (i.e., F1, G1, H1, and I1) within the ARP I retrieval enclosure that are not included in the 0.50-acre ARP I retrieval area or the 5.69-acre-minimum retrieval area specified in the ROD (DOE-ID 2008a).

b. Row A within the ARP I retrieval enclosure is part of P04P03 (ARP VI, Pit 4 West), which is included in the 5.69-acre-minimum retrieval area specified in the ROD (DOE-ID 2008a). Row A grids were excavated by ARP I.

c. Nontargeted final waste packages comprise secondary waste, packaging debris, and Agency samples. Nontargeted final waste packages are not counted when measuring progress against performance objectives (i.e., removal of 7,485 m³ [9,790 yd³] of targeted waste, as packaged for shipment).

ARP Accelerated Retrieval Project
 ROD Record of Decision

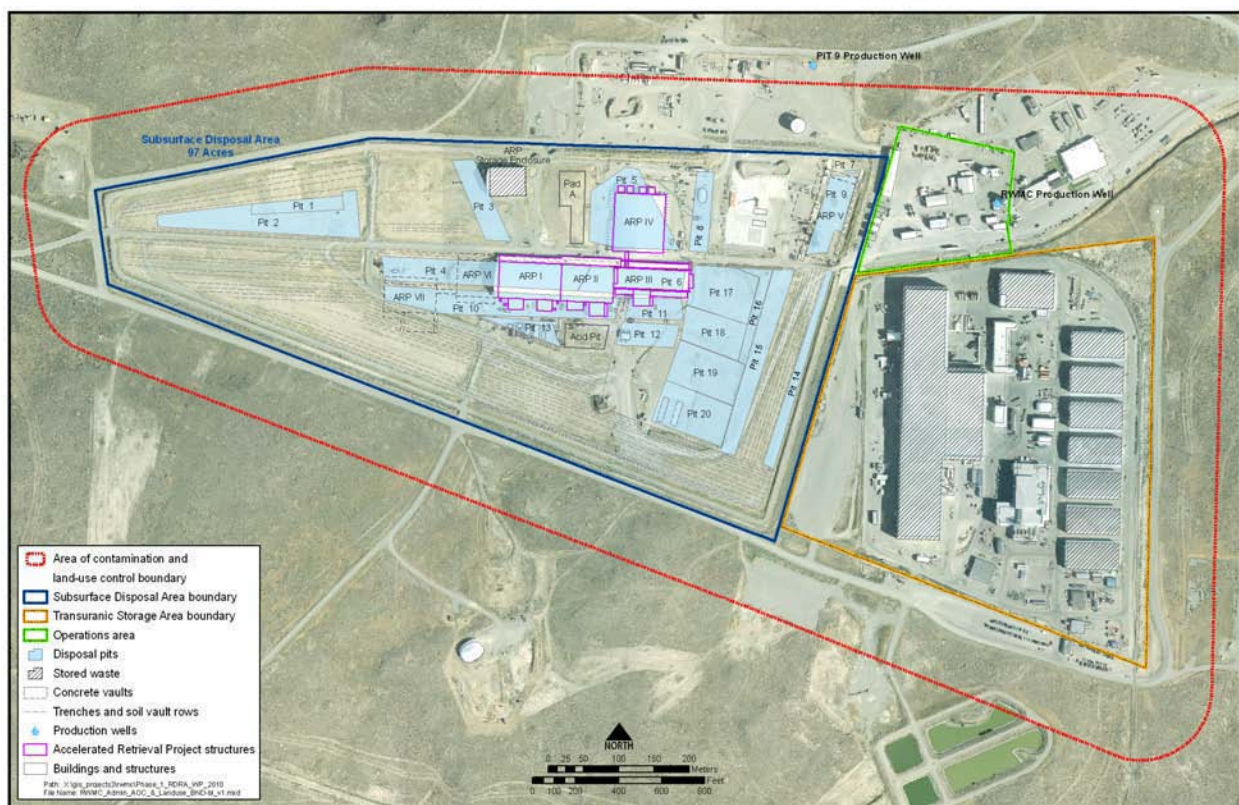


Figure 8-8. Land-use control boundary at the Radioactive Waste Management Complex.

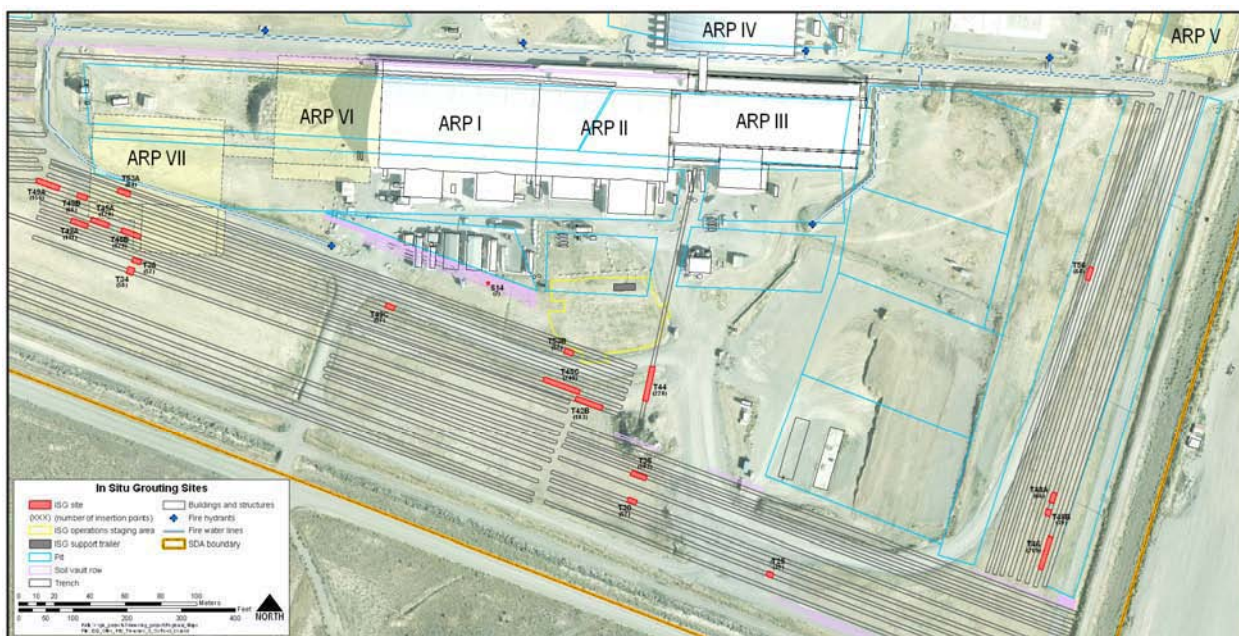


Figure 8-9. In situ grouting sites in the Subsurface Disposal Area.

8.4.2.7 Decommissioning Non-Time-Critical Removal Actions. The Agencies selected the joint DOE and EPA approach (DOE and EPA 1995) for general decommissioning of facilities at the INL Site in 2006 (DOE-ID 2009). An action memorandum (DOE-ID 2009) authorized these NTCRAs under CERCLA in accordance with EPA guidance (EPA 1990, 1993) and with the concurrence of DOE, EPA, and DEQ. Though general decommissioning of buildings and structures is not specifically addressed in the OU 7-13/14 ROD, NTCRAs are consistent with RAOs and support overall cleanup objectives established through the FFA/CO (DOE-ID 1991).

Since the OU 7-13/14 ROD (DOE-ID 2008) was published, five RWMC facilities have been decommissioned under the General Decommissioning Action Memorandum (DOE-ID 2009) (Table 8-7). These structures were totally removed, and areas were graded to match surrounding contours. Based on specific requirements, waste from these facilities was shipped to an appropriate treatment or disposal facility. Mixed waste was shipped off-INL Site to a permitted facility (e.g., Energy Solutions). Radioactive waste was shipped to ICDF. Nonradioactive friable asbestos was shipped to the CFA landfill. Other nonradioactive, nonhazardous demolition waste was sent to the CERCLA Demolition Waste Landfill at INTEC. Figure 8-10 shows photos of the facilities that are identified in Table 8-7. As the facilities existed within the WAG 7 area of contamination, the sites could not be released for unrestricted use based solely on removal of the building or structures. Upon completion of the NTCRAs, the sites were released back to the WAG 7 program.

Additional facilities at WAG 7 have been identified for decommissioning as NTCRAs (Table 1 in DOE-ID 2009). If additional facilities are identified for decommissioning, then these facilities will either be added to the General Decommissioning Action Memorandum (DOE-ID 2009) or a facility-specific action memorandum will be prepared.

Table 8-7. Non-time-critical removal actions completed under general decommissioning in Waste Area Group 7.

Facility Identifier		Facility Name	Completion Date
WMF-733		Drum Inspection Station	3/24/2009
WMF-648		ILTSF Trailer	7/16/2009
WMF-714		ILTSF Pad #1	7/30/2009
WMF-720		ILTSF Pad #2	7/30/2009
WMF-671		Glovebox Excavator Method Weather Enclosure Structure	9/30/2009
ILTSF Intermediate-Level Transuranic Storage Facility			

8.4.3 Operations and Maintenance

Two elements of WAG 7, the organic contamination in the vadose zone system and Pad A, are subject to routine O&M. The organic contamination in the vadose zone system is an active remedial response, while Pad A remediation is complete and being maintained in the interim until the final surface barrier is constructed over the SDA. Currently, O&M of both organic contamination in the vadose zone and Pad A occur under the OU 7-13/14 O&M Plan (Lopez et al. 2009). Previously, they were managed under separate plans.

The organic contamination in the vadose zone system includes extraction wells, vapor ports, pipelines, treatment units, and ancillary equipment. Three catalytic oxidizers (i.e., units D, E, and F) extract vapors from the vadose zone beneath RWMC. System technicians and engineers maintain and monitor vapor vacuum extraction with treatment unit operations during the 4-day, 10-hour/day workweek.



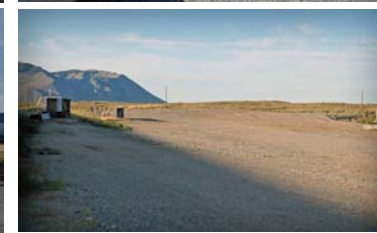
WMF-733, Drum Inspection Station, before and after decommissioning



WMF-648, Intermediate-Level Transuranic Storage Facility Trailer, before and after decommissioning



WMF-714 Intermediate-Level Transuranic Storage Facility Pad #1 before, during, and after decommissioning



WMF-720, Intermediate-Level Transuranic Storage Facility Pad #2 before, during, and after decommissioning



WMF-671, Glovebox Excavator Method Weather Enclosure Structure, before, during, and after decommissioning

Figure 8-10. Photographs of non-time-critical removal actions at Waste Area Group 7.

They schedule and oversee routine maintenance, collect influent samples, complete operations logs and reports, and perform troubleshooting activities, when necessary. In this 5-year review period, organic contamination in the vadose zone O&M were conducted in accordance with activity-specific O&M plans for OU 7-08: INEEL (2004) was in effect until superseded by PLN-2291.

WAG 7 personnel inspect Pad A several times each year to assess the vegetative cover, soil cover, and rock armor. Erosion, animal intrusion, and subsidence are the most common problems warranting repair to the soil cover. Other than removing noxious weeds, attempts to maintain the vegetative cover were abandoned, with Agency concurrence, after a repeated lack of success. Inspections for each fiscal year in this 5-year review period are summarized from archived inspection forms, as follows:

- FY 2005—Pad A was inspected three times and found acceptable. Minor subsidences were identified and repaired, and areas of absent and sparse vegetation were noted.
- FY 2006—Pad A was inspected five times. A subsidence on top near the center was identified in April and was repaired before the next inspection. Though areas of absent and sparse vegetation were noted, conditions were generally acceptable.
- FY 2007—Pad A was inspected five times. Though generally satisfactory, three unsatisfactory conditions were noted—recurring subsidence, weed encroachment in the rock-armored area, and backfill from construction of a fire water line covering a portion of the armored area.
- FY 2008—Pad A was inspected four times. Subsidence on Pad A was not significant in FY 2008. Pad A conditions were generally acceptable with the exceptions of weed encroachment and backfill from construction affecting the armored area.
- FY 2009—Pad A was inspected four times. Conditions were generally satisfactory. A previously repaired subsidence required additional backfill. Weeds were removed and damage to the rock armor caused by construction of a fire water line was repaired.

8.5 Progress Since the Last Review

The previous 5-year review contained three protectiveness statements for WAG 7 because the review evaluated three individual OUs. These statements are repeated below because one or more issues were identified with each:

- Previous protectiveness statement for OU 7-08 organic contamination in the vadose zone:

The OCVZ remedy is functioning as the OU 7-08 ROD intended (DOE-ID 1994b). Current monitoring data indicate that the remedy is functioning as required to achieve current cleanup goals. The long-term effectiveness of the remedy will be verified by monitoring of VOCs in the vadose zone and in groundwater within and outside of the SDA boundary. Monitoring will continue for the foreseeable future.
- Previous protectiveness statement for OU 7-10 Pit 9:

Upon completion, the OU 7-10 remedy is expected to be protective of human health and the environment. In the interim, exposure pathways that could result in unacceptable risk are being controlled. The OU 7-10 remedy is being implemented as a demonstration project and is not intended to be the final remedy for the SDA.

The milestone for completion of the Pit 9 Stage III 10% design is being met through the ongoing removal action in Pit 4 (i.e., the Accelerated Retrieval Project). The ARD (DOE-ID 2002a) establishes the milestone for commencement of operations for Stage III of the OU 7-10 demonstration project no later than March 31, 2010. The 2004 agreement to extend deadlines extends the deadline for remedial design and commencing construction until March 31, 2008 (DOE-ID 2004b). The final remedy for the SDA will be determined by the OU 7-13/14 ROD. The draft OU 7-13/14 ROD is scheduled for submittal to the DEQ and EPA no later than December 31, 2007.

- Previous protectiveness statement for OU 7-12 Pad A:

The remedy at Pad A currently protects human health and the environment and is functioning as intended in the ROD. Ongoing maintenance and institutional controls preclude prolonged direct contact with the waste. Current monitoring data indicate that the remedy is functioning as required to achieve cleanup goals. However, the Pad A remedy will be reevaluated based on cumulative impacts as part of the WAG 7 comprehensive OU 7-13/14 RI/FS and ROD.

Table 8-8 lists issues and recommendations identified in the last 5-year review and the current status of each. One issue was eliminated from further consideration, while all other issues have been addressed by completing previously identified recommendations and follow-up actions.

8.6 Data Review and Evaluation

Environmental monitoring provides data with which to assess the effectiveness of remedial actions at WAG 7 in meeting RAOs.

8.6.1 Vadose Zone Soil Moisture and Perched Water Monitoring

This section summarizes reportable detections associated with vadose zone soil moisture and perched water samples collected October 2004 through September 2009. Vadose zone monitoring supports WAG 7 in accordance with the ROD for OU 7-13/14 (DOE-ID 2008a). Vadose zone monitoring focuses on the SDA. Monitoring requirements to satisfy objectives of the ROD during Phase 1 are described in the Vadose Zone Field Sampling Plan for OU 7-13/14 (Koeppen and Holdren 2009). A description of the monitoring network, analyses and reporting protocol, and monitoring results are provided in the subsections below.

The vadose zone monitoring network consists of 60 lysimeters and three perched water wells in and around RWMC (Figure 8-11). Sampling points are located at distinct lithologic monitoring intervals (sampling zones) within the subsurface. Vadose zone monitoring intervals and sampling locations are illustrated in Figure 8-12. Soil moisture and perched water sampling of the vadose zone occurs twice a year in accordance with the Field Sampling Plan (Koeppen and Holdren 2009). The Field Sampling Plan addresses requirements for collecting and analyzing samples, including sampling locations, sampling frequency, analyses priorities, data quality objectives, quality assurance and quality control protocols, data validation, and reporting.

Table 8-8. Actions taken since the last 5-year review for Waste Area Group 7.

Issues from Previous Review ^a	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Operable Unit 7-08 Organic Contamination in the Vadose Zone					
OCVZ (VVET is operating with PRGs that were updated in 2005. These PRGs are a range of carbon tetrachloride concentrations that span Region A and B, Zones 1–3 in the vadose zone. The PRGs are documented in the <i>Data Quality Objectives Summary Report for Operable Unit 7-08 Post-Record of Decision Sampling</i> (INEEL 2005). As active extraction continues, the measured subsurface carbon tetrachloride concentrations need to be compared to the PRGs to determine the effectiveness of the extraction operation. If subsurface concentrations are approaching the PRGs, a decision to shut down the operation for rebound needs to be made. The PRGs need to be assessed to determine whether adjustments are needed, and these remediation goals should be referred to as remediation goals.	OCVZ is being evaluated in the context of the entire SDA in the OU 7-13/14 RI/FS.	DOE	April 2008	The comprehensive ROD for OU 7-13/14 (DOE-ID 2008a) superseded the OCVZ ROD for OU 7-08 (DOE-ID 1994). The OU 7-13/14 ROD identifies remediation goals for OCVZ. The work plan for Phase 1 of the OU 7-13/14 selected remedy (DOE-ID 2010d) defers shutdown strategies for OCVZ until Phase 3. This task is complete.	September 2008 August 2009
Operable Unit 7-10 Pit 9					
The volume of retrieved waste that will require treatment to meet waste acceptance criteria for the WIPP is unknown, resulting in complications in preparing the cost estimates for Stage III operations and in determining compliance approaches for ARARs for OU 7-10 (Pit 9).	This issue is internal to ICP and does not impact the protectiveness of the remedy. Standard estimating practices will be followed to develop a cost estimate for the Stage III operations.	DOE	Not applicable	This topic should not have been identified as an issue in the previous 5-year review because it does not affect current or future protectiveness. The comprehensive ROD for WAG 7, OU 7-13/14 (DOE-ID 2008a) superseded the OU 7-10 ROD (DOE-ID 1993), eliminating Stage III and selecting an alternate approach for retrieval. This issue is eliminated from further consideration.	September 2008

Table 8-8. (continued).

Issues from Previous Review ^a		Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
RAOs, ARARs, and the treatment train identified in the OU 7-10 ROD need to be updated.		This issue will be discussed between the Agencies and the ICP contractor.	DOE	November 2008	The comprehensive ROD for OU 7-13/14 superseded the OU 7-10 ROD and established RAOs, ARARs, and treatment strategies for waste retrieved from the SDA. This task is complete.	September 2008
Operable Unit 7-12 Pad A						
Nitrate concentration in vadose zone is trending upward at Pad A (per EPA [Opalski 2006]).		Evaluation of this trend will be performed as part of the site wide RI/FS.	DOE	2009	The OU 10-08 RI/BRA (Cahn et al. 2008) evaluated nitrate in the aquifer. See Section 10. This task is complete.	April 2008
Nitrates continue to be detected in the vadose zone. The significance of these detections should be evaluated.		The significance of the detections is being evaluated in the context of the entire SDA in the OU 7-13/14 RI/FS.	DOE	November 2008	The OU 7-13/14 RI/BRA (Holdren et al. 2006) evaluated the significance of nitrate detections and considered all sources of nitrate in the SDA, including Pad A. Nitrate is widespread in the subsurface at RWMC. Nitrate was identified as a COC and is being addressed by the OU 7-13/14 selected remedy. This task is complete.	September 2008
a. Issues were identified either in Appendix C of the previous 5-year review (DOE-ID 2007a) or in the addendum to Appendix C enclosed with EPA's letter of concurrence with the previous 5-year review (Opalski 2006).						
ARAR	applicable or relevant and appropriate requirement	PRG	preliminary remediation goal		RWMC	Radioactive Waste Management Complex
COC	contaminant of concern	RAO	remedial action objective		SDA	Subsurface Disposal Area
EPA	Environmental Protection Agency	RI/BRA	remedial investigation and baseline risk assessment		VVET	vapor vacuum extraction with treatment
ICP	Idaho Cleanup Project	ROD	Record of Decision		WAG	waste area group
OCVZ	Organic Contamination in the Vadose Zone	RI/FS	remedial investigation/feasibility study		WIPP	Waste Isolation Pilot Plant
OU	operable unit					

Figure 8-11. Soil moisture and perched water monitoring wells at the Radioactive Waste Management Complex.

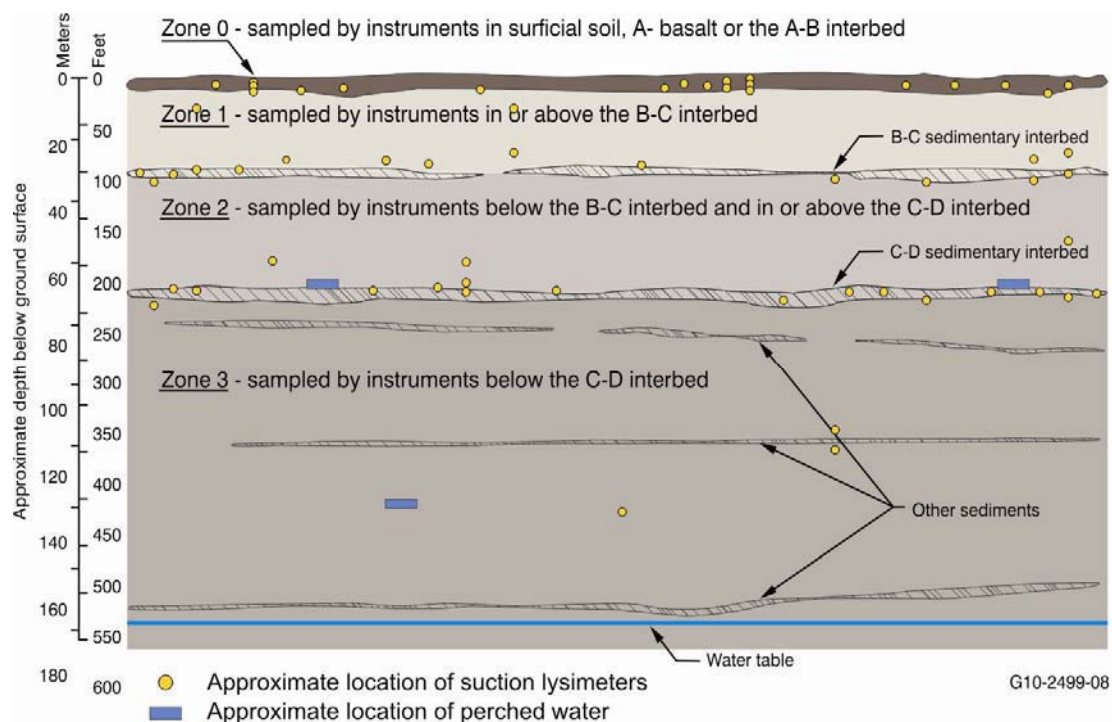


Figure 8-12. Sample zones and approximate locations of vadose zone sampling points beneath the Radioactive Waste Management Complex.

This 5-year review summarizes reportable detections of primary groundwater COCs^c in vadose zone soil moisture and perched water samples (i.e., C-14, nitrate, Tc-99, and 1,4-dioxane). For purposes of this summary, reportable detections for C-14, nitrate, and Tc-99^d are defined as positive detections that exceed background reporting thresholds or MCLs. Though perched water and soil moisture are not sources of drinking water, MCLs provide convenient and familiar values for comparison. Reportable detections for 1,4-dioxane are defined as positive detections that exceed analytical method quantitation (reporting) limits or MCLs. For radionuclides, a positive detection is defined as a result greater than three times the 1σ uncertainty and greater than the sample-specific minimum detectable concentration. For nitrate and 1,4-dioxane, positive detections are determined in accordance with data validation procedures. Intermittent or random detections, including analytes that are not COCs, are not included in this 5-year review because they are not meaningful to objectives. These data are presented in OU 7-13/14 annual monitoring reports (Koeppen et al. 2006, 2007; Koeppen, Bechtold, and Cresap 2008; Koeppen, Bechtold, and Holdren 2009; Koeppen 2009).

More than 28,000 analyses (excluding approximately 3,500 analyses of field blank and control blank samples) were performed on samples collected from vadose zone suction lysimeters and perched water wells from October 2004 through September 2009. Table 8-9 summarizes reportable detections, maximum concentrations, sample locations, and comparison values. More than half of the reportable detections occurred in samples obtained from Zone 0, the interval containing the landfill (Table 8-10). Subsections that follow summarize results for two contaminants, nitrate and Tc-99, with (1) multiple detections at the same monitoring location, (2) concentrations that exceed an MCL, and (3) increasing concentration trends. Monitoring locations where nitrate and Tc-99 were detected in the vadose zone at concentrations above MCLs are illustrated in Figure 8-13.

c. Groundwater risk-drivers include several VOCs (e.g., carbon tetrachloride) that are monitored as vapor in the vadose zone (see Section 8.6.2).

d. I-129, also a primary groundwater COC, is monitored indirectly by analyzing for Tc-99 in the vadose zone.

Table 8-9. Summary of reportable detections in vadose zone soil moisture and perched water samples.

Contaminant of Concern ^a	Number of Lysimeters and Perched Wells Sampled	Number of Analyses	Number of Reportable Detections	Sample Zone Where Detections Occurred	Concentration			Number of Detections Greater Than Maximum Contaminant Level ^b	Monitoring Wells Exceeding Maximum Contaminant Levels
					Maximum $\pm 1\sigma$	Units	MCL		
1,4-Dioxane	22	92	1	0, 1	43.1	µg/L	NA	0	NA
Carbon-14	48	515	32	0, 1, 2, 3	316 $\pm$ 17	pCi/L	2,000	0	NA
Nitrate	51	522	227	0, 1, 2	6,800^c	mg/L	10	201	98-3, 98-4, D06, D15, IE6, I-2S, I-4S, PA02, PA03, R2004, R2006, TW1, W08, W09, W13, W23, W25
Technetium-99	51	637	47	0, 1, 2	18,700 $\pm$ 1,160^c	pCi/L	900	11	R2004

a. Other detected contaminants are presented in annual monitoring reports (Koeppen et al. 2006, 2007; Koeppen, Bechtold, and Cresap 2008; Koeppen, Bechtold, and Holdren 2009; Koeppen 2009).

b. MCLs are from "National Primary Drinking Water Regulations" (40 CFR 141) established by EPA to protect public drinking water sources. Though soil moisture and perched water are not sources of drinking water, MCLs are used as convenient and familiar values for comparison.

c. **Black bold font** indicates a sample concentration that exceeds the MCL (Footnote b).

EPA Environmental Protection Agency
MCL maximum contaminant level
NA not applicable

Table 8-10. Summary of reportable detections in each sampling zone.

Sampling Zone	Vadose Zone Interval	Number of Reportable Detections	Detection Rates	
			All Detections ^a (%)	All Analyses ^b (%)
0	Surface soil, basalt-flow group A, and A-B interbed	156	51	0.56
1	Below Zone 0 and in or above B-C interbed	97	32	0.35
2	Below Zone 1 and in or above the C-D interbed	53	17	0.19
3	Below Zone 2 and above the aquifer	1	0	0.00
Total	All	307	100	Not applicable

a. Detection rate based on total number of reportable detections (i.e., 307).

b. Detection rate based on total number of sample analyses (i.e., 28,000 excluding field blank and control blank samples).

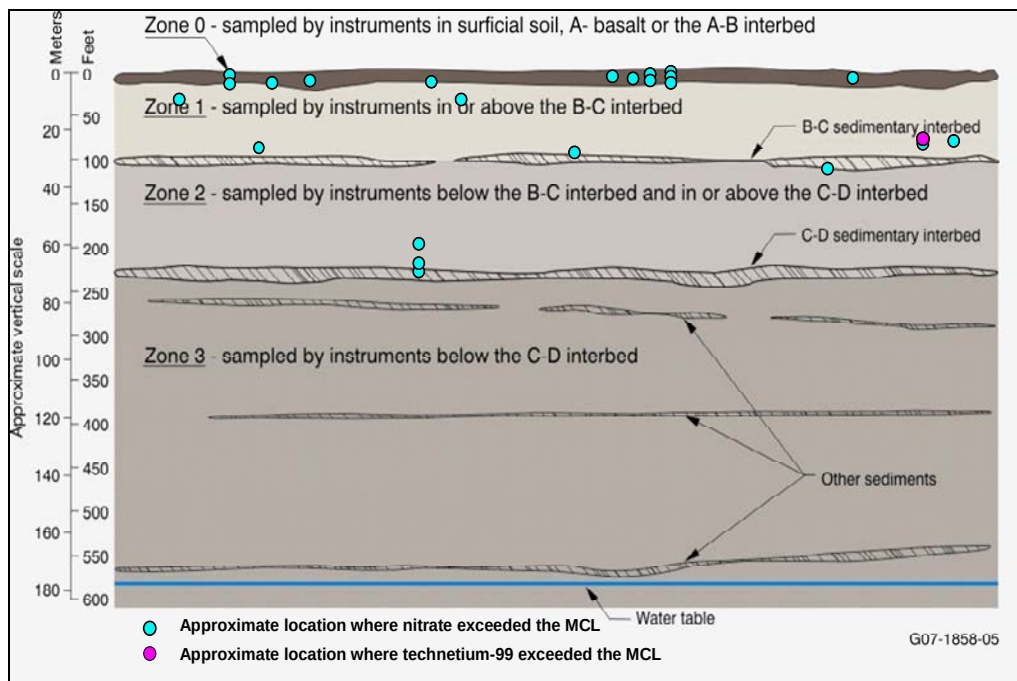
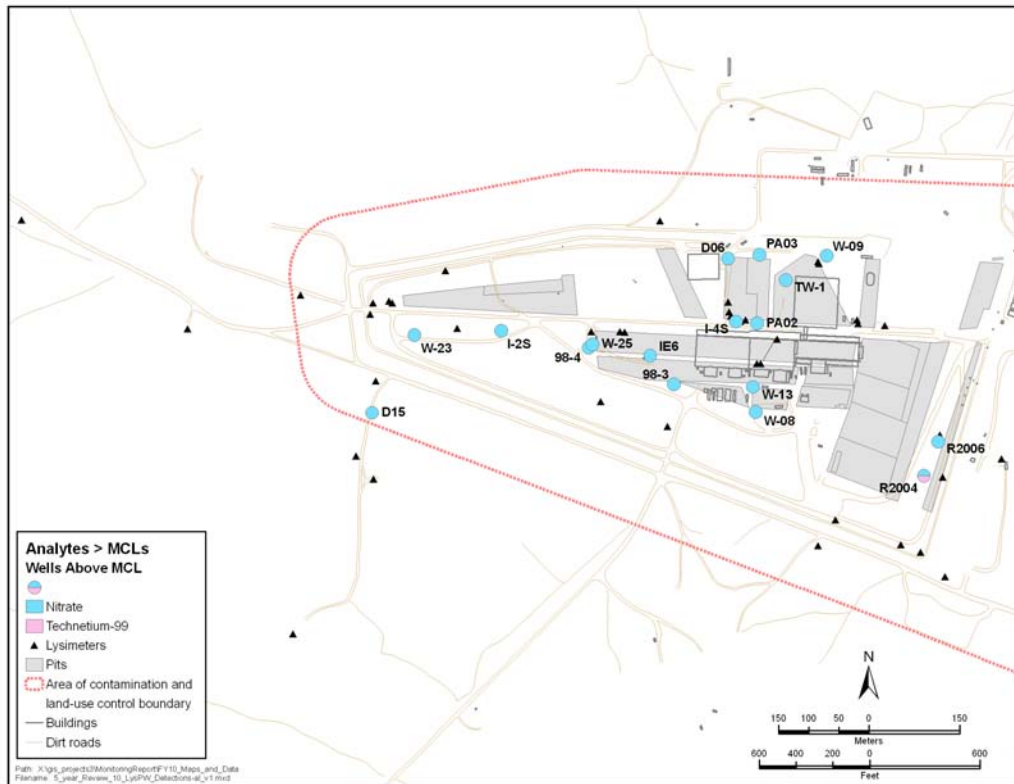


Figure 8-13. Two views showing sampling locations in the vadose zone where contaminants of concern were detected above maximum contaminant levels.

8.6.1.1 Nitrate. Nitrate (as nitrogen) is commonly detected throughout the vadose zone at concentrations that range from background to exceeding the MCL by several orders of magnitude. Nitrate was detected above the MCL at 16 monitoring locations (21 sampling points) in Zones 0, 1, and 2 (Table 8-10). Figure 8-13 shows vadose zone monitoring wells where nitrate concentrations were greater than the MCL. Monitoring wells listed in Table 8-10 have a history of elevated nitrate. Sampling points with increasing concentration trends are discussed in their respective sample zones listed below.

- **Sampling Zone 0**—Most samples with nitrate concentrations above the MCL occurred at sampling points near Pad A (D06:DL02, PA02:L16 and PA03:L33) and the Acid Pit (W08:L12, W08:L13, W08:L14, W13:L29, and W13:L30). Large amounts of Rocky Flats Plant Series 745 inorganic salts are located on Pad A (Holdren et al. 2006), and large volumes of nitric acid dissolution product were disposed of in the Acid Pit (Jorgensen et al. 1994). Concentrations at sampling points W13:L29 (14 ft bgs) and W13:L30 (2.0 m [6.7 ft] bgs) are higher than all other locations in the SDA. Though concentrations at W13:L29 have remained relatively stable, they have increased sixfold at sample point W13:L30 since monitoring began in 2008 (Figure 8-14). Notable trends were not evident at other sampling points in Zone 0.
- **Sampling Zone 1**—Nitrate was detected above the MCL in two or more samples from I-2S:DL11, I-4S:DL15, R2004:DL50, and TW1:DL04. Nitrate concentrations at I-2S:DL11 (28 m [92 ft] bgs) are higher than other monitoring locations in Zone 1; however, a trend is not evident. At I-4S:DL15 (30 m [97 ft] bgs), nitrate is accompanied by elevated levels of chloride, potassium, and sodium, which are inorganic salts characteristic of waste disposed of on Pad A. Elevated nitrate at I-4S:DL15 (97 ft bgs) suggest that contaminants are migrating from Pad A. The only notable trend in Zone 1 occurred at sample point R2004:DL50 (23 m [74 ft] bgs) (Figure 8-14).
- **Sampling Zone 2**—Nitrate was detected above the MCL in two or more samples from suction lysimeters IE6:DL34 and IE6:DL83 and suction bailer IE6. Concentrations of IE6 bailer samples remained relatively stable, while they increased at IE6:DL34 (67 m [220 ft] bgs) and decreased at IE6:DL83 (68 m [212 ft] bgs) (Figure 8-14).
- **Sampling Zone 3**—Nitrate was not detected at concentrations above background reporting thresholds.

8.6.1.2 Technetium-99. Tc-99 was detected primarily at two locations in the SDA: one near Pad A and one in the trench area on the east side of the SDA between Pit 14 and Pit 15. Concentrations near Pad A are considerably below the MCL; however, the other location yielded concentrations much greater than the MCL and was steadily increasing. Seeing Tc-99 in soil moisture is consistent with expectations that form the basis for the selected remedy. In situ grouting, a component of the selected remedy (completed September 2010), was chosen to reduce release of Tc-99 (and I-129) in the interim until the surface barrier is constructed. Grouting does not address Tc-99 that has already been released to the subsurface (and detected in monitoring), but will reduce further release. The future surface barrier is expected to prevent Tc-99 from reaching the aquifer in concentrations that exceed risk thresholds or the MCL and, thus, will be protective of human health and the environment. Figure 8-13 shows the monitoring well where Tc-99 was greater than the MCL. Reportable detections and concentration trends are summarized by sampling zones as follows:

- **Sampling Zone 0**—Technetium-99 was detected in samples collected near Pad A (i.e., D06:DL02, PA01:L15, and PA03:L33). Though concentrations are less than the MCL and exhibit no apparent trends, the presence of Tc-99 is notable because it is frequently detected around Pad A.

- Sampling Zone 1**—Tc-99 was predominantly detected at sample points D06:DL01 and R2004:DL50. Concentrations at D06:DL01 (88 ft bgs) are less than the MCL and exhibit no trend. Tc-99 concentrations at sample point R2004:DL50 (23 m [74 ft] bgs), exceeded the MCL by more than twentyfold in May 2009 and the trend was increasing rapidly (Figure 8-15). Lysimeter R2004:DL50 also yielded samples containing high levels of tritium, various inorganic constituents, and total uranium concentrations that exceed the MCL.
- Sampling Zone 2 and 3**—Tc-99 was not detected in samples collected from these zones.

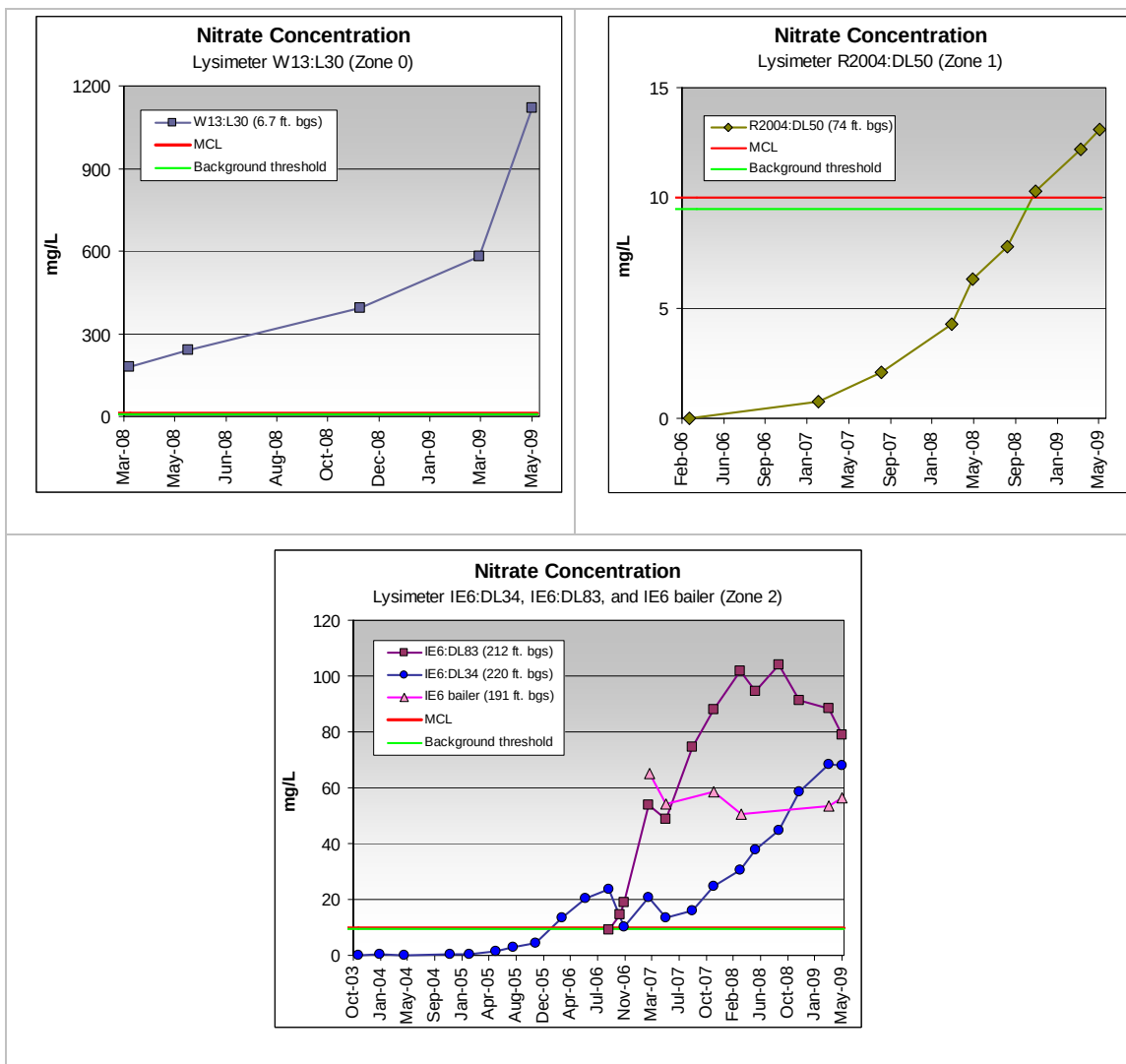


Figure 8-14. Nitrate (as nitrogen) concentration trends at sampling points in Zones 0, 1, and 2 (note different x and y axes).

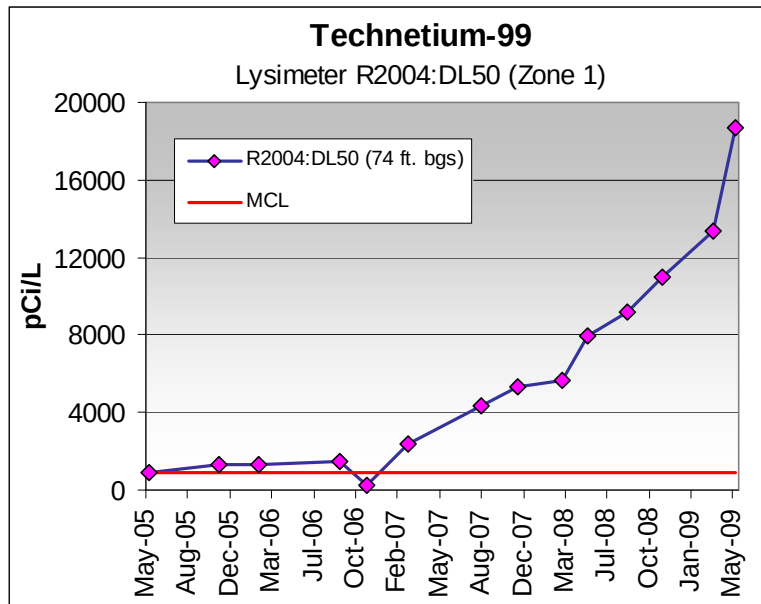


Figure 8-15. Technetium-99 concentration trend at Sample Point R2004:DL50.

8.6.2 Vadose Zone Soil Gas Monitoring

The vadose zone vapor monitoring network consists of 57 vapor monitoring wells containing 168 vapor ports ranging from about 9 m (30 ft) to more than 123 m (500 ft) bgs (Figure 8-16). Each well has from one to nine vapor ports (not all of which are sampled), ranging from 9.9 to 174.7 m (32.5 to 573 ft) bgs. Samples are analyzed for carbon tetrachloride, tetrachloroethylene, trichloroethylene, 1,1,1-trichloroethane, and chloroform. Data from representative monitoring well vapor samples are used to assess effectiveness of the organic contamination in the vadose zone system (Section 8.4.2.1).

The cleanup levels established for the organic contamination in the vadose zone component of the OU 7-13/14 selected remedy are based on carbon tetrachloride in two regions of the vadose zone. Though the Agencies expect vapor vacuum extraction with treatment operations to continue throughout Phase 1 while targeted waste retrievals are completed, removal of a significant portion of the VOC source term through targeted waste retrieval is expected to reduce the amount of time that vapor vacuum extraction with treatment operations will be required to achieve cleanup levels.

Monitoring indicates that concentrations of VOCs are decreasing throughout the vadose zone. Table 8-11 summarizes carbon tetrachloride detections for October 2004 through September 2009. Concentrations of most soil gas samples were less than 10 ppmv, with several samples reaching levels as high as 611 ppmv (carbon tetrachloride). The highest concentrations occurred in Zone A1. Concentrations are decreasing in the vast majority of the vadose zone, especially above the B-C interbed (Zone A1), where most of the extraction has occurred. Reductions in concentrations have been steady in areas located away from source zones.

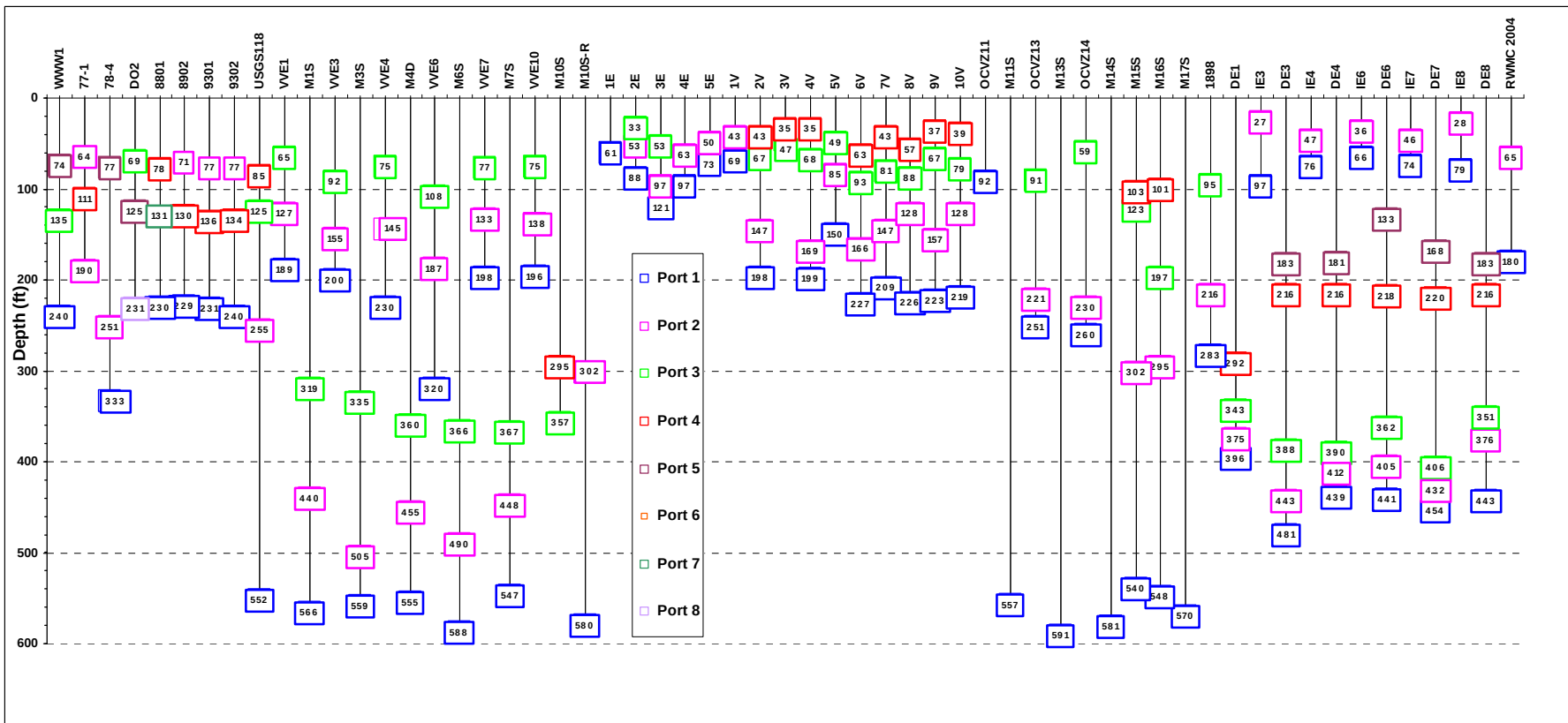


Figure 8-16. Depths of regularly monitored vapor ports.

Monitoring results are biased because they are based on dynamic conditions (i.e., with the vapor vacuum extraction with treatment system operating). Table 8-11 compares carbon tetrachloride concentrations to remediation goals. Figure 8-17 is a simple conceptual representation of the carbon tetrachloride plume under static conditions (i.e., with the vapor vacuum extraction with treatment system not operating) before the start of vapor vacuum extraction with treatment in January 1996. Figure 8-18 shows average detected concentrations in 2009. The current shape and distribution of the plume under static conditions is not known because vapor vacuum extraction with treatment operations have been nearly constant; therefore, equilibrium conditions cannot develop.

Table 8-11. Maximum and mean carbon tetrachloride concentrations in Zones A1 and A2 from October 1, 2004 to September 30, 2009.

Zone	Number of Detections	Maximum (ppmv)	Mean (ppmv)	Remediation Goal (ppmv)	Number of Detections Exceeding the Remediation Goal
A1	1,941	611	25.77	190	64
A2	1,474	220	18.72	39	159

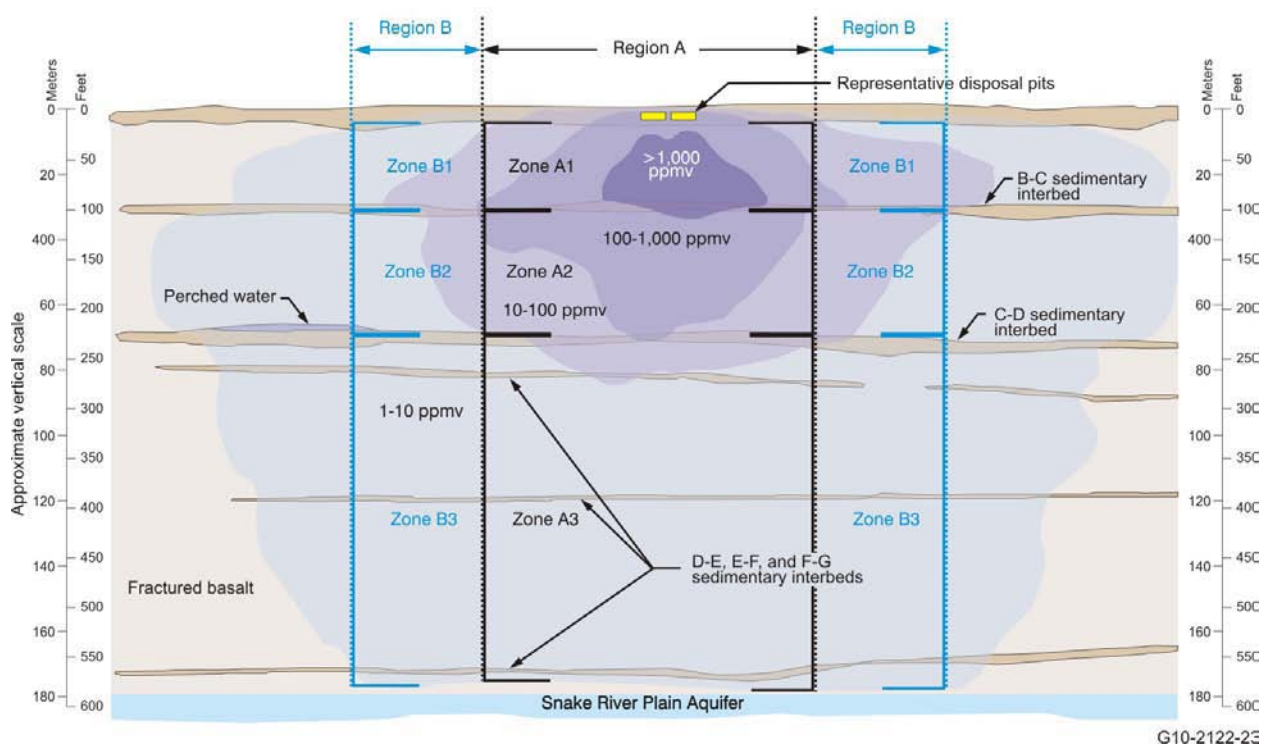
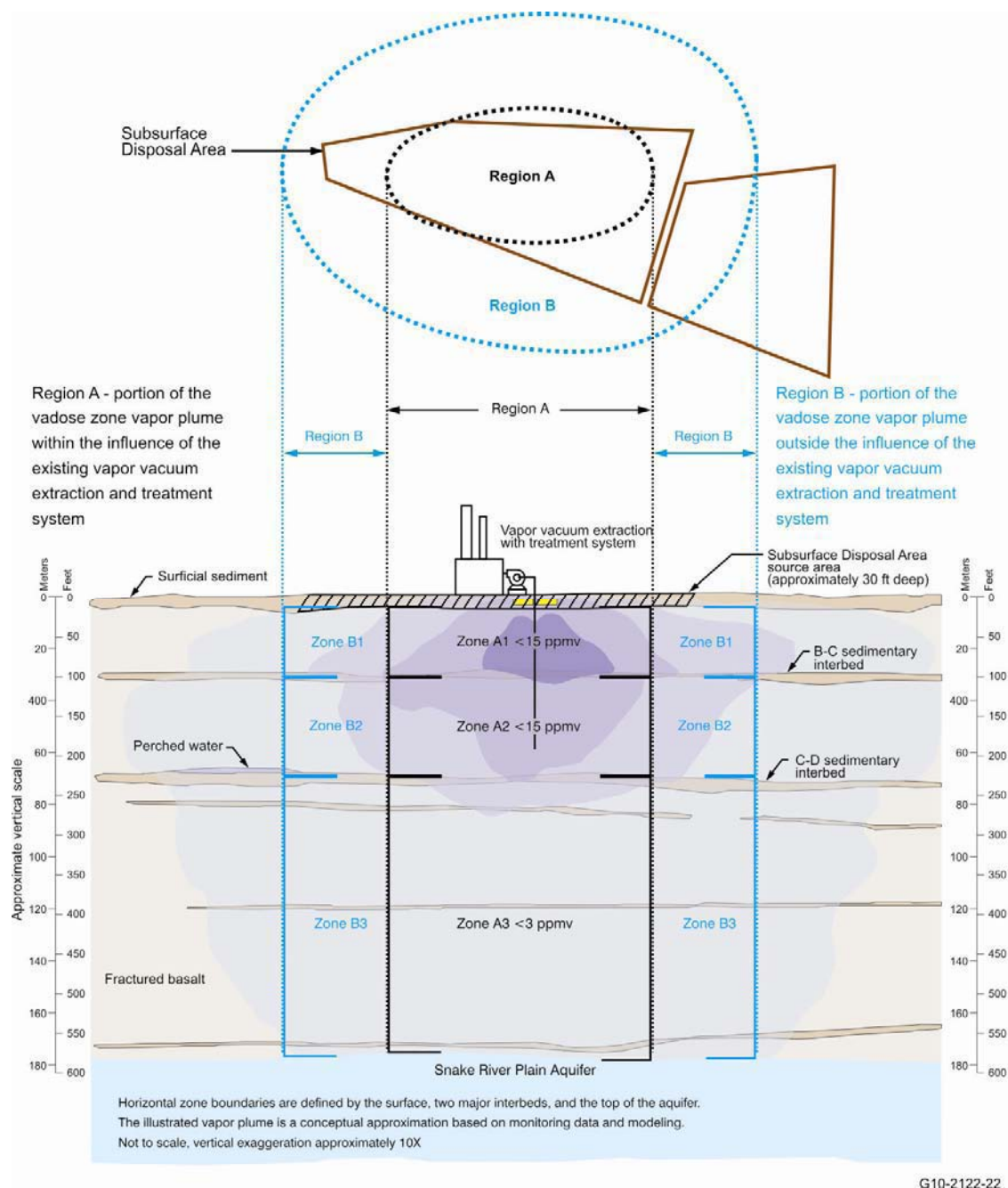


Figure 8-17. Conceptual drawing of the carbon tetrachloride soil gas plume in the vadose zone before remediation began in 1996.



G10-2122-22

Figure 8-18. Average carbon tetrachloride vapor concentrations detected in 2009.

8.6.3 Snake River Plain Aquifer Monitoring

Monitoring the aquifer in the vicinity of RWMC has been ongoing since 1972. Information below describes the monitoring network, analyses and reporting protocol, and monitoring results from October 2004 through September 2009. Only one contaminant (i.e., carbon tetrachloride) exceeds MCLs and is presented in detail. Complete aquifer monitoring results are presented in OU 7-13/14 annual monitoring reports (Koeppen et al. 2006, 2007; Koeppen, Bechtold, and Cresap 2008; Koeppen, Bechtold, and Holdren 2009; Koeppen 2009).

Fifteen aquifer monitoring wells are sampled by OU 7-13/14 twice a year and analyzed for radionuclides, inorganic constituents, VOCs, and 1,4-dioxane in accordance with the Field Sampling Plan (Bechtold et al. 2008). Eight additional monitoring wells at RWMC are sampled by the U.S. Geological Survey, though Well USGS-132 is generally sampled by OU 10-08. Figure 8-19 shows locations of aquifer monitoring wells at RWMC. Monitoring data obtained by the U.S. Geological Survey and OU 10-08 are not reported by OU 7-13/14; however, data are compared to substantiate concentration trends or to corroborate unexpected detections.

Primary groundwater COCs identified in the ROD are carbon tetrachloride, C-14, I-129, methylene chloride, nitrate, Tc-99, tetrachloroethylene, trichloroethylene, and 1,4-dioxane. Reportable detections for C-14, I-129, nitrate, and Tc-99 are defined as positive detections that exceed background reporting thresholds or MCLs. Reportable detections for VOCs and 1,4-dioxane are defined as positive detections that exceed analytical method quantitation (reporting) limits or MCLs. Contaminants that are not COCs also are reported if detected concentrations exceed MCLs or exhibit meaningful trends. For radionuclides, a positive detection is defined as a result greater than three times the 1σ uncertainty and greater than the sample-specific minimum detectable concentrations. For inorganic constituents, VOCs, and 1,4-dioxane, positive detections are determined in accordance with data validation procedures.

Nearly 18,000 analyses (excluding approximately 2,200 analyses of field blanks, trip blanks, and equipment rinsate samples) were performed on samples collected from OU 7-13/14 aquifer wells during this 5-year review period. Reportable detections are listed in Table 8-12, along with maximum concentrations, sample locations, and comparison values. The most frequently detected COCs in the vicinity of RWMC are carbon tetrachloride and trichloroethylene. Carbon tetrachloride and trichloroethylene exceeded the reporting limit of 1 $\mu\text{g/L}$ at seven monitoring locations. Two of these locations slightly exceeded the carbon tetrachloride MCL on numerous occasions. Trichloroethylene has never exceeded its MCL.

The two wells to exceed the carbon tetrachloride MCL (i.e., M7S and M16S) between 2004 and 2009 are located northeast of RWMC (Figure 8-20). Aquifer concentrations north and northeast of RWMC (i.e., Wells M3S, M7S, M16S, and USGS-87) are generally higher than concentrations south and east of RWMC (i.e., Wells A11A31, M6S, M15S, OW2, and USGS-120). Carbon tetrachloride in the aquifer at RWMC is attributed to waste disposed of in the SDA because VOCs are not present in plumes from upgradient sources.

Trends were evident at monitoring locations north, northeast, and south of RWMC. Since 2004, concentrations south of RWMC have steadily declined; whereas, locations north and northeast either remained relatively stable or exhibited a slower rate of increase. The most notable concentration trends occurred prior to 2004. In wells south of RWMC (i.e., Wells A11A31 and USGS-120), including abandoned Well M10S, carbon tetrachloride reached peak concentrations at different times, depending on well distance from RWMC (Figure 8-21). The progressive increase and decrease at each monitoring location (Figure 8-22), with no rebound, appear to be the result of a contaminant release that occurred in the SDA before 1995. In wells north and northeast of RWMC (i.e., Wells M3S, M7S, and USGS-87), peaks also occurred at different times. For example, at location USGS-87, the annual average concentration increased 450% from 1987 to 2000; then, from 2000 through 2009, annual average concentrations decreased 18% (Figure 8-21). Similar concentration changes occurred at Wells M3S and M7S, though the changes were not as pronounced.

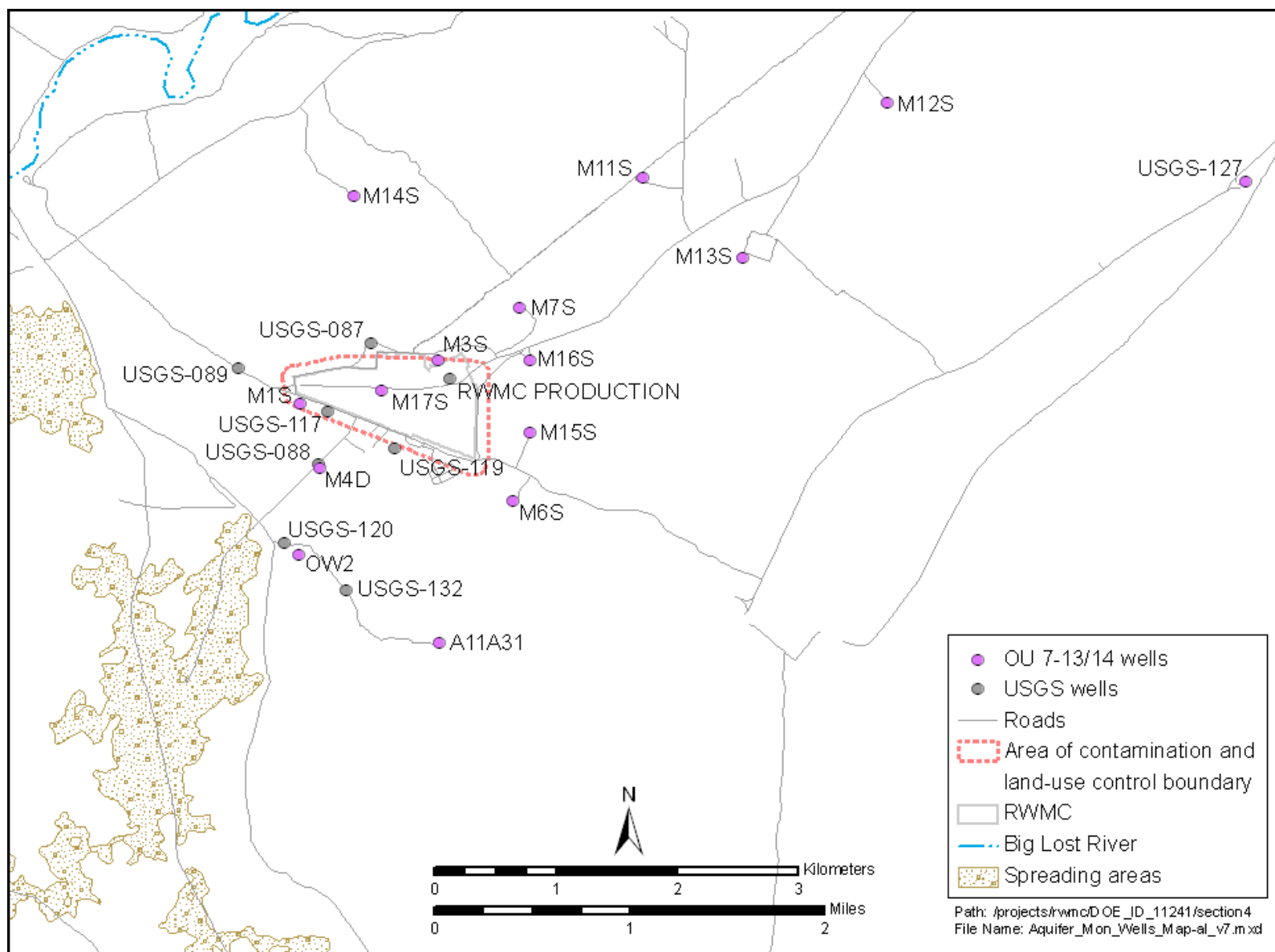


Figure 8-19. Aquifer monitoring wells at the Radioactive Waste Management Complex.

Table 8-12. Summary of contaminants of concern detected in Radioactive Waste Management Complex aquifer samples October 2004 through September 2009.

Contaminant of Concern ^a	Number of Wells Sampled	Number of Analyses	Number of Reportable Detections	Concentration		Maximum Contaminant Level ^b	Number of Detections Greater Than Maximum Contaminant Level ^b	Aquifer Monitoring Wells Exceeding Maximum Contaminant Level ^b
				Maximum $\pm 1\sigma$	Units			
Carbon tetrachloride	15	163	83	8.3^c	µg/L	5	5	M7S, M16S
Carbon-14	15	163	2	7.6 $\pm$ 1.2	pCi/L	2,000	0	NA
Nitrate	15	163	1	2.3	mg/L	10	0	NA
Technetium-99	15	164	1	1.6 $\pm$ 0.4	pCi/L	900	0	NA
Trichloroethylene	15	163	44	3.0	µg/L	5	0	NA

a. Other detected contaminants are presented in annual monitoring reports (Koeppen et al. 2006, 2007; Koeppen, Bechtold, and Cresap 2008; Koeppen, Bechtold, and Holdren 2009; Koeppen 2009).

b. MCLs are from “National Primary Drinking Water Regulations” (40 CFR 141) established by EPA to protect public drinking water sources.

c. **Black bold** font indicates a sample concentration that exceeds the MCL (Footnote b of this table). The number of analyses include duplicate samples collected for quality control purposes.

EPA Environmental Protection Agency
MCL maximum contaminant level
NA not applicable

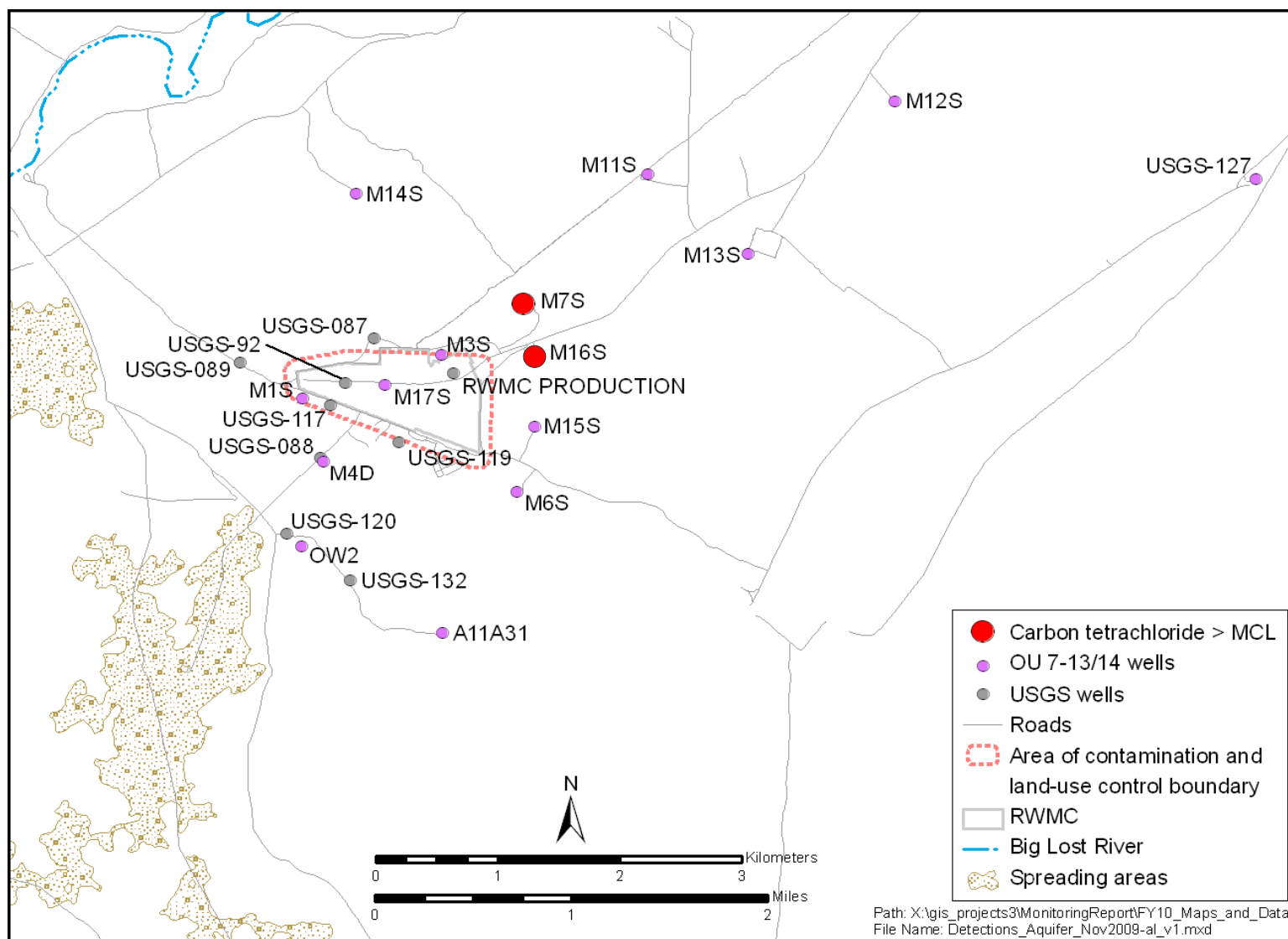


Figure 8-20. Aquifer wells where carbon tetrachloride concentrations exceeded the maximum contaminant level during this 5-year review period.

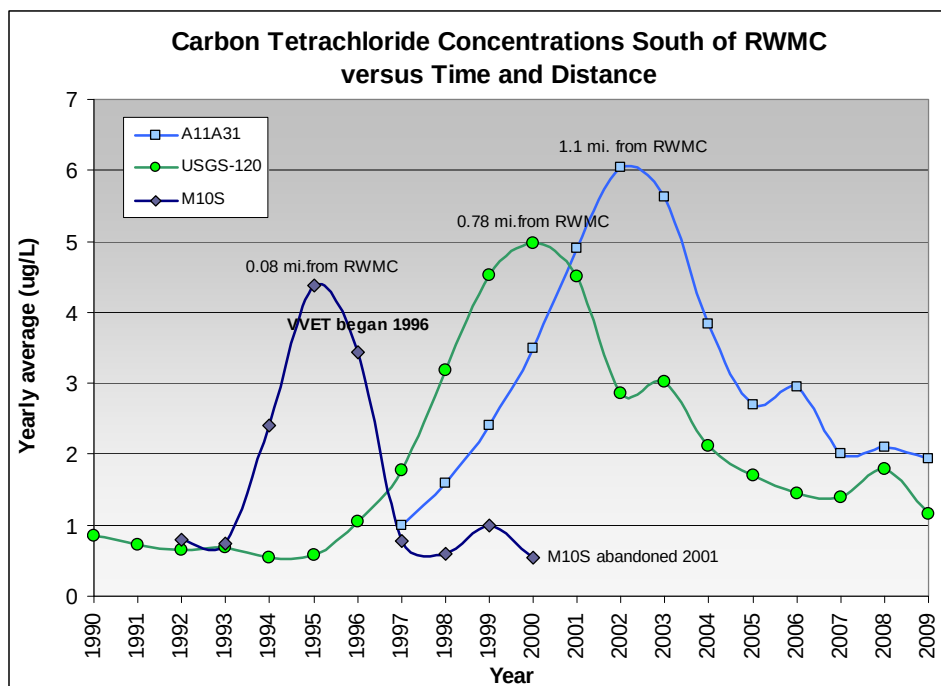


Figure 8-21. Carbon tetrachloride concentration trends in aquifer wells south of the Radioactive Waste Management Complex from 1990 through 2009.

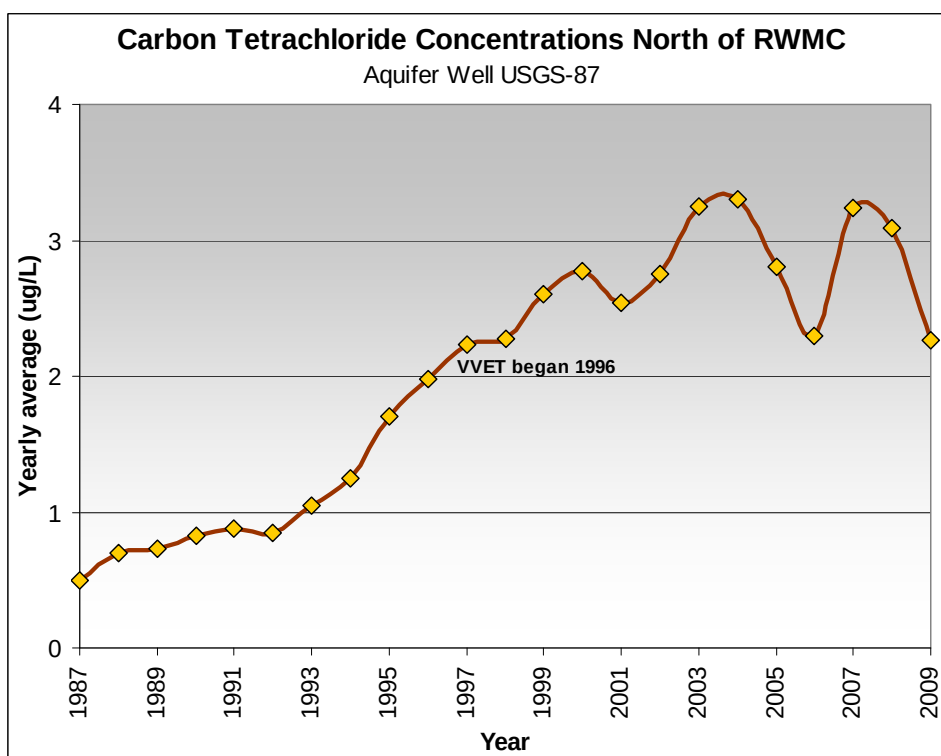


Figure 8-22. Change over time in carbon tetrachloride concentrations in aquifer well USGS-87 before and after vapor vacuum extraction and treatment began in 1996.

8.7 Technical Assessment

The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. Components of the OU 7-13/14 selected remedy under Phase 1 are functioning as intended. Miscellaneous elements of the selected remedy (e.g., maintenance of Pad A and environmental monitoring) are conducted according to requirements and controls in place to prevent exposure while remediation proceeds. Implementation of the organic contamination in the vadose zone system and retrieval of targeted waste are progressing as expected.

The organic contamination in the vadose zone system functioned reliably throughout the period of this report, and targeted waste retrievals (i.e., ARPs) have removed a substantial portion of the VOC source term. The generally declining rate of removal of vapors from the vadose zone, currently about 5,000 lb/year, implies progress toward remediation goals. Monitoring shows that concentrations of VOCs are decreasing at most vadose zone monitoring points, and the rate of increase in aquifer wells north and northeast of RWMC appears to be slowing. Reductions in concentration have been most steady in areas located away from source zones.

Targeted waste retrievals are proceeding, as planned, within this 5-year review period. Visual identification and retrieval of targeted waste have proven feasible, and targeted waste retrieval from areas P04P01 (ARP I; 0.50 acres) and P46P01 (ARP II; 0.34 acres) is complete. ARPs I and II generated 14,481 final waste packages, 9,558 of which have been shipped for disposal outside of Idaho. Operating procedures have been exercised and proven adequate. Off-normal events and delays experienced during project startup have been resolved, and lessons learned have been incorporated into new facility designs and operating procedures.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Yes.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

Technical Assessment Summary

All components of the selected remedy under Phase 1 are in progress and operating as required. The organic contamination in the vadose zone system functioned reliably throughout the period of this report and continues to make progress toward achieving OU 7-13/14 cleanup levels. Targeted waste retrieval from areas P04P01 (ARP I; 0.50 acres) and P46P01 (ARP II; 0.34 acres) is complete, and ARPs III and IV are in progress. The basis for the selected remedy remains valid, and no information has come to light that would call into question the protectiveness of the comprehensive remedy for OU 7-13/14.

8.8 Issues and Recommendations

No issues are identified, and, therefore, recommendations are not necessary. The technical assessment did not give rise to any new issues, and all issues from the previous 5-year review have been satisfactorily completed.

8.9 Protectiveness Statement for Operable Unit 7-13/14

The remedy at OU 7-13/14 is expected to be protective of human health and the environment upon completion, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled.

The comprehensive selected remedy is ongoing at RWMC. Individually and collectively, all elements of the remedial action (e.g., targeted waste retrieval, organic contamination in the vadose zone, and land-use controls) currently protect human health and the environment and are functioning as intended in the OU 7-13/14 ROD (DOE-ID 2008a). Ongoing maintenance and ICs preclude prolonged direct contact with contamination. Current operational and monitoring data indicate that the remedy is functioning as required to achieve cleanup goals. Upon completion, the OU 7-13/14 remedy is expected to be protective of human health and the environment. In the interim, exposure pathways that could result in unacceptable risk are being controlled, and monitoring of the vadose zone and aquifer will continue for the foreseeable future.

Following completion of Phases 1 and 2, an evapotranspiration surface barrier will be designed and constructed over the entire SDA under Phase 3. Phase 3 also will include tasks that prepare for transitioning the site to long-term management and control after the cap is constructed and the remedy is declared operational and functional. The long-term effectiveness of the remedy will be verified by monitoring and will be assessed in future 5-year reviews.

8.10 Waste Area Group 7 Summary and Conclusions

The FFA/CO (DOE-ID 1991) defines WAG 7 as RWMC. This is the first 5-year review since the Comprehensive ROD for RWMC OU 7-13/14 (DOE-ID 2008a) was published. Because the OU 7-13/14 ROD either eliminated or incorporated all OUs for WAG 7, evaluation of protectiveness in this 5-year review considers all of WAG 7 as OU 7-13/14; individual OUs are no longer assessed separately.

Remediation will occur over approximately 20 years, in three overlapping construction phases, followed by a final phase invoking long-term IC (DOE-ID 2008c). Phase 1 includes the first two major components of the comprehensive selected remedy—vapor vacuum extraction with treatment of organic contamination in the vadose zone and targeted waste retrieval. In addition, Phase 1 encompasses ongoing miscellaneous activities at RWMC, specifically, maintaining the cover on Pad A, monitoring the environment, and restricting access and controlling land use through ICs. In situ grouting comprises Phase 2. Preliminary work on Phase 2 began within this 5-year review period. Phase 3 involves preparing the site, constructing the evapotranspiration surface barrier, and transferring the site to the final phase. Work for Phase 3 has not begun. This 5-year review focuses on ongoing activities under Phase 1.

All components of the selected remedy under Phase 1 are in progress and operating as required. The organic contamination in the vadose zone system functioned reliably throughout the period of this report and continues to make progress toward achieving OU 7-13/14 cleanup levels. Targeted waste retrieval from areas P04P01 (ARP I; 0.50 acres) and P46P01 (ARP II; 0.34 acres) is complete, and ARPs III and IV are in progress. The basis for the selected remedy remains valid, and no information has come to light that would call into question the protectiveness of the comprehensive remedy for OU 7-13/14. No issues are identified, and, therefore, recommendations are not necessary. The technical assessment did not give rise to any new issues, and all issues from the previous 5-year review have been satisfactorily completed.

The remedy at OU 7-13/14 is expected to be protective of human health and the environment upon completion, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled.

Because the OU 7-13/14 selected remedy includes containment with an evapotranspiration surface barrier, 5-year statutory reviews will be required indefinitely. The next 5-year review is expected to cover the period from 2010 through 2014.

8.11 References

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9. WASTE AREA GROUP 9—MATERIALS AND FUELS COMPLEX

To facilitate cleanup, MFC, originally called Argonne National Laboratory-West, was designated as WAG 9 under the FFA/CO (DOE-ID 1991). The Comprehensive Remedial Investigation/Feasibility Study was completed in 1997 (Lee et al. 1997). The Remedial Investigation/Feasibility Study evaluated 37 sites, collectively designated as OU 9-04. Five sites were found to pose unacceptable risks to human health or the environment. Remedial action proceeded in accordance with the OU 9-04 ROD (DOE-CH 1998a). OU 9-04 is the only component of WAG 9 that remains subject to 5-year review.

9.1 Site Chronology

MFC was established in the 1950s to research and develop nuclear reactors and fuel. Table 9-1 provides a chronology of significant documents and events for OU 9-04.

Table 9-1. Chronology of significant documents and events for Operable Unit 9-04.

Date	Document or Event
December 1997	<i>Comprehensive Remedial Investigation/Feasibility Study for the Argonne National Laboratory-West Operable Unit 9-04 at the Idaho National Engineering and Environmental Laboratory</i> (Lee et al. 1997)
January 1998	<i>Proposed Plan for Waste Area Group 9—Argonne National Laboratory-West</i> (DOE-CH 1998b)
September 1998	<i>Final Record of Decision Argonne National Laboratory-West, Operable Unit 9-04</i> (DOE-CH 1998a)
February 1999	Completed bench-scale phytoremediation testing
October 1999	<i>Final Remedial Design Argonne National Laboratory-West, Operable Unit 9-04</i> (ANL-W 1999)
May 17, 1999	Began phytoremediation at four sites
February 2000	<i>Final Explanation of Significant Differences to the Record of Decision for Argonne National Laboratory-West Operable Unit 9-04</i> (DOE-CH 2000)
March 2001	<i>Phytoremediation 2-Year Field Season Demonstration Project Report, Argonne National Laboratory-West</i> (ANL-W 2001)
July 2003	<i>Sampling and Analysis Plan for the Post-Phytoremediation Characterization of ANL-W CERCLA Sites</i> (Portage 2003)
May 2004	<i>Explanation of Significant Difference for Argonne National Laboratory-West</i> (DOE-CH 2004).
August 2004	<i>Final Remedial Design Argonne National Laboratory-West, Operable Unit 9-04</i> (ANL-W 2004)
February 2005	Battelle Energy Alliance assumed ownership of WAG 9 and renamed the facility to Materials and Fuels Complex
March 2005	Site ANL-04 (sewage lagoons) administratively transferred to OU 10-08 (Hain 2005)
June 2005	<i>Remedial Action Report for Waste Area Group 9, Operable Unit 9-04 at the Idaho National Laboratory</i> (Portage 2005a)

Table 9-1. (continued).

Date	Document or Event
October 2005	<i>Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory</i> (DOE-ID 2007) ^a
September 2008	MFC-64 and MFC-65 identified as potential new sites
a. Revision 0 of the 5-year review was completed in October 2005. Subsequent revisions did not affect analysis of OU 9-04.	
ANL-W	Argonne National Laboratory West
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
OU	operable unit
WAG	waste area group

9.2 Background

MFC was established in the 1950s to research and develop nuclear reactors and fuel. Since then, three reactors have been constructed at MFC: Transient Reactor Test Facility, Experimental Breeder Reactor II (EBR-II), and Zero Power Physics Reactor. None of these reactors is currently operating, but past operations and support activities resulted in chemical and radioactive contamination. Information that follows summarizes site background information presented in the OU 9-04 Comprehensive Remedial Investigation/Feasibility Study (Lee et al. 1997).

9.2.1 Physical Characteristics

MFC, like the rest of the INL Site, is located on the Eastern Snake River Plain physiographic province and has semidesert characteristics with hot summers and cold winters. The Snake River Plain is a broad low-relief sagebrush-covered basin floored with basalt lava flows and terrestrial sediments. MFC is found in the southeastern portion of the INL Site and contains a roughly rectangular-shaped administrative area encompassing approximately 890 acres. A double security fence with largest east-west and north-south dimensions of 580 m and 765 m (1,902 ft and 2,512 ft) surrounds the major portion of MFC, respectively. The fenced area contains more than 60 buildings and 13 temporary trailers. Outside the security fence are the following: six buildings supporting the Transient Reactor Test Facility, three sanitary sewage lagoons, the radioactive scrap waste facility, the security area firing range, parking lot, and helicopter landing pad. Outside the perimeter of MFC are unpaved roads, groundwater monitoring wells, interceptor canal, industrial waste pond, three old construction rubble burn areas, and borrow pits. All MFC facilities are within a local topographically closed basin. The surface of the facility slopes gradually from south to north, at approximately 30 ft per mile. Maximum topographic relief within the MFC administrative boundary is about 50 ft, ranging from 5,110 ft above mean sea level on the north boundary to 5,160 ft on a basalt ridge to the southeast. Average annual precipitation is approximately 9 in. per year. The geology and hydrology are discussed below.

9.2.1.1 Geology. Surficial materials at MFC facilities are found within a topographically closed basin. Low ridges of basalt found east of the area rise as high as 100 ft above the level of the plain. Surficial sediments cover most of the underlying basalt, except where pressure ridges form basalt outcrops. Thickness of these surficial sediments ranges from zero to 20 ft.

Test borings at MFC have revealed two distinct layers in the surface sediments. The uppermost layer, from zero to several feet bgs, consists of a light brown silty loam. The upper 1 to 2 ft of this silty loam layer contains plant roots. This silty loam layer may also contain basalt fragments in areas where it directly overlies basalt. The lower layer is a sandy-silt (loess) that extends to the underlying basalt.

The subsurface geology at MFC is similar to that on the rest of the INL Site. The most striking difference is the lack of continuous sedimentary interbeds beneath the facility. Those sedimentary interbeds intercepted during drilling appear to be discontinuous stringers, deposited in low areas on basalt surfaces. The interbeds range in thickness from less than 1 in. to 15 ft. Areally extensive interbeds have been identified above the regional water table, at approximately 400, 550, and 600 ft bgs. The depth to the SRPA below MFC is approximately 640 ft bgs.

9.2.1.2 Hydrology. MFC has no permanent, natural surface water features nearby. During rapid snowmelt events at MFC, the interceptor canal (ANL-09) and the industrial waste pond have received surface water run-off. A diversion dam south of the facility handles these events. This dam has a headgate that, when closed, diverts water into the adjacent drainage ditch and eventually to the interceptor canal, and, from there, directly into the industrial waste pond.

9.2.2 Land and Resource Use

The land and facilities at WAG 9 are expected to remain under government management and control until at least 2095. Regardless of the future use of land now occupied by the INL Site, the federal government has an obligation to provide adequate ICs (e.g., limit access) to areas that pose a significant health and/or safety risk to the public and workers until that risk diminishes to an acceptable level for the intended purpose.

Two of the major facilities, EBR-II reactor and Zero Power Physics Reactor, at MFC are being decommissioned. Other support buildings, such as the Sodium Process Facility and Sodium Components Maintenance Shop, are tentatively scheduled for decommissioning. MFC will continue to use all other support facilities for current work scope. Additional buildings are tentatively planned that could add hundreds of additional personnel located at MFC. Because of the growing work scope in development of fuels, MFC likely will remain in DOE control well beyond 2095.

9.2.3 History of Contamination

MFC was established in the 1950s to research and develop nuclear reactors and fuel. Over time, three reactors have been constructed at MFC. Reactor operations and support resulted in chemical and radioactive contamination.

9.2.4 Initial Response

Neither interim actions nor removal actions were implemented in WAG 9 in advance of the OU 9-04 Comprehensive ROD (DOE-CH 1998a).

9.2.5 Basis for Taking Action

The OU 9-04 Remedial Investigation/Feasibility Study concluded that eight areas posed unacceptable risk. Two posed unacceptable risks to humans, one posed unacceptable risks to humans and ecological receptors, and the remaining five posed unacceptable risks to ecological receptors only. Three sites that contained Cs-137 were the only MFC sites that posed a risk to human health, and sites that contained various inorganics posed unacceptable risks to ecological receptors. Figure 9-1 is an aerial photograph of MFC taken in 2009. Figure 9-2 shows locations of the release sites at WAG 9 that required remediation under the OU 9-04 ROD.



Figure 9-1. Aerial photograph of the Materials and Fuels Complex.

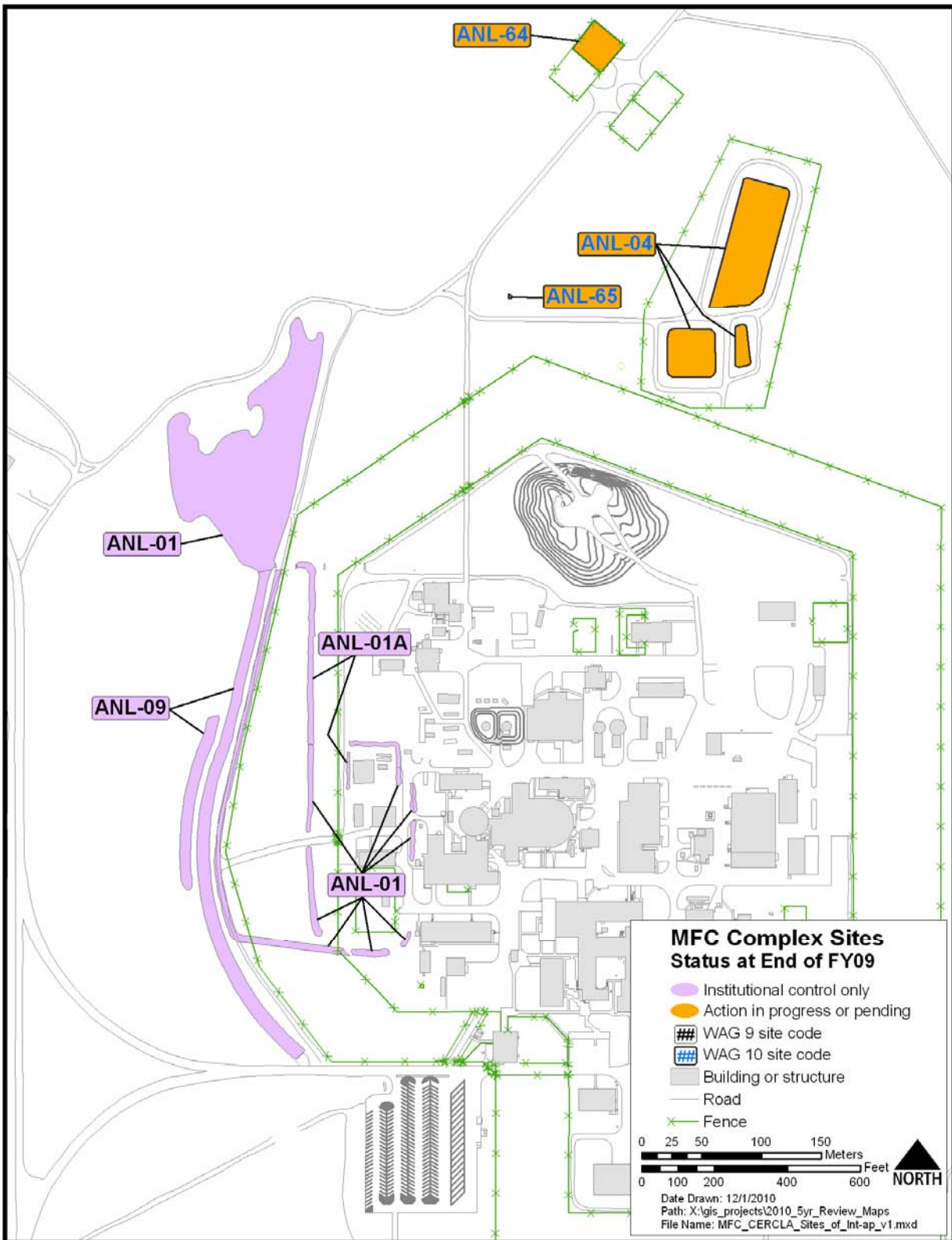


Figure 9-2. Materials and Fuels Complex sites.

9.3 Operable Unit 9-04

OU 9-04 is the comprehensive remedy for WAG 9.

9.3.1 Remedy Selection

The OU 9-04 ROD (DOE-CH 1998a) selected remedies for eight sites. One site, ANL-04, sewage lagoons, was subsequently transferred to WAG 10, OU 10-08 (see Section 10.4.4) for future remedial action (Hain 2005; Ceto 2005; Koch 2005); thus, ANL-04 is excluded from discussions that follow for WAG 9. Risks from the remaining 32 sites in WAG 9 were considered acceptable; thus, they required no action. Figure 9-1 is an aerial photograph of MFC taken in 2009. Figure 9-2 shows locations of the release sites at WAG 9 that required remediation under the OU 9-04 ROD.

The selected remedy for the industrial waste pond and associated Ditches A and B (ANL-01), main cooling tower blowdown ditch (ANL-01A), interceptor canal (ANL-09) and mound, and the industrial waste lift station discharge ditch (ANL-35) was phytoremediation. Phytoremediation was expected to remove contaminants to acceptable levels after five field seasons. A contingent remedy of excavation and disposal was specified if phytoremediation was not adequate.

9.3.1.1 Remedial Action Objectives. Table 9-2 summarizes RAOs for OU 9-04.

Table 9-2. Final remedial action objectives for Operable Unit 9-04 remediation sites.

Sites	Remedial Action Objectives
ANL-01, industrial waste pond	Reduce risk from all pathways and all COCs to a total excess cancer risk of less than 1 in 10,000 and a total hazard index of less than 1 for the hypothetical resident 100 years in the future and for the current and future worker.
ANL-01, Ditch A	Prevent exposure to COCs in soils that may have potential adverse effects to resident populations of flora and fauna, as determined by a hazard quotient greater than or equal to 10 times the hazard quotient calculated from INL Site background soil concentrations.
ANL-01, Ditch B	Prevent exposure to COCs in soils that may have potential adverse effects to resident populations of flora and fauna, as determined by a hazard quotient greater than or equal to 10 times the hazard quotient calculated from INL Site background soil concentrations.
ANL-01A, main cooling tower blowdown ditch	Prevent exposure to COCs in soils that may have potential adverse effects to resident populations of flora and fauna, as determined by a hazard quotient greater than or equal to 10 times the hazard quotient calculated from INL Site background soil concentrations.
ANL-09, interceptor canal-canal	Reduce risk from all pathways and all COCs to a total excess cancer risk of less than 1 in 10,000 and a total hazard index of less than 1 for the hypothetical resident 100 years in the future and for the current and future worker.
ANL-09, interceptor canal-mound	Reduce risk from external radiation exposure from Cs-137 to a total excess cancer risk of less than 1 in 10,000 for the hypothetical resident 100 years in the future and the current and future worker.
ANL-35, industrial waste ditch	Prevent exposure to COCs in soils that may have potential adverse effects to resident populations of flora and fauna, as determined by a hazard quotient greater than or equal to 10 times the hazard quotient calculated from INL Site background soil concentrations.
COC	contaminant of concern
INL	Idaho National Laboratory

9.3.1.2 Cleanup Levels. Table 9-3 lists COCs and cleanup levels for each of the seven sites.

Table 9-3. Contaminants of concern and remediation goals for Operable Unit 9-04.

Site Code	Area	COC	Risk	95% UCL Concentration	Remediation Goal
ANL-01	Industrial waste pond	Chromium-III	Ecological	1,030 mg/kg	50 mg/kg
		Mercury	Ecological	2.62 mg/kg	0.74 mg/kg
		Selenium	Ecological	8.41 mg/kg	3.4 mg/kg
		Zinc	Ecological	5,012 mg/kg	2,200 mg/kg
		Cs-137	Human	29.2 pCi/g	23.3 pCi/g
	Ditch A	Mercury	Ecological	3.94 mg/kg	0.74 mg/kg
	Ditch B	Chromium	Ecological	1,306 mg/kg	50 mg/kg
		Zinc	Ecological	3,020 mg/kg	2,200 mg/kg
ANL-01A	Main cooling tower blowdown ditch	Chromium	Ecological	709 mg/kg	50 mg/kg
		Mercury	Ecological	8.83 mg/kg	0.74 mg/kg
ANL-09	Interceptor canal-canal	Cs-137	Human	30.53 pCi/g	23.3 pCi/g
	Interceptor canal-mound	Cs-137	Human	18 pCi/g	23.3 pCi/g
ANL-35	Industrial waste lift station discharge ditch	Silver	Ecological	352 mg/kg	112 mg/kg
ANL	Argonne National Laboratory				
COC	contaminant of concern				
UCL	upper confidence limit				

9.3.2 Remedy Implementation

The following subsections describe the nature of, extent of, and remedial actions for the seven sites remediated under OU 9-04.

9.3.2.1 ANL-01 Industrial Waste Pond. The industrial waste pond (ANL-01) is an unlined, approximately 3-acre evaporative seepage pond fed by the interceptor canal and site drainage ditches. The pond was excavated in 1959, obtained a maximum water depth of about 4 m (13 ft) in 1988, and is still in use today. During this time, the cooling tower blowdown ditches have been rerouted several times. MFC auxiliary cooling tower blowdown ditches convey industrial wastewater from the EBR-II power plant and the fire station (MFC-768 and MFC-759) to the industrial waste pond. The industrial waste pond was originally included with the main cooling tower blowdown ditch (ANL-01A) as a land disposal unit under the RCRA Consent Order and Compliance Agreement (EPA 1987) on the basis of potentially corrosive liquid wastes discharged with the cooling tower effluent. However, MFC conducted a field demonstration that showed that any potentially corrosive wastes discharged to the industrial waste pond were naturally neutralized in the main cooling tower blowdown ditch before reaching the industrial waste pond. On that basis, EPA removed the industrial waste pond as a land disposal unit and re-designated it as a solid waste management unit. Therefore, this site is under the regulatory authority of both RCRA and CERCLA.

DOE anticipates the industrial waste pond will continue to be used for storm water disposal for the foreseeable future.

The implemented remedy for the soil in the industrial waste pond was excavation with disposal at the ICDF. Excavation involved removal of soil contaminated with Cs-137 above 23.3 pCi/g. Confirmation sampling conducted after the initial removal indicated a small localized area that required additional excavation and confirmation sampling. Confirmation sampling was required to demonstrate compliance with remediation goals and to establish the need for ICs.

Confirmation sampling indicated that the residual Cs-137 concentration was 10 pCi/g (95% upper confidence limit); however, one hot spot remained for chromium that exceeded the remediation goal. Consequently, a second campaign of excavation and disposal was conducted in November 2004 which removed all soil from this hot spot down to the basalt. The hot spot removal resulted in 136 tons of soil that was transported to the ICDF.

After remediation, the five contaminants were below the established remediation goals for the surface and subsurface data sets with the exception of chromium in the surface soils. The chromium in the surface soils had a mean concentration of 433 mg/kg and a calculated upper confidence limit of 626 mg/kg, which exceeded the 500-mg/kg remediation goal. However, the State of Idaho and EPA agreed that since the pond will continue to be used, no vegetation (bunch grass) could grow underwater; thus, no pathway exists.

9.3.2.2 ANL-01 Ditch A. Ditch A conveyed industrial wastewater from the EBR-II power plant auxiliary cooling tower to the industrial waste pond. Ditch A is still being used today to transport storm water run-off as well as intermittent auxiliary cooling tower waters. Discharges to Ditch A flow into the main cooling tower blowdown ditch and ultimately into the industrial waste pond.

Soil samples were collected from Ditch A as part of two different investigations. These are the Chen-Northern study in 1988 (Chen-Northern 1989) and the 1994 Argonne National Laboratory-West study (ETAS 1995). Appendix A of the OU 9-04 Comprehensive Remedial Investigation/Feasibility Study (Lee et al. 1997) shows the sampling location plan map, color intensity profile maps, and statistics for COC by pathway. In the 1988 Chen-Northern study, eight soil samples were collected from three locations in the western part of the ditch. In the 1994 Argonne National Laboratory-West study, 30 soil samples were collected from 11 locations throughout the entire length of the ditch.

Mercury was retained as a contaminant of potential concern for ecological receptors and was detected in 74% (27/38) of the samples analyzed. All mercury detections exceeded the upper limit of the 95% upper confidence limit background concentration (0.074 mg/kg). The source of the mercury is most likely from mercuric chloride used as a wood preservative in the cooling tower or from a neutron absorber in the power plant, which is being decommissioned. A maximum concentration of 4.1 mg/kg was detected at Location #10W in the surface sample (0 to 6 in.). The upper confidence limit concentration for mercury in Ditch A was 3.94 mg/kg. In all but one instance, the surface samples at each location contained the highest concentrations of mercury, with the exception of Location #26E. The mercury contamination in Ditch A is spread through the entire length, with the highest concentrations near the intersection of the main cooling tower blowdown ditch and Ditch A. The mercury concentrations also decrease with increasing depth, with the highest concentrations in the surface 0 to 6-in. samples. Therefore, the extent of contamination is the dimensions of both the eastern and western part of Ditch A (5 ft × 400 ft) and 0 to 6 in.

In May 1999, phytoremediation was initiated at Ditch A, which contained mercury contamination that posed an unacceptable risk to ecological receptors. Phytoremediation was estimated to take 7 years to

meet the remediation goal of 0.74 mg/kg for mercury. Preliminary results from two field seasons showed that phytoremediation with hybrid willows and poplars was working better than expected and that remediation goals could be met after 4 years.

Phytoremediation continued in 2001 and 2002, and confirmation samples were collected in 2003 and summarized in the *Data Quality Assessment Report for the Post-Phytoremediation Characterization of ANL-W CERCLA Sites* (Portage 2005b). The sampling results indicated that hot spots remained; therefore, the MFC implemented the contingent remedy of excavation and disposal and completed activities in 2004. The excavated soil was transported to the CFA bulky waste landfill and placed at a depth greater than 10 ft to prevent exposure to ecological receptors.

Tables 13 and 16 of the *Data Quality Assessment Report for the Post-Remedial Action Confirmation Sampling of the ANL-W CERCLA Sites* (Portage 2005c) show the statistical calculation of mercury for the surface and subsurface soils, respectively. The upper confidence limit values in the surface and subsurface soils were 0.64 mg/kg and 0.74 mg/kg, respectively, which are at or below the mercury remediation goal of 0.74 mg/kg.

9.3.2.3 ANL-01 Ditch B. Ditch B was also used to transport storm water run-off as well as wastewater from the EBR-II power plant and the fire station (MFC-768 and MFC-759) to the industrial waste pond. Only a small 125-ft portion of Ditch B is still being used today since the majority 1,275 ft of Ditch B was backfilled with clean soil to grade with approximately 5 ft of soil during the installation of a secondary security fence.

Soil samples were collected from Ditch B as part of three different investigations. Six soil samples were collected from the 1988 DOE study, 15 samples collected from the 1988 Chen-Northern study (Chen-Northern 1989), and 10 samples in the 1994 Argonne National Laboratory-West study (ETAS 1995). Appendix A of the OU 9-04 Comprehensive Remedial Investigation/Feasibility Study shows the sampling location plan map, color intensity profile maps, and statistics for COCs by pathway for the 1994 samples collected from Ditch B. The contaminant screening resulted in contaminants of potential concern for humans and only two inorganics being retained as contaminants of potential concern for ecological receptors. These two inorganics are trivalent chromium and zinc. The extent of the inorganic contaminants is discussed below.

The contaminants in the covered portion of Ditch B have been screened from the risk assessment since the pathway was eliminated when the area was backfilled with clean soils. The open portion of Ditch B has chromium and zinc at concentrations that could pose unacceptable human and ecological risks. The maximum concentration of trivalent chromium and zinc are 4,530 and 3,020 mg/kg and the upper confidence limit concentrations are 1,306 and 1,460 mg/kg, respectively. The extent of the inorganic contaminants spans the entire length of the open portion of Ditch B, which is 5 ft wide and 125 ft long. No stratification of inorganics was determined from the results in that portion of Ditch B; thus, the total depth of the alluvium to the basalt (0 to 1.3 ft) defines the extent of contamination.

An Explanation of Significant Differences (DOE-CH 2000) issued in February 2000 implemented the contingent remedy of excavation and disposal of the soil, rather than phytoremediation, at Ditch B. The excavation activities were conducted in June 2000 using front-end loaders and backhoes to remove the soil from the ditch down to the top of the basalt. Dump trucks moved the soil to the staging area. The soil was stockpiled near the ditch and covered with plastic material to prevent the spread of contamination from windblown dust, rainfall, and leachate. The soil remained at the stockpiled area until it could be accepted at a new waste cell in the CFA landfill. The soil was deposited in the bottom of the cell at a depth greater than 10 ft to prevent exposure to ecological receptors. Confirmation samples could not be collected because all the soil was removed.

9.3.2.4 ANL-01A Main Cooling Tower Blowdown Ditch. The main cooling tower blowdown ditch (ANL-01A) runs north on the west side of the main cooling tower and then north between the security fences to the industrial waste pond. It is an unlined channel approximately 700 ft long and 3–15 ft wide. From 1962 to 1996, the ditch conveyed industrial wastewater from the cooling tower to the industrial waste pond. The main source of impurities to the industrial waste pond was water treatment chemicals used to regenerate backwash waters from the ion exchange resin beds and remove minerals from cooling tower water used in the EBR-II steam system. From 1962 to July 1980, a chromate-based corrosion inhibitor was added to the cooling tower water and the blowdown contained significant quantities of hexavalent chromium. Ion exchange column regeneration discharges have occurred from 1962 to March 1986. Regeneration of these columns is accomplished with sulfuric acid for cation columns and sodium hydroxide for anion columns.

Chromium concentrations were the highest in the outfall from the cooling tower. But the entire length of the main cooling tower blowdown ditch has concentrations of chromium above the 95% upper confidence limit background concentration levels for the INL Site surface soils. The analysis performed on the chromium was for the total chromium analysis. The chromium was almost exclusively in the trivalent form rather than the more toxic hexavalent form. But, to be conservative, DOE assumed that 10% of the total chromium would be in the more toxic hexavalent form. The chromium concentrations almost exclusively decreased with increasing depth and with increasing distance downstream of the cooling tower outfall. The maximum chromium concentration was 2,200 mg/kg for the main cooling tower blowdown ditch, with the upper confidence limit concentration of 1,306 mg/kg.

Remediation for this site began in May 1999. The main cooling tower blowdown ditch was divided into two portions based on location. The east portion of the ditch is located near the cooling tower inside the MFC protection area. The west portion of the ditch is located between the inner and outer security fences. Contaminant concentrations for the soil in these two portions varied by orders of magnitude, and the selected remedy of phytoremediation would only work on the west portion. The east portion received the cooling tower discharge and had the highest contaminant concentrations, and the west portion had much lower concentrations and conveyed the effluent to the industrial waste pond. Because of the concentration differences between these two portions of the same CERCLA site, the decision was made to use excavation and disposal on the east portion and phytoremediation on the west portion.

The east portion of the main cooling tower blowdown ditch lies within the MFC security protection area and received water discharged from the cooling tower. For that portion of the ditch, the contingent remedy of excavation and disposal of the soils—rather than phytoremediation—was implemented in accordance with an Explanation of Significant Differences issued in February 2000 (DOE-CH 2000). The excavation activities were conducted in May 2000 using front-end loaders and backhoes to remove soil from the ditch down to a depth of 2 ft. The soil was stockpiled with the Ditch B soil and covered with plastic material to prevent the spread of contamination from windblown dust, rainfall, and leachate. Soil samples indicated that the remediation goals had not been achieved, and additional soil was removed to basalt (approximately 6 ft) in June 2000. The 130 yd³ of stockpiled soil was disposed of at the CFA landfill in July. The soil was placed in the bottom of the CFA landfill cell at a depth greater than 10 ft to prevent exposure to ecological receptors. Confirmation sampling results were not collected, because no soil existed above basalt, and the ditch was backfilled with clean soil to grade.

Phytoremediation actions were initiated at the west portion of the main cooling tower blowdown ditch in May 1999. Initial activities included removal of soil from the area inside the two security fences and placing the soil inside the MFC controlled area. That action was necessary because trees growing in the security area could have potentially provided concealment of threats to MFC. Phytoremediation was estimated to take 7 years to meet the remediation goals of 500 mg/kg and 0.74 mg/kg for chromium and mercury, respectively. The results after the first 2 years of implementation showed that phytoremediation

using the hybrid willows and poplars was working better than expected and remediation goals could be met after 4 years. Phytoremediation activities continued in 2001 and 2002, and confirmation samples were collected in 2003. Tables 5 and 9 of the *Data Quality Assessment Report for the Post-Phytoremediation Characterization of ANL-W CERCLA Sites* (Portage 2005b) show the upper confidence limit values for chromium and mercury in the surface and subsurface soils, respectively. The upper confidence limits for surface samples and subsurface for chromium were 54.8 mg/kg and 61 mg/kg, respectively, well below the remediation goal of 500 mg/kg. The upper confidence limit for mercury in the surface and subsurface was 0.42 mg/kg and 0.37 mg/kg, respectively, both below the remediation goal of 0.74 mg/kg.

9.3.2.5 ANL-09 Interceptor Canal. The canal portion transported industrial waste to the industrial waste pond and diverted spring run-off and other natural waters around MFC for flood control. Between 1962 and 1975, two 4-in. pipes transported liquid industrial wastes and cooling tower effluent to the interceptor canal. One line transported cooling tower blowdown water and regeneration effluent while the other line originated at the industrial waste lift station (MFC-760) and transported industrial wastes. Liquid radioactive wastes were discharged through the same line as the industrial wastes, but they were diverted to the EBR-II leach pit. Discharge of industrial wastes was discontinued in 1973, and discharge of cooling tower blowdown water was discontinued in 1975.

During clean-out operations at the interceptor canal in October 1969, abnormal background radioactivity was detected. Additional radiation surveys in 1969, 1973, and 1975 indicated that the entire length of the interceptor canal was contaminated. Approximately 4,540 yd³ of contaminated soil was identified and only 1,240 yd³ was targeted for removal. Of the removed soil, approximately 182 yd³ was disposed of at RWMC from 1975 to 1976, and the remaining 1,058 yd³ was stockpiled onsite (this stockpiled soil was evaluated as part of OU 10-06). The remaining soil, 3,300 yd³, was left in the ANL-09-mound and was investigated as part of the Remedial Investigation/Feasibility Study process. Another survey conducted in 1993 indicated that two small areas had elevated readings above background.

The contaminant screening resulted in only Cs-137 being retained as a contaminant of potential concern for humans and no contaminants of potential concern for the ecological receptors. The 95% upper confidence limit concentration for Cs-137 is 18 pCi/g and is fairly uniform throughout the entire length of the ditch. Thus, the extent of contamination is 30 × 1,425 × 6 ft.

The only contaminant in the interceptor canal-canal soils was Cs-137 at 18 pCi/g, which was below the remediation goal of 23.3 pCi/g and, thus, did not require remediation. However, this site will remain under ICs until Cs-137 levels decay to background. No additional confirmation sampling was required to demonstrate compliance with remediation goals.

The interceptor canal-canal contains low levels of Cs-137 that pose unacceptable risks to humans for the occupational receptor scenario. The concentration of Cs-137 was 18 pCi/g, which is below the remediation goal of 23.3 pCi/g. This site will remain under ICs until Cs-137 decays sufficiently to allow unrestricted land use in approximately 2048.

9.3.2.6 ANL-09 Interceptor Canal-Mound. This section summarizes the analytical results for soil samples collected at the interceptor canal-mound (ANL-09) area. The interceptor canal-mound was formed when 1,384 m³ (1,810 yd³) of dredged material was placed on the bank of the interceptor canal. Soil samples from the interceptor canal-mound were only analyzed for radionuclides. Inorganic releases to the interceptor canal-canal occurred after the canal was dredged and, therefore, would not be in the dredged piles. Surface soil samples (0 to 6 in. deep) and a subsurface soil sample (approximately 3 to 4 ft deep) were collected at the ANL-09-mound area. In addition, another subsurface soil sample was

collected from approximately 5 to 6 ft deep at three sample locations (#356, #368, and #378). Subsurface soil samples were collected at a depth that corresponded to the bottom of the mound. The deeper subsurface samples were collected to determine if contaminants migrated. The contaminant screening retained only one radionuclide (Cs-137) as a contaminant of potential concern for humans and no contaminants of potential concern for ecological receptors.

Cs-137 was detected at every sample location throughout the mound, with the highest detected concentration (52 pCi/g) at Location M19, while the upper confidence limit concentration for the Cs-137 was 30.53 pCi/g. Therefore, the horizontal extent of the Cs-137 is defined as the entire length of the mound (500 × 20 ft). Vertically, Cs-137 concentration decreases significantly (approximately one order of magnitude) between the surface and subsurface samples. The maximum detected Cs-137 concentration in the subsurface sample was 5.9 pCi/g. Nevertheless, as this concentration is above the established background, the vertical extent of contamination will be 4 ft.

Phytoremediation actions were initiated at the interceptor canal-mound in May 1999. Phytoremediation was estimated to take 7 years to meet the remediation goal of 23.3 pCi/g. Results documented in the *Phytoremediation 2-Year Field Season Demonstration Project Report*, Argonne National Laboratory-West (ANL-W 2001) showed that phytoremediation using an annual planting of 750,000 *kochia scoparia* plants was working better than expected and that remediation goals could be met after 4 years. The phytoremediation activities were again initiated for the 2001 and 2002 field seasons. After each field season, plant matter was collected, compacted, sampled, and placed into waste boxes. After 4 years of phytoremediation, the 10.6 yd³ of waste was transported to the RWMC for disposal as low-level waste. Sample results of soil taken in 2003 indicate that the Cs-137 concentration was below the established remediation goal. Tables 14 and 18 of the *Data Quality Assessment Report of the Post-Phytoremediation Characterization of ANL-W CERCLA Sites* (Portage 2005b) compare the surface and subsurface soils to the remediation goal. Upper confidence limits for surface and subsurface Cs-137 were 9.54 pCi/g and 2.48 pCi/g, respectively, well below the 23.3-pCi/g remediation goal. However, because the Cs-137 concentrations were greater than those that are acceptable for the occupational receptors, the site will remain under ICs until the levels decay sufficiently to allow unrestricted land use.

9.3.2.7 ANL-35 Industrial Waste Ditch. The industrial waste lift station discharge ditch (ANL-35), also known as the north ditch, is located inside the MFC security fences. The ditch is approximately 500 ft long and 3 to 4 ft wide at the bottom. At any one time, the ditch contains 2 to 3 in. of water. The ditch receives industrial wastewater, primarily cooling water and photo processing wastes (e.g., photo developers, fixers, and stabilizers, and acids), and also several retention tank overflows that may contain ethanol, sodium hydroxide, and some radionuclides from various MFC facilities. The ongoing and future discharges of these processing wastes are regulated under other EPA laws such as RCRA. The cleanup action specified in this ROD addresses only past releases of these processing wastes.

Soil samples were collected three times: 3 samples during the 1989 DOE survey, 17 samples during the 1988 Chen-Northern sampling (Chen-Northern 1989), and 19 samples in 1994 by MFC (ETAS 1995). Samples were analyzed for organics, inorganics, radionuclides, and dioxin/furans. Appendix A of the OU 9-04 Comprehensive Remedial Investigation/Feasibility Study (Lee et al. 1997) shows the sampling location plan map, color intensity profile maps, and statistics for COC by pathway for all samples collected in 1994 from the industrial waste lift station discharge ditch. Sample collection depths for the 1994 study were 0 to 6 in. and 1.5 to 2 ft.

Contaminant screening resulted in no contaminants of potential concern for humans and only one inorganic, silver, being retained as a contaminant of potential concern the ecological receptors. Silver was analyzed for in all three studies and was detected at 87% (33 of 39) of the sample locations, with the

highest detection (352 mg/kg) at Location #41, which is in the middle of the ditch. The maximum concentration was used in the risk assessment as the upper confidence limit value because of the small data set and large standard deviation in the data. However, high concentrations were also detected at other locations (Grids 18, ND03, 15, 18, and 19). Therefore, the horizontal extent of contamination is defined as the entire length of the ditch. No trends on the vertical extent of contamination were detected for silver. Thus, the average soil depth on top of the basalt (1.0 ft) was used to define the vertical extent of contamination. The extent of contamination at the industrial waste lift station discharge ditch is defined as $15 \times 500 \times 1$ ft.

Phytoremediation was initiated at the industrial waste lift station discharge ditch in May 1999 to remediate silver contamination that posed unacceptable risk to ecological receptors. Initially, phytoremediation was estimated to take 7 years to meet the remediation goal of 112 mg/kg. Results of the Phytoremediation 2-Year Field Season Demonstration Project Report (ANL-W 2001) showed that phytoremediation with hybrid willows and poplars was working better than expected and remediation goals could be met after 4 years. Phytoremediation continued for the 2001 and 2002 field seasons with confirmation samples collected in 2003. Tables 22 and 26 of the *Data Quality Assessment Report for the Post-Phytoremediation Characterization of ANL-W CERCLA Sites* (Portage 2005b) show the surface and subsurface upper confidence limits and remediation goal for silver. As shown, the upper confidence limits of 104 mg/kg for silver in the surface and 55.4 mg/kg for silver in the subsurface are below the remediation goal of 112 mg/kg. However, data indicated that a hot spot near the surface contributed significantly to the statistics and additional remediation was warranted.

As such, the 2004 Explanation of Significant Differences (DOE-CH 2004) called for implementing the contingent remedy of excavation and disposal. Excavation and disposal were conducted in summer 2004. Tables 5 and 9 of the *Data Quality Assessment Report for the Post-Remedial Action Confirmation Sampling of the ANL-W CERCLA Sites* (Portage 2005c) show that the upper confidence limit for silver in the surface was 191 mg/kg and the upper confidence limit for silver in the subsurface was 32.3 mg/kg, while the remediation goal was 112 mg/kg. Thus, the surface soil exceeded the remediation goal, and further excavation was warranted.

Consequently, in October 2004, the area with highest silver results was excavated to basalt. Approximately 100 yd³ of soil was removed and disposed of at the CFA bulky waste landfill at a depth greater than 10 ft to prevent exposure to ecological receptors. Confirmation samples were not collected after the removal because all soil in the targeted area was removed to basalt.

9.3.2.8 Removal Actions. Subsections that follow describe post-ROD NTCRA completed, under way, or planned for WAG 9.

9.3.2.8.1 Minor Facilities Decommissioned under General Decommissioning Action Memorandum—At WAG 9, one structure was decommissioned as a NTCRA under general decommissioning (DOE-ID 2009a) from October 1, 2004, until September 30, 2009: MFC-757A, EBR-II cooling tower support building. Decommissioning was completed on August 13, 2009, and the area graded to match surrounding contours (Figure 9-3). Debris from MFC-757A was not radioactively contaminated and was staged pending the opening of the MFC CERCLA Demolition Waste Landfill, where it was disposed of.



MFC-757A, Cooling Tower System Building, before and after NTCRA

Figure 9-3. MFC-757A before and after decommissioning.

9.3.2.8.2 Minor Facilities Being Decommissioned Under the General Decommissioning Action Memorandum—Decommissioning was under way on September 30, 2009, within WAG 9 at five facilities or structures (see Table 9-4 and Figure 9-4). Waste from these facilities will be shipped to an appropriate treatment or disposal facility. Hazardous Waste Management Act/RCRA closure activities at MFC-766, MFC-776, MFC-793E, MFC-793F, and MFC-795 will be conducted outside of the scope of the NTCRA and pursuant to RCRA closure plans identified in the Hazardous Waste Management Act/RCRA permit for the EBR-II Complex (PER-120). Mixed waste typically is shipped to a permitted facility such as Energy Solutions. Radioactive waste typically is shipped to ICDF. Nonradioactive friable asbestos waste is typically shipped to the CFA landfill. Other waste will be sent to the MFC CERCLA Demolition Waste Landfill. Decommissioning of these facilities is expected to be complete before the next 5-year review. No contamination is expected to be left upon the completion of these NTCRAs that would preclude release for unrestricted use.

9.3.2.8.3 Major Facilities Where Decommissioning Is Expected Under a Facility-Specific Action Memorandum—One facility at WAG 9 is being decommissioned as a NTCRA under a facility-specific action memorandum, MFC-767 EBR-II reactor building. An engineering evaluation/cost analysis is being prepared to evaluate a range of alternatives and address the MFC-767 EBR-II vessel disposition and building end state. An action memorandum will be issued to document the selected alternative. Decommissioning at MFC-767 is expected to be complete before the next 5-year review. A removal action report will be prepared upon completion of the NTCRA that will document any contamination left in place that may preclude release of the site for unrestricted use.

Table 9-4. Waste Area Group 9 facilities being decommissioned as non-time-critical removal actions.

Facility Identifier	Facility Name
MFC-766	Sodium Boiler Building
MFC-776	ZPPR Reactor Cell Equipment
MFC-793E	SCMS Storage Building
MFC-793F	SCMS Storage Building
MFC-795	EBR-II Cover Gas Cleanup System
EBR	Experimental Breeder Reactor
SCMS	Sodium Components Maintenance Shop
ZPPR	Zero Power Physics Reactor



MFC-793E and MFC-793F, Sodium Storage Buildings, with NTCRA underway



MFC-776, ZPPR Reactor Cell, equipment removal



MFC-795, Cover Gas Clean-Up System



MFC-766, Sodium Boiler Building

Figure 9-4. Non-time-critical removal actions currently under way at Waste Area Group 9.

9.3.2.8.4 Future Removal Actions at WAG 9. Five additional facilities at WAG 9 are currently identified for decommissioning as NTCRAs (see Table 9-5). If additional facilities are identified for decommissioning, they will be submitted to the CERCLA Agencies either for inclusion in the general decommissioning action memorandum or for preparation of facility-specific action memoranda. Decommissioning of the currently identified facilities is expected to be completed prior the next 5-year review.

Table 9-5. Waste Area Group 9 facilities planned for decommissioning.

Facility Identifier	Facility Name
MFC-750A	EBR-II Experimental Building
MFC-793A	Alcohol Recovery Facility Pad and Tanks
MFC-793B	Alcohol Recovery Facility Annex
EBR	Experimental Breeder Reactor

9.3.2.9 New Sites. In September 2008, Battelle Energy Alliance (MFC operations contractor) submitted New Site Identification Form #25232 to identify two potential newly discovered areas. These two potential new sites, which are located north of MFC, were discovered in 2008.

ANL-64 is a 100- × 100-ft fenced area where surplus materials were stored. The area remains fenced but is no longer used for storage and is currently empty; however, the ground surface within the fenced area was littered with lead fragments. In 2009, Battelle Energy Alliance completed an investigation of this area, removed the lead fragments, and performed confirmation sampling to verify that all materials were successfully remediated.

ANL-65 is a small area, approximately 6 × 6 ft, located west of the MFC sewage lagoon. Steel shot (presumed to be bead blast media) was found scattered on the ground surface. The shot is rusted and appears to have been weathering for many years. In June 2008, the shot and soil beneath the shot were sampled and analyzed for metals. Sample results of the shot revealed a lead concentration of 605 mg/kg and a chromium concentration of 1,320 mg/kg. Analysis of the soil beneath the shot showed 20,500 mg/kg lead and 1,100 mg/kg chromium, which exceeded remediation goals of 400 mg/kg for lead and 210 mg/kg chromium for the future resident. Additional removal of soils and shot was performed in 2009, and those verification sample results also showed areas above the remediation goals. These areas were scheduled for removal in summer 2010 with subsequent verification sampling.

The initial evaluation of the sites found that lead was present at both sites, either as fragments scattered on the ground or as contamination in the soil. A Notice of Soil Disturbance form was prepared and approved by the Agencies to accommodate the removal of the lead and contaminated soil. Concurrent with the approval of the Notice of Soil Disturbance form, a New Site Identification form was prepared for the two sites, identifying them as ANL-64 and ANL-65. The sites were accepted by the Agencies as new CERCLA sites to be included in OU 10-08 without a recommended action for the sites. Subsequently, actions were taken to remove debris and topsoil, and sampling was performed to determine the remaining lead concentration. As a result, the New Site Identification form for ANL-64 will be resubmitted as required with a recommendation of no action. The New Site Identification form for ANL-65 will be resubmitted as required with a recommendation for the OU 10-08 plug-in approach. WAG 9 (Battelle Energy Alliance) will submit the follow-up New Site Identification forms with the identified recommendations by September 30, 2011. Temporary ICs are in place at the sites to control access, and warning signs were posted in 2010.

9.3.3 Operations and Maintenance Summary

This review covers the period from October 2004 through September 2009 and is the second 5-year review of OU 9-04. As noted above under remedial action, work under the OU 9-04 ROD was completed prior to the first 5-year review and all sites met the identified remediation goals.

During this second 5-year period, MFC conducted annual onsite visits of the three IC sites to verify that signage was still in place. Table 9-6 shows the results for the three sites from the INL Site-wide IC/O&M Annual Report – FY 2009 (RPT-672). Previous annual inspections had similar results and can be found in corresponding annual reports.

Changes that have occurred from the previous 5-year report include replacing the former MFC signs at these three sites in 2005 with the standard site signage that directs calls to the Emergency Operations Command Center. Additionally, a few signs around the industrial waste pond were repaired in 2008 after health and safety personnel completed a walk-through and noted signs lying on the ground near the fence posts. (Evidence suggested some large animal had used the posts as scratching posts and broke the wire ties holding the signs.) Also, since the last report, MFC built another guard gate on the main access road in 2009, which adds a level of protection to prevent inadvertent public access.

Table 9-6. Operable Unit 9-04 remedial action sites requiring institutional controls.

Site	Signs	Permanent Markers	Fences	Administrative Boundary Controls
ANL-01	Good condition	NA	NA	Coordinates and map are in IC database
ANL-04 ^a	Good condition	NA	Good condition	Coordinates and map are in IC database
ANL-09	Good condition	NA	NA	Coordinates and map are in IC database

a. Site is administratively assigned to WAG 10.

IC institutional control
NA not applicable

9.4 Progress Since the Last Review

One administrative item was identified as an issue in the last 5-year review. The WAG 9 protectiveness statement in the last 5-year review (DOE-ID 2007) was as follows:

Remedial actions have been completed at seven of the eight areas identified in the OU 9-04 ROD (DOE, DEQ, and EPA 1998). These seven areas are awaiting final regulatory approval of the *Remedial Action Report for Waste Area Group 9, Operable Unit 9-04 at the Idaho National Engineering and Environmental Laboratory* (Portage 2005c). The remaining area that has not undergone remediation is activities is the sanitary sewage lagoon site, which is being transferred to OU 10-08. This five-year review is being used to officially document the transfer of the sanitary sewage lagoons to OU 10-08, as discussed in Ceto (2005) and Faulk (2005). The remedies on the remaining areas at OU 9-04 are protective of human health and the environment.

Table 9-7 lists the issue and recommendation identified in the last 5-year review and the current status. The issue has been addressed by completing the previously identified recommendation.

9.5 Data Review and Evaluation

Surface water, groundwater, and drinking water monitoring data are collected and reported in the INL Annual Site Environmental Report. Calendar year 2008 is the most recent annual monitoring report (Stoller 2009). These annual monitoring reports can be found at the following url: <http://www.stoller-eser.com/Publications.htm>. Monitoring data for WAG 9 include air, drinking water, groundwater, thermoluminescent dosimetry, in situ gamma, and liquid effluent. In the WAG 9 Remedial Investigation/Feasibility Study, GWSCREEN modeling indicated that groundwater concentrations may trend upward based on releases to the industrial waste pond and that WAG 9 would continue sampling for 20 years (1997-2017) (Lee et al. 1997). Monitoring results indicate that concentrations in soil and groundwater have not increased from historical levels and are well below the levels defined as hazardous waste. Table 9-8 summarizes groundwater data collected from October 2004 through September 2009.

Table 9-7. Actions taken since the last 5-year review for Waste Area Group 9.

Issues from Previous Review ^a	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
The sanitary lagoon site (ANL-04) was administratively transferred to OU 10-08 to facilitate closure of WAG 9 and allow for the completion of the WAG 9 Remedial Action Report.	The sanitary lagoon site (ANL-04) was transferred from WAG 9 to WAG 10 OU 10-08 in 2005. This transition will be documented in the OU 10-08 ROD.	DOE	July 2009	The OU 10-08 ROD (DOE-ID 2009b) documented the administrative transfer. This task is complete.	July 2009

a. Issues were identified either in Appendix C of the previous 5-year review (DOE-ID 2007) or in the addendum to Appendix C enclosed with EPA's letter of concurrence with the previous 5-year review (Opalski 2006).

DOE Department of Energy
EPA Environmental Protection Agency
OU operable unit
ROD Record of Decision
WAG waste area group

Table 9-8. Summary of Materials and Fuels Complex groundwater monitoring data: Fiscal Year 2005 to Fiscal Year 2009.

Analyte	ANL-MON-A-011	ANL-MON-A-012	ANL-MON-A-013	ANL-MON-A-014	EBR-II-#2
Alkalinity (mg/L)	124–140	124–146	131–141	126–140	125–147
Aluminum (mg/L)	<0.05	<0.05	<0.025–0.306	<0.05	<0.0079–0.056
Antimony (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005
Arsenic (mg/L)	<0.0075	<0.0075	<0.0075	<0.0075	<0.0075
Barium (mg/L)	0.0332–0.072	<0.001–0.0422	0.0335–0.044	0.0339–0.0382	0.034–0.0382
Beryllium (mg/L)	<0.0025	<0.0025	<0.0025	<0.003	<0.003
Cadmium (mg/L)	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Calcium (mg/L)	34.2–41.2	38.1–44.6	37.2–44.7	35.1–42.8	37.1–43.1
Chloride (mg/L)	17.6–20.4	17.3–18.5	17.8–20	12–19.3	18.1–23.9
Chromium (mg/L)	<0.0025–0.011	<0.0025–0.0054	0.003–0.0894	<0.0025–0.008	<0.0025–0.0041
Cobalt (mg/L)	<0.007	<0.007	<0.05	<0.05	<0.007
Copper (mg/L)	0.0006–0.146	<0.00025–0.0576	0.0017–0.0402	0.0074–0.0216	0.0015–0.0229
Iron (mg/L)	0.0206–2.32	<0.05–0.099	<0.05–5.76	<0.05–1.04	<0.06
Lead (mg/L)	<0.001–0.0228	<0.042	<0.042	<0.001–0.0056	0.00085–0.0089
Magnesium (mg/L)	11.6–13.2	11.2–13	11.9–13.7	11.8–13.5	11.8–13.7
Manganese (mg/L)	<0.0025	<0.0025–0.005	<0.0025–0.1	<0.0025–0.024	<0.00034–0.005
Mercury (mg/L)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002

Table 9-8. (continued).

Analyte	ANL-MON-A-011	ANL-MON-A-012	ANL-MON-A-013	ANL-MON-A-014	EBR-II-#2
Nickel (mg/L)	<0.005	<0.005	<0.0025–0.0169	<0.005	0.00075–0.0053
Nitrate (mg/L)	1.18–2	1.12–1.9	1.7–2	1.7–1.9	1.7–2
Nitrite (mg/L)	<0.05	<0.05	<0.02–0.55	<0.02–0.56	<0.05
Potassium (mg/L)	2.61–3.36	3.36–3.7	3.08–4.22	2.99–3.38	3.02–3.39
Selenium (mg/L)	<0.005	<0.00281	<0.001	<0.005	<0.005
Silver (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium (mg/L)	15.9–19.2	16.8–20.2	17.6–20.6	16.3–19.9	16.8–21.3
Sulfate (mg/L)	16.4–17.3	15.3–16.7	16.8–19.5	16.5–19	16.9–19.4
Thallium (mg/L)	<0.0005	<0.0006	<0.00059	<0.0005	<0.0005
Tin (mg/L)	<0.0292	<0.0292	<0.0292	<0.0292	<0.0292
Vanadium (mg/L)	<0.008	0.0041–0.008	<0.00278–0.0089	<0.008	<0.008
Zinc (mg/L)	0.001–0.0366	<0.0025–0.0095	0.002–0.0714	<0.02	<0.01–0.039
Americium-241 (pCi/L)	ND	ND	ND	ND	ND
Antimony-125 (pCi/L)	ND	ND	ND	ND	ND
Cerium-144 (pCi/L)	ND	ND	ND	ND	ND
Cesium-134 (pCi/L)	ND	ND	ND	ND	ND
Cesium-137 (pCi/L)	ND	ND	ND	ND	ND
Cobalt-58 (pCi/L)	ND	ND	ND	ND	ND
Cobalt-60 (pCi/L)	ND	ND	ND	ND	ND
Europium-152 (pCi/L)	ND	ND	ND	ND	ND
Europium-154 (pCi/L)	ND	ND	ND	ND	ND
Europium-155 (pCi/L)	ND	ND	ND	ND	ND
Manganese-54 (pCi/L)	ND	ND	ND	ND	ND
Niobium-95 (pCi/L)	ND	ND	ND	ND	ND
Potassium-40 (pCi/L)	ND	ND	ND	ND	ND
Radium-226 (pCi/L)	ND	ND	ND	ND	ND
Ruthenium-103 (pCi/L)	ND	ND	ND	ND	ND
Ruthenium-106 (pCi/L)	ND	ND	ND	ND	ND
Silver-108m (pCi/L)	ND	ND	ND	ND	ND
Silver-110m (pCi/L)	ND	ND	ND	ND	ND
Tritium (pCi/L)	ND	ND	ND ^a	ND ^a	ND
Uranium-233/234 (pCi/L)	1.11–1.66	1.03–1.79	1.13–1.56	<0.0353–1.72	1.22–1.63
Uranium-235 (pCi/L)	<12.2	<10.9	<12.7	<13.5	<13.5
Uranium-238 (pCi/L)	0.409–0.913	0.546–0.728	0.51–0.777	<0.0393–0.681	0.511–0.718

Table 9-8. (continued).

Analyte	ANL-MON-A-011	ANL-MON-A-012	ANL-MON-A-013	ANL-MON-A-014	EBR-II-#2
Zinc-65 (pCi/L)	ND	ND	ND	ND	ND
Zirconium-95 (pCi/L)	ND	ND	ND	ND	ND
a. Tritium was slightly above the detection limit in the April 13, 2009 sample. Requested reanalysis was below the detection limit.					
ND not detected (i.e., less than the detection limit)					

9.6 Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

Yes. The functional status of the remedy for each OU 9-04 area is provided in Table 9-9. Remedial actions are complete. For three areas, continued ICs are required because Cs-137 concentrations remain at levels greater than the remediation goal.

Housekeeping activities performed during due diligence investigation at the potential new site MFC-64 indicated that no contamination existed above screening levels. At potential new site MFC-65, Battelle Energy Alliance removed soil and shot in 2009 and performed verification sampling. These verification sampling results showed areas with concentrations in excess of screening levels. This area is scheduled for further characterization in summer 2010; this work will use a magnet to identify the location of the shot material. Soils and shot in the defined area will be removed and verification samples will be collected. In the meantime, ICs are in place and functioning to preclude exposures, though the sites are not listed in the IC database.

Table 9-9. Summary of responses to Question A.

Site	Area	Remedy	Remedial Action Complete	Remedy Functioning
ANL-01	Industrial waste pond	Soil excavation	Yes—2004	Yes (ICs are required)
	Ditch A	Phytoremediation then soil excavation	Yes—2004	Yes
	Ditch B	Soil excavation	Yes—2004	Yes
ANL-01A	Main cooling tower blowdown ditch	Phytoremediation	Yes—2004	Yes
ANL-09	Interceptor canal-canal	Phytoremediation	Yes—2004	Yes (ICs are required)
ANL-09	Interceptor canal-mound	Natural attenuation	Yes—2004	Yes (ICs are required)
ANL-35	Industrial waste lift station discharge ditch	Phytoremediation then soil excavation	Yes—2004	Yes
IC institutional control				

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Yes.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

Technical Assessment Summary

The technical assessment for WAG 9 finds that remedial actions have been completed in accordance with the decision documents at the ANL-01, ANL-01A, ANL-09, and ANL-35 sites. Remedial actions at the sites were completed successfully and the remedies are functioning as intended. The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selections are still valid, and no new information has come to light that could call into question the protectiveness of the remedies. In addition to the remediation of these sites, ICs have been implemented at the industrial waste pond (ANL-01) and at both areas within ANL-09 (interceptor canal–canal and interceptor canal–mound) and are functioning as required.

9.7 Issues

The new site identification process for two sites, ANL-64 and ANL-65, was initiated and left incomplete. Therefore, these sites were not added to the IC database or addressed in the IC/O&M Plan or annual reports.

9.8 Recommendations and Follow-up Actions

The new site identification process should be completed for ANL-64 and ANL-65 to ensure that both sites are appropriately managed and tracked under OU 10-08.

9.9 Protectiveness Statement for Operable Unit 9-04

The remedy at OU 9-04 is protective of human health and the environment. Remediation goals were achieved and ICs are in place as necessary. Remedies are functioning as intended by decision documents.

9.10 Summary

To facilitate cleanup, MFC, originally called Argonne National Laboratory-West was designated as WAG 9 under the FFA/CO (DOE-ID 1991). The Comprehensive Remedial Investigation/Feasibility Study was completed in 1997 (Lee et al. 1997). The Remedial Investigation/Feasibility Study evaluated 37 sites, collectively designated as OU 9-04. Five sites were found to pose unacceptable risks to human health or the environment. Remedial action proceeded in accordance with the OU 9-04 ROD (DOE-CH 1998a). OU 9-04 is the only component of WAG 9 that remains subject to 5-year review.

The technical assessment for WAG 9 finds that remedial actions have been completed in accordance with the decision documents at the ANL-01, ANL-01A, ANL-09, and ANL-35 sites and that remedies are functioning as intended.

This 5-year review identified one issue for WAG 9—incomplete processing of the New Site Identification form for ANL-64 and ANL-65. Table 9-10 describes the issue; Table 9-11 gives a recommendation and follow-up actions for resolving the issue.

Remedial actions have been completed at seven of the eight areas identified in the OU 9-04 ROD (DOE-CH 1998a), and the eighth area has been administratively transferred to WAG 10. Documentation is not complete for new sites ANL-64 and ANL-65; however, ICs are in place at MFC to preclude unrestricted access. The remedies on the remaining areas at OU 9-04 are protective of human health and the environment.

WAG 9 includes a containment remedy and ICs; therefore, statutory 5-year reviews will be required until the sites qualify for unrestricted land use. The next CERCLA 5-year review is expected to cover from FY 2010 through FY 2014.

Table 9-10. Issue for Waste Area Group 9.

Issues		Affects Current Protectiveness (Yes/No)	Affects Future Protectiveness (Yes/No)
The new site identification process for two sites, ANL-64 and ANL-65, was initiated and left incomplete. Therefore, these sites were not added to the IC database or addressed in the IC/O&M Plan or annual reports.		No	Yes
IC	institutional control		
O&M	operations and maintenance		

Table 9-11. Recommendations and follow-up actions for Waste Area Group 9.

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Yes/No)	
					Current	Future
The new site identification process for two sites, ANL-64 and ANL-65, was initiated and left incomplete. Therefore, these sites were not added to the IC database or addressed in the IC/O&M Plan or annual reports.	Finish processing the new site identification form and identify responses in accordance with the process established in the OU 10-08 ROD.	DOE	EPA and DEQ	September 2011	No	Yes
DOE	Department of Energy	O&M	operations and maintenance			
DEQ	Department of Environmental Quality (Idaho)	OU	operable unit			
EPA	Environmental Protection Agency	ROD	Record of Decision			
IC	institutional control					

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10. WASTE AREA GROUP 10—SITE-WIDE AREA

10.1 Introduction

WAG 10 comprises miscellaneous surface sites and liquid disposal areas throughout the INL Site that are not included within WAGs 1 through 9. WAG 10 also includes regional SRPA concerns related to the INL Site that cannot be addressed on a WAG-specific basis.

The FFA/CO (DOE-ID 1991) originally identified nine no action sites under WAG 10 and five OUs (OUs 10-01 through 10-05). Three OUs (10-06 through 10-08) and many sites were added subsequently to WAG 10, and INL Site-wide groundwater concerns were shifted from OU 10-04 and deferred to OU 10-08, the last planned ROD for WAG 10 and the INL Site. This 5-year review focuses on those portions of OU 10-04 still subject to 5-year review and on parts of OU 10-08.

OU 10-04^a is the comprehensive remedy for WAG 10 and includes munitions response areas, munitions response sites, the STF-02 gun range, and INL Site-wide ICs and O&M. The term munitions and explosives of concern distinguishes specific categories of military munitions that may pose unique explosives safety risks: unexploded ordnance, discarded military munitions, and munitions constituents. This document uses these current terms and definitions from the Department of Defense, as follows (DOD 2010):

- Unexploded ordnance—munitions that (a) have been primed, fuzed, armed, or otherwise prepared for action; (b) have been fired, placed, dropped, launched, or projected; and (c) remain unexploded by design or malfunction.
- Discarded military munitions—unfired munitions that have been abandoned, discarded, or improperly disposed of and are still capable of functioning.
- Munitions constituent—a chemical constituent originating from munitions (e.g., trinitrotoluene [TNT] and cyclotrimethylene trinitroamine [RDX]).
- Munitions response area—Any area that is known or suspected to contain unexploded ordnance, discarded military munitions, or munitions constituent. A munitions response area is comprised of one or more munitions response sites.
- Munitions response site—A discrete location within a munitions response area that is known to require a munitions response.

Existing documents and references may use older terminology. At the INL Site, the term unexploded ordnance as traditionally applied included both unexploded ordnance and discarded military munitions as described above, while specific contaminant names (e.g., TNT and RDX) were used instead of munitions constituent. Unexploded ordnance and discarded military munitions are objects, while munitions constituents are contaminants.

The OU 10-08 ROD (DOE-ID 2009a) addresses INL Site-wide groundwater and miscellaneous sites. It was finalized at the end of this 5-year review period. Except for TSF-07, analysis of OU 10-08 is deferred to the next 5-year review in accordance with the OU 10-08 ROD. No action sites are not subject to the 5-year review and are not discussed further^b. WAG 10 sites where ICs constitute the ongoing

a. OU 10-04 includes the WAG 6 Comprehensive Remedial Investigation/Feasibility Study (OU 6-05) in accordance with the FFA/CO. Section 7 discusses OU 6-05.

b. The OU 10-08 ROD (DOE-ID 2009a) documents no action decisions for 76 sites. Two of these sites were cleaned up under a NTCRA (i.e., TSF-52 and TSF-54, see Section 2.3.3.3.9.2.1). No action was selected for some of these sites following decommissioning, RCRA closure, or further analysis that occurred within this 5-year review timeframe (e.g., PBF-38, TSF-55, MISC-45, and TSF-08 Area 13B).

response are addressed collectively under INL Site-wide ICs in Section 10.5. Other WAG 10 OUs were previously eliminated from further review.

10.2 Site Chronology

Table 10-1 provides a chronology of significant documents and events relevant to CERCLA response actions at WAG 10.

Table 10-1. Chronology of significant documents and events at Waste Area Group 10.

Date	Publication or Event
June 1992	<i>Declaration of the Record of Decision Ordnance Interim Action Operable Unit 10-05 Waste Area Group 10 Idaho National Engineering Laboratory</i> (DOE-ID 1992)
May 1993	<i>Interim Ordnance Cleanup Program Remedial Design</i> (Wyle 1993)
April 1994	<i>Engineering Evaluation/Cost Analysis (EE/CA) for Non-Time-Critical Removal Action at Unexploded Ordnance Locations at the Idaho National Engineering Laboratory (INEL), Operable Unit (OU) 10-03</i> (INEL 1994a)
May 1994	<i>Remedial Action Report for the Interim Action to Cleanup Unexploded Ordnance Locations at the INEL (Operable Unit 10-05)</i> (Wyle 1994)
June 1994	<i>Department of Energy Idaho Field Operations Office Lead Agency Action Memorandum for the Non-Time Critical Removal Action at Unexploded Ordnance Locations at the Idaho National Engineering Laboratory (INEL)</i> (DOE-ID 1994a)
June 1994	<i>Engineering Evaluation/Cost Analysis for a Non-Time Critical Removal Action of TNT- and RDX-Contaminated Soil at the Idaho National Engineering Laboratory</i> (INEL 1994b)
July 1994	<i>Department of Energy Idaho Operations Office Lead Agency Action Memorandum for the Non-Time Critical Removal Action of TNT- and RDX-Contaminated Soil, Idaho National Engineering Laboratory</i> (DOE-ID 1994b)
March 1995	<i>Removal Action Report for the Ordnance Removal Action, Operable Unit 10-03</i> (Wyle 1995a)
June 1995	<i>Engineering Evaluation/Cost Analysis for Operable Unit 10-06 Radionuclide-Contaminated Soils Removal Action at the Idaho National Engineering Laboratory</i> (INEL 1995) (formerly the Draft Operable Unit (OU) 10-06 Remedial Investigation/Feasibility (RI/FS) Study Report)
August 1995	<i>Department of Energy Idaho Operations Office Lead Agency Action Memorandum for the Non-Time Critical Removal Action at OU 10-06 Radionuclide Contaminated Soil Locations at the Idaho National Engineering Laboratory</i> (DOE-ID 1995a)
October 1995	<i>Addendum to the Removal Action Report for the Ordnance Removal Action, Operable Unit 10-03</i> (Wyle 1995b)
September 1996	<i>U.S. Department of Energy, Idaho Operations Office Lead Agency Action Memorandum Time-Critical Removal Action Ordnance Areas Operable Unit 10-03 Idaho National Engineering Laboratory (INEL)</i> (INEL 1996)
January 1997	<i>Final Action Report for the Time Critical Removal Action, Operable Unit 10-03</i> (Parsons 1997)
June 1997	<i>Engineering Evaluation Cost Analysis for Nontime-Critical Removal Action for Unexploded Ordnance at the Idaho National Engineering and Environmental Laboratory Operable Unit 10-03</i> (DOE-ID 1997a)
June 1997	<i>Action Memorandum for the 1997 Ordnance Removal Action at Operable Unit 10-03 at the INEEL</i> (INEEL 1997)

Table 10-1. (continued).

Date	Publication or Event
January 1999	<i>Summary Report for the 1997 Non-Time Critical Removal Action for Ordnance at Operable Unit 10-03</i> (INEEL 1999)
August 2001	<i>Comprehensive Remedial Investigation/Feasibility Study for Waste Area Groups 6 and 10 Operable Unit 10-04</i> (DOE-ID 2001a)
November 2002	<i>Record of Decision for Experimental Breeder Reactor-I/Boiling Water Reactor Experiment Area and Miscellaneous Sites, Operable Units 6-05 and 10-04</i> (DOE-ID 2002)
February 2003	<i>U.S. Department of Energy Idaho Operations Office, Lead Agency Action Memorandum Time-Critical Removal Action for Unexploded Ordnance, Operable Unit 10-04, Idaho National Engineering and Environmental Laboratory</i> (INEEL 2003)
February 2004	<i>Remedial Design/Remedial Action Work Plan for Operable Units 6-05 and 10-04, Phase I</i> (DOE-ID 2004a)
July 2004	<i>Summary Report for the 2004 Time-Critical Removal Action for Unexploded Ordnance at Operable Unit 10-04</i> (ICP 2004)
August 2004	<i>Remedial Design/Remedial Action Work Plan for Operable Units 6-05 and 10-04, Phase II</i> (DOE-ID 2004b)
January 2005	<i>Remedial Action Report for Operable Units 6-05 and 10-04, Phase I</i> (DOE-ID 2005a)
October 2005	<i>Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory</i> (DOE-ID 2007a) ^a
March 2006	<i>Explanation of Significant Differences for the Record of Decision for the Experimental Breeder Reactor-I/Boiling Water Reactor Experiment Area and Miscellaneous Sites</i> (DOE-ID 2006a)
January 2007	Issued PBF-33 and PBF-34 project closeout report (DOE-ID 2007b)
April 2008	<i>Remedial Action Report for Operable Units 6-05 and 10-04, Phase III</i> (DOE-ID 2007c)
March 2009	<i>Operable Unit 10-08 Sitewide Groundwater and Miscellaneous Sites Remedial Investigation/Baseline Risk Assessment</i> (Cahn et al 2008); <i>Operable Unit 10-08 Sitewide Groundwater and Miscellaneous Sites Feasibility Study</i> (Holdren et al 2008)
May 2009	<i>Remedial Action Report for Operable Units 6-05 and 10-04, Phase II</i> (DOE-ID 2009b)
July 2009	<i>Engineering Evaluation/Cost Analysis for TSF-07 Disposal Pond at Test Area North</i> (DOE-ID 2009c)
September 2009	<i>Action Memorandum for TSF-07 Disposal Pond at Test Area North</i> (DOE-ID 2009d)
September 2009	Completed remediation of TSF-07 Disposal Pond under action memorandum (DOE-ID 2010a)
September 2009	<i>Operable Unit 10-08 Record of Decision for Site-Wide Groundwater, Miscellaneous Sites, and Future Sites</i> (DOE-ID 2009a)
January 2010	“Documentation of minor change to the <i>Operable Unit 10-08 Record of Decision for Site-Wide Groundwater, Miscellaneous Sites, and Future Sites</i> , Idaho National Laboratory Site, Idaho – Removal of Institutional Controls for TSF-07” (Arenaz 2010).
a. Revision 0 of the 5-year review was completed in October 2005. Subsequent revisions did not affect analysis of WAG 10.	
EE/CA	engineering evaluation/cost analysis
INEL	Idaho National Engineering Laboratory
OMRE	Organic-Moderated Reactor Experiment
OU	operable unit
RDX	cyclotrimethylene trinitroamine
TNT	trinitrotoluene

10.3 Background

WAG 10 encompasses sites that are outside of facilities or WAGs, sites that were transferred to WAG 10 from other WAGs, new sites discovered after individual WAGs completed comprehensive Remedial Investigation/Feasibility Studies, and INL Site-wide concerns such as munitions response areas, munitions response sites, and groundwater. The physical characteristics, land use, and resource use are addressed in Section 1 for the INL Site.

10.3.1 History of Contamination

Three munitions response areas occur on the INL Site and comprise extensive artillery testing and bombing ranges used by the U.S. Navy and U.S. Army Air Corps during World War II (see Figure 10-1). They are the Naval Proving Ground (also known as the Naval Gun Range and designated as CFA-633 Naval Firing Site and Downrange Area [ORD-03] under CERCLA), which encompasses 172,495 acres along the central corridor of the INL Site; the Arco High-Altitude Bombing Range (ORD-01), a 26,406-acre area to the west; and the Twin Buttes Bombing Range (ORD-09), which encloses 9,291 acres on the southeast periphery of the INL Site. Activities that may have left munitions and explosives of concern behind include aerial bombing practice, naval artillery testing, detonation research, explosives storage bunker testing, and munitions and explosives of concern disposal. ORD-03 encompasses most of the munitions response sites and includes two sites originally in OU 4-01 that the FFA/CO stated were to be addressed in OU 10-05 because they contained munitions and explosives of concern (i.e., the CFA gravel pit [CFA-09] and the CFA french drain [CFA-11]; these sites were later placed in ORD-04 and ORD-03, respectively, in WAG 10).

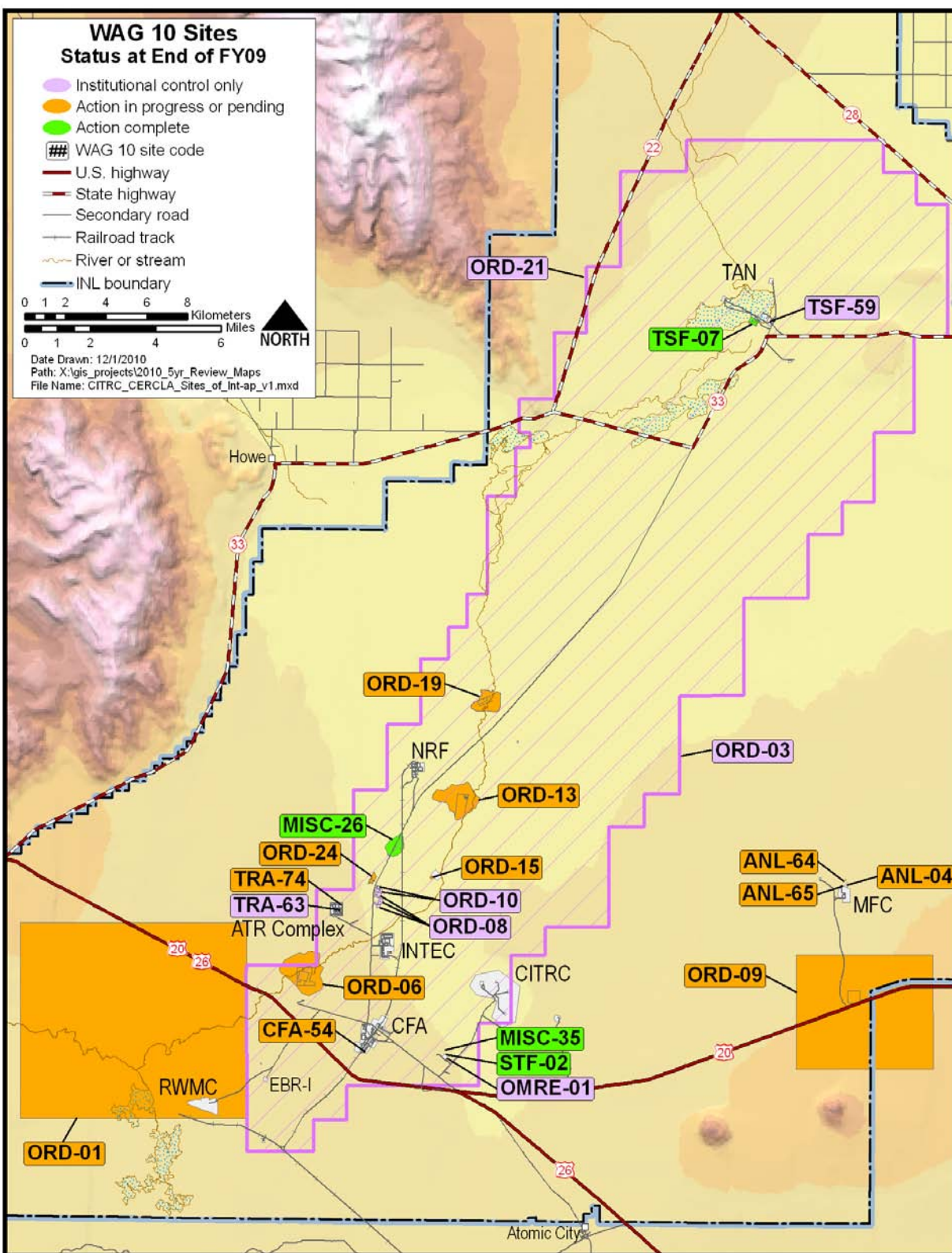
10.3.2 Initial Response

Several removal actions were conducted within WAG 10 before the timeframe covered in this review. These actions were discussed in previous reviews.

10.3.3 Basis for Taking Action

The three munitions response areas (the CFA-633 Naval Firing Fan and Downrange Area [ORD-03], the Arco High Altitude Bombing Range [ORD-01], and the Twin Buttes Bombing Range [ORD-09]) presented a hazard from munitions and explosives of concern. The boundary of ORD-03 encompasses numerous separate munitions response sites.

At ORD-06 (Naval Ordnance Disposal Area), the soil was contaminated with RDX. ORD-08 (National Oceanic and Atmospheric Administration site) presented unacceptable risk to human health from TNT and ecological risks from 1,3-dinitrobenzene, RDX, and TNT in the surface soil. ORD-10 (Fire Station II Zone and Range Fire Burn Area) presented unacceptable human health risks from TNT and potential risk to ecological receptors from TNT and RDX in the soil. ORD-15 (Experimental Field Station) presented unacceptable human health risks from TNT and potential risk to ecological receptors from exposure to 1,3-dinitrobenzene and TNT in the soil. ORD-24 (Land Mine Fuze Burn Area) presented unacceptable human health and ecological risks from exposure to TNT in the soil. MISC-26 (zone east of the Big Lost River) was thought to contain unacceptable levels of munitions constituent. MISC-35 (detonation pit north of the Experimental Organic-Cooled Reactor) posed an unacceptable risk from munitions constituent.



At the STF-02 gun range, soil concentrations of lead were at unacceptable levels for human health and the environment.

Soil at the TSF-07 disposal pond posed an unacceptable risk to human health from Cs-137 and to ecological receptors from mercury.

10.4 Remedial Actions for Operable Unit 10-04

OU 10-04 consists of a final remedy for munitions response areas, munitions response sites including munitions constituent-contaminated soil sites, and the STF-02 gun range; limited action consisting of ICs; and no action with INL Site-wide ecological monitoring. Section 10.5 discusses the establishment and maintenance of INL Site-wide ICs. Subsections that follow discuss the other elements of the remedy.

10.4.1 Remedy Selection

10.4.1.1 Operable Unit 10-04 Phase I Remedial Action. Phase I for the comprehensive remedial action includes developing and implementing ICs at OU 10-04 sites and developing and implementing INL Site-wide plans for both ICs and ecological monitoring (DOE-ID 2004a). Phase I also provided for removal or isolation of identified surface discarded military munitions and munitions constituent fragments that pose an unacceptable near-term physical hazard. Removal or isolation during Phase I of the OU 10-04 RD/RA will not constitute full remediation of the contaminated areas.

10.4.1.2 Operable Unit 10-04 Phase II Remedial Action. Phase II in the ROD for OU 10-04 (DOE-ID 2002) consisted of remediation of the munitions constituent-contaminated soils at the National Oceanic and Atmospheric Administration site, the Fire Station II and Range Fire Burn Area, the Land Mine Fuze Burn Area, the Experimental Field Station, and Naval Ordnance Disposal Area. MISC-26 and MISC-35 were originally in OU 10-08 but were transferred to OU 10-04 in an Explanation of Significant Differences (DOE-ID 2006a). The selected remedy is removal, treatment of munitions constituent fragments, disposal of soil, and ICs.

10.4.1.3 Operable Unit 10-04 Phase III Remedial Action. Phase III consists of remediation of the lead-contaminated soil at the STF-02 gun range. The selected remedy was removal and treatment.

10.4.1.4 Operable Unit 10-04 Phase IV Remedial Action. Phase IV involves remediation of the three munitions response areas—the Arco High-Altitude Bombing Range (ORD-01), the Twin Buttes Bombing Range (ORD-09), and the CFA-633 Naval Firing Site and Downrange Area (ORD-03). The selected remedy is discarded military munitions detection, removal, and ICs.

10.4.1.5 Remedial Action Objectives. The RAO for munitions response areas is:

- Prevent any inadvertent contact with potential discarded military munitions by onsite workers and members of the public.

RAOs developed to protect human health and ecological receptors for munitions constituent-contaminated soil sites are as follows:

- Inhibit dermal exposure to and ingestion of contaminated soils and food crops with a total excess cancer risk level of greater than 1E-04 and noncarcinogenic COCs with hazard quotients greater than 1 for current and future workers and future residents.
- Prevent contamination of groundwater.

- Inhibit ecological receptor exposures to soil contaminated with COCs, primarily concentrations in soils that result in a hazard quotient greater than or equal to 10.0. The RAO excludes naturally occurring elements and compounds that are not attributable to historic releases.

RAOs developed for the STF-02 gun range to protect human health and ecological receptors are as follows:

- Prevent exposure to soils contaminated with lead at concentrations greater than 400 mg/kg.
- Prevent groundwater contamination.
- Inhibit ecological receptor exposures to soil contaminated with COCs, primarily concentrations in soils that result in a hazard quotient greater than or equal to 10.0. The RAO excludes naturally occurring elements and compounds that are not attributable to historic releases.

10.4.1.6 Cleanup Levels. Table 10-2 lists remediation goals for the five munitions constituent contaminated soil sites. The remediation goal for the Security Training Facility gun range was 400 mg/kg lead in soil.

Table 10-2. Operable Unit 10-04 munitions-constituent-contaminated soil remediation goals.

Site	Contaminant of Concern	Remediation Goal (mg/kg)
Naval Ordnance Disposal Area (ORD-06)	RDX	4.4
National Oceanic and Atmospheric Administration (ORD-08)	TNT	16
	RDX	4.4
	1,3-Dinitrobenzene	6.1
Fire Station II Zone and Range Fire Burn Area (ORD-10)	TNT	16
	RDX	4.4
Experimental Field Station (ORD-15)	TNT	16
	1,3-Dinitrobenzene	6.1
Land Mine Fuze Burn Area (ORD-24) and detonation pit north of the Experimental Organic-Cooled Reactor (MISC-35)	TNT	16
RDX cyclotrimethylene trinitroamine TNT trinitrotoluene		

10.4.2 OU 10-04 Remedy Implementation

Since the last 5-year review, Phase II and Phase III remedial actions at OU 10-04 have been completed and Phases I and IV are ongoing. Implementation of the phased remedy for OU 10-04 is summarized below. Sites where ICs are the only ongoing response are discussed in Section 10.5.

10.4.2.1 Phase I. The Phase I Remedial Design/Remedial Action Work Plan was issued in February 2004 (DOE-ID 2004a). A Phase I Operations and Maintenance Plan was issued in December 2003 (DOE-ID 2004c, current revision). A remedial action report for Phase I was published in January 2005 (DOE-ID 2005a). In February 2008, the INL Site-wide IC Plan was expanded to include INL Site-wide O&M requirements for most CERCLA response actions as required by the OU 10-04 ROD.

With the exception of ORD-01 (Arco High Altitude Bombing Range), portions of ORD-06 (Naval Ordnance Disposal Area), ORD-09 (Twin Buttes Bombing Range), and ORD-21 (Juniper Mine), munitions response sites^c covered by this 5-year review are located within ORD-03 (CFA-633 Naval Firing Site and Downrange Area). ORD-03 requires ICs for an indeterminate length of time. ICs currently are maintained and tracked both for ORD-03 and for numerous individual sites within ORD-03. Based on this 5-year review, it is suggested that ICs be maintained and tracked for ORD-03 rather than separately for individual sites within ORD-03. This change would be implemented in the next revision to the INL Site-wide IC/O&M Plan.

Other requirements are to remove or isolate surface munitions and explosives of concern that pose an unacceptable near-term physical hazard. Discovery of new munitions and explosives of concern must be recorded and evaluated. Qualified explosive ordnance disposal personnel must inspect the munitions and explosives of concern to identify it, determine if it is live or inert, identify the hazards, and determine if it should be detonated in place or disposed of. Items that are determined to pose an unacceptable physical hazard must be isolated and posted with signs until the hazards can be mitigated. The location and description of the munitions and explosives of concern are documented, and surveyed coordinates are maintained in the geographical information system database.

The Agencies agreed in the OU 10-04 ROD (DOE-ID 2002) that, although no action is required for protection of ecological receptors, long-term ecological monitoring at the INL Site will be performed to address uncertainties identified during the ecological assessment and ensure protection of the ecosystem. The OU 10-04 ROD mandated implementation of an INL Site-wide, long-term comprehensive approach for ecological monitoring to ensure protection of the ecosystem at the INL Site.

The *Long-Term Ecological Monitoring Plan for the Idaho National Engineering and Environmental Laboratory* (VanHorn and Haney 2007) presents the approach for INL Site long-term ecological monitoring and two primary objectives. The first is to verify that the objectives of each INL Site remedial action are maintained. The second is to determine that the long-term, INL Site-wide ecological impact of the contamination left in place is within acceptable limits. In accordance with that plan, an annual field sampling plan will be prepared to describe the field investigations to be performed within a fiscal year. Once the monitoring was completed for a particular year, an annual report that summarized the results of the monitoring effort was prepared.

The *Remedial Design/Remedial Action Work Plan for Operable Units 6-05 and 10-04, Phase I* (DOE-ID 2004a) states that the INL Site-wide long-term ecological monitoring will be implemented under the OU 10-04 ROD (DOE-ID 2002) by the Long-Term Ecological Monitoring Plan (VanHorn and Haney 2007). Six years of sampling have been completed. The yearly data were summarized in 2005 (Van Horn and Haney 2006) and 2006 (VanHorn 2009). Because the summary report from 6 years of sampling was not finalized by the end of FY 2009, the results of the analysis of the long-term ecological monitoring baseline sampling will be discussed in the next 5-year review.

10.4.2.2 Phase II. Phase II activities consisted of remediation of the munitions constituent contaminated soils at the National Oceanic and Atmospheric Administration site, the Fire Station II and Range Fire Burn Area, the Land Mine Fuze Burn Area, the Experimental Field Station, Naval Ordnance Disposal Area, and MISC-35. Remediation was not required at MISC-26 to achieve remediation goals for munitions constituents. The remedy provided for the recovery and disposal of chunks of explosives found at the sites, as well as excavation of contaminated soils. The Phase II Remedial Design/Remedial Action Work Plan was finalized in August 2004 (DOE-ID 2004b). The Phase II Remedial Action Report was completed in March 2009 (DOE-ID 2009b).

c. The OU 10-04 ROD used the term ordnance and explosives.

Remediation of the Phase II contaminated soil sites included the following activities:

- Established and maintained ICs, such as access controls and land-use restrictions.
- Performed a visual survey for discarded military munitions and munitions constituent fragments and stained soil, along with a geophysical survey for discarded military munitions in those areas impacted by the remedial action.
- Excavated contaminated soil with concentrations in excess of the remediation goals by hand, as well as by mechanical means as it was determined that doing so could be performed safely.
- Manually segregated fragments of munitions constituent from the soil.
- Disposed of munitions constituent fragments at an off-INL Site treatment, storage, and disposal facility.
- Employed field-screening methods and soil sampling with laboratory analysis to determine the extent of soil removal required to meet remediation goals.
- Sampled and analyzed excavated soil to determine munitions constituent concentrations and to determine if the soil exhibited any RCRA hazardous waste characteristics. The soil was determined to meet waste acceptance criteria for ICDF and was not RCRA characteristic; therefore, the soil was disposed of at the ICDF landfill.
- Backfilled areas excavated to depths greater than 1 ft with uncontaminated soil and contoured to match surrounding terrain. All excavated areas were revegetated.

Phase II remediation activities included surveying the sites for visible soil staining and the presence of explosive fragments, manual recovery of the fragments, excavation of contaminated soils, disposal of the waste streams, and contouring and revegetating the affected areas. Each of the six areas was sampled and analyzed using a combination of field test kit and analytical laboratory methods. The analytical results were compared to the remedial action goals specified in the OU 10-04 ROD (DOE-ID 2002), and the areas were determined to have been successfully remediated. Table 10-3 summarizes the 95% upper confidence limit on the mean for the analytical confirmation sampling as compared to the remediation goals.

For three of the sites (Fire Station II Zone and Range Burn Area [ORD-10], National Oceanic and Atmospheric Administration [ORD-08], and Detonation Pits [MISC-35]), ICs for munitions constituents were removed because remediation is complete as documented in the Phase II Remedial Action Report (DOE-ID 2009b). Munitions constituents identified at these sites in the future, if any, would be managed in accordance with an O&M plan. Though these sites were not identified with discarded military munitions, they are within the ORD-03 (CFA-633 Naval Firing Site and Downrange Area) IC area. This 5-year review suggests that ICs for discarded military munitions be implemented under ORD-03 rather than for each site individually. Visible access restrictions are posted at the normal approach points to ORD-03, rather than at each individual site.

For three other sites (Experimental Field Station [ORD-15], Land Mine Fuze Burn Area [ORD-24], and Naval Ordnance Disposal Area [ORD-06]), ICs will be maintained for the sites individually until the sites are remediated for discarded military munitions under Phase IV of the OU 10-04 selected remedy scheduled for FY 2011.

Table 10-3. Summary of 95% upper confidence limit on the mean versus remediation goals.

CERCLA Site	Field Test Kit Data (mg/kg)		Laboratory Analytical Data (mg/kg)		
	TNT	RDX	TNT	RDX	1,3-DNB ^a
Fire Station II Zone and Range Fire Burn Area (ORD-10)	13.2	NA ^b	15.1	0.3	NA
Experimental Field Station (ORD-15)	4.6	NA	2.44	NA	<0.4 ^c
Land Mine Fuze Burn Area (ORD-24)	8.8	NA	4.6	NA	NA
National Oceanic and Atmospheric Administration (ORD-08)	6.4	NA	4.7	<0.4 ^c	0.2
Naval Ordnance Disposal Area (ORD-06)	5.87	0.65	4.1	1.9	NA
Detonation Pits North of Experimental Organic-Cooled Reactor (MISC-35)	6.66	NA	7.2	NA	NA
Remediation goal	16	4.4	16	4.4	6.1

a. 1,3-DNB = 1,3-dinitrobenzene.

b. Results marked NA did not have this particular contaminant defined as a contaminant of concern for the given site.

c. Results listed as <0.4 mg/kg are listed as such because none of the samples collected had detectable concentrations of the analyte; therefore, the remedial action objective was considered as having been achieved for the analyte at the given site.

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
RDX	cyclotrimethylene trinitroamine
TNT	trinitrotoluene

10.4.2.3 Phase III. Phase III consisted of remediation of the lead-contaminated soil at the STF-02 gun range. The remedial action report for Phase III was completed in August 2007 (DOE-ID 2007c). In accordance with the OU 10-04 ROD (DOE-ID 2002) and Work Plan (DOE-ID 2006b), remediation included the following:

- Excavated the berms, surrounding soil, and the adjacent pond with mechanical equipment to remove soil above the remediation goal for lead. Field screening was used to initially identify the extent of soil excavation required to meet the remediation goal.
- Performed physical separation to remove copper and lead fragments (bullets, casings, etc.) that were intended to be sent offsite for recycle provided that DOE policy allowed it. Although DOE policy allowed for the shipment of copper and lead offsite for recycle, an offsite recycler was not located that would accept the material; therefore, it was shipped offsite for treatment and disposal.
- After sorting, returned any soil that was below the remediation goal to the site. All other soil that exceeded the remediation goal was determined to be RCRA-characteristic for lead and was shipped offsite for treatment and disposal.
- Disposed of railroad ties, wooden building, and asphalt pads onsite in an approved landfill.
- Sampled and analyzed excavated areas to confirm that the remediation goal had been achieved. Because all contamination above the remediation goal was removed, monitoring and sampling after remediation are not required, and ICs are no longer required.
- Backfilled and contoured the excavated areas to match surrounding terrain, and then revegetated the areas.

During Phase III, confirmation samples from the STF-02 gun range were analyzed both onsite and offsite by an independent laboratory in accordance with SW-846 Methods 3050B (EPA 1996a) and 6020A (EPA 2007a). For the onsite laboratory, the 95% upper confidence limit calculated using ProUCL Version 3.0 (EPA 2007b) is 68.6 mg/kg, assuming a gamma distribution of the data. For the offsite laboratory, the 95% limit is 91.6 mg/kg, again assuming a gamma distribution of the data. The remediation goal of 400 mg/kg for lead was achieved for the site; therefore, no ICs are required.

10.4.2.4 Phase IV. Phase IV involves remediation of three munitions response areas—the Arco High-Altitude Bombing Range (ORD-01), the Twin Buttes Bombing Range (ORD-09), and the CFA-633 Naval Firing Site and Downrange Area (ORD-03). The Phase IV Remedial Design/Remedial Action Work Plan was completed in November 2006 (DOE-ID 2006c) and specifically addresses five sites within ORD-03 that have confirmed discarded military munitions present: Naval Ordnance Disposal Area, Land Mine Fuze Burn Area, Experimental Field Station, Railcar Explosion Area (ORD-19), and Mass Detonation Area (ORD-13). Surveys will be conducted over the five sites to identify potential discarded military munitions. Suspect targets detected from the surveys will be noted and investigated further. Any items that are determined to be discarded military munitions will be transported to the Mass Detonation Area for disposal by high-order detonation. If the discarded military munitions poses an unacceptable risk for safe retrieval and transport, it will be disposed of in place by high-order detonation. Detonation of discarded military munitions will be performed in a manner that does not pose an unacceptable risk to human health or the environment and meets the minimum distance to the property of others as specified in the 40 CFR 265.382, “Open Burning: Waste Explosives.”

Remediation of the five ORD-03 munitions response sites includes the following activities:

- Maintain ICs consistent with land use that were implemented as part of the OU 10-04 Phase I activities. The specific goals of the ICs are to control human activity at sites with suspected discarded military munitions contamination and prevent harm from unintentional detonation of discarded military munitions. ICs include access restrictions, excavation restrictions, restrictive covenants, and other restrictions, such as signage and educational programs. ICs will be maintained until the discarded military munitions hazard is removed or reduced to levels acceptable for current and anticipated future land use. ICs will be reassessed as needed to reflect findings during the discarded military munitions survey and removal actions that might impact the protectiveness of the Phase I selected controls.
- Perform visual or geophysical surveys for the presence of discarded military munitions.
- Investigate potential discarded military munitions targets identified on the surface during the surveys.
- Identify and define the boundaries of the firing and bombing impact areas and the weapons testing and ammunition detonation areas.
- Determine the discarded military munitions density, explosive characteristics of the discarded military munitions, and discarded military munitions accessibility.
- Determine the relative risks of land use based on the type, amount, and accessibility of discarded military munitions and determine the extent of discarded military munitions removal required to meet desired land-use objectives.
- Perform surface clearance and discarded military munitions removal with disposal by detonation at the Mass Detonation Area or in-place detonation. Address waste generated during detonation activities using current disposal practices. If secondary explosive contamination, such as TNT or RDX, is discovered, perform remediation as described for the munitions constituent-contaminated soil sites.
- Backfill excavated areas deeper than 1 ft, contour to match the surrounding terrain, and vegetate.

During the 5-year review period, the Naval Ordnance Disposal Area, Experimental Field Station, Railcar Explosion Area, and Land Mine Fuze Burn Area were visually and geophysically surveyed for discarded military munitions anomalies. Future plans include additional surveys at the Railcar Explosion Area and the Mass Detonation Area, followed by recovery and disposal of discarded military munitions and its hazardous components (i.e., split projectiles with exposed explosives and fuzes). In addition, munitions constituents (i.e., TNT and RDX) found during Phase IV remediation and soil contaminated during Phase IV activities, such as high-order detonation at the Mass Detonation Area to destroy discarded military munitions, will be removed and disposed of.

Soil sampling will determine if products of incomplete combustion are present following the completion of munitions constituent and discarded military munitions disposal operations at the Mass Detonation Area (or areas where discarded military munitions is detonated in place). Though detectable levels are not expected, soil contamination at those sites where residual risk exceeds $1\text{E-}04$ will be remediated.

For the other two munitions response areas, the Arco High-Altitude Bombing Range and the Twin Buttes Bombing Range, munitions and explosives of concern have largely consisted of sand-filled practice bombs that do not pose an explosion risk. Munitions and explosives of concern encountered in these areas will be addressed under the Phase I Operations and Maintenance Plan (DOE-ID 2004c) that allows for the recovery and disposal of munitions and explosives of concern that poses an imminent risk to human health or the environment.

Investigations for munitions are seldom 100% effective. In many cases, ammunition is buried too deep, is too small to be detected, or is constructed of a material difficult to detect. Later, through frost heave, erosion, or construction, the item can reach the surface. Also, because the total amount of munitions at a site is almost never known, complete recovery cannot be documented. Therefore, ICs have been implemented in accordance with the *INL Site-wide Institutional Controls and Operations and Maintenance Plan* (IC/O&M Plan) (DOE-ID 2010b). ICs will be maintained at the three munitions response areas for an indeterminate timeframe until the munitions and explosives of concern hazard is removed or reduced to acceptable levels. Controls are required to restrain human activity in areas with suspected munitions and explosives of concern and prevent harm from unintentional detonation of munitions and explosives of concern. In addition, periodic surveys may be required in accordance with the *Operations and Maintenance Plan for Operable Units 6-05 and 10-04, Phase I* (DOE-ID 2004c) to continue the management of the munitions and explosives of concern hazards.

Access to the INL Site is currently restricted for security and public safety, and DOE land-use projections indicate INL Site-wide access restrictions will continue until at least 2095 (DOE-ID 1995b). Installation of additional fences or relocation of existing fences also may be necessary. Other access control measures currently include warning signs and training requirements. Land-use restrictions will be specified if government control of the INL Site is not maintained throughout the IC period.

10.4.3 Operations and Maintenance

Munitions and explosives of concern encountered on the INL Site was originally addressed under the Phase I Operations and Maintenance Plan (DOE-ID 2004c) that allows for the recovery and disposal of munitions and explosives of concern that poses an imminent risk to human health or the environment. The IC/O&M Plan consolidated the requirements for addressing newly discovered munitions and explosives of concern. O&M relating to OU 10-04 has not been required in this review period.

10.4.4 Progress Since the Last Review

The protectiveness statement from the previous 5-year review is as follows:

Institutional controls have been implemented at WAG 10 sites where contamination currently exists and might pose an unacceptable risk to human health or the environment. The use of institutional controls will preclude the inadvertent exposure of personnel and the public until such time as the remedial action is implemented. Overall protectiveness of the defined remedy will be evaluated upon completion.

No recommendations, follow-up actions, or issues were identified for WAG 10 during the last 5-year review.

Table 10-4 provides details of two issues identified in the last 5-year review—one for WAG 7 (Opalski 2006) and one for WAG 9 (Appendix C of DOE-ID 2007a). Because the associated recommendations/follow-up actions were deferred to WAG 10, the two issues are addressed in this section.

Table 10-4. Actions taken since the last 5-year review for Waste Area Groups 7 and 9 with actions assigned to Waste Area Group 10.

Issues from Previous Review ^a	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Waste Area Group 7					
Nitrate concentration in vadose zone is trending upward at Pad A (Opalski 2006).	Evaluation of this trend will be performed as part of the Site-wide remedial investigation/ feasibility study	DOE	2009	The OU 10-08 RI/BRA (Cahn et al. 2008) evaluated nitrate in the aquifer. This task is complete.	April 2008
Waste Area Group 9					
The sanitary lagoon site (ANL-04) was administratively transferred to OU 10-08 to facilitate closure of WAG 9 and allow for the completion of the WAG 9 remedial action report (DOE-ID 2007a)	The sanitary lagoon site (ANL-04) was transferred from WAG 9 to WAG 10 (OU 10-08) in 2005. The transition will be documented in the OU 10-08 ROD.	DOE	July 2009	The OU 10-08 ROD documented the transition (DOE-ID 2009a). This task is complete.	July 2009

a. Issues were identified either in Appendix C of the previous 5-year review (DOE-ID 2007a) or in the addendum to Appendix C enclosed with EPA's letter of concurrence with the previous 5-year review (Opalski 2006).

OU operable unit
 ROD Record of Decision
 WAG waste area group

The nitrate source term and trend at Pad A were evaluated as part of the OU 7-13/14 Remedial Investigation/Baseline Risk Assessment (Holdren et al. 2006). The OU 7-13/14 ROD (DOE-ID 2008a) selected an evapotranspiration surface barrier over the entire SDA, including Pad A. The surface barrier will reduce migration of water into the subsurface to ensure risk from nitrates remains at levels that are protective of human health. Until the barrier is constructed, the existing Pad A cover is inspected and maintained to ensure it remains effective (Lopez et al. 2009). The nitrate source term from WAG 7 was used as input to the OU 10-08 Site-wide groundwater fate and transport model and nitrate was addressed as a Site-wide contaminant of potential concern. The OU 10-08 model addressed the potential for nitrate from WAG 7 to be commingled with any other plume on the INL Site. The model predicted that the WAG 7 nitrate plume would not commingle above one-tenth the MCL. The Agency decision for Site-wide groundwater in the OU 10-08 ROD (DOE-ID 2009a) was no action with monitoring. Therefore, this issue has been addressed and is not retained as an issue for this 5-year review.

The last 5-year review recommended that the active sewage lagoons (ANL-04) at WAG 9 be transferred to OU 10-08 to allow for closure of WAG 9 and identified this as an issue. In 2005, the Agencies administratively transferred ANL-04 to OU 10-08 (Hain 2005; Ceto 2005; Koch 2005) for implementation of the remedy selected in the OU 9-04 ROD (DOE-CH 1998). Because the lagoons are expected to remain active until MFC closes (approximately 2033), the OU 10-08 ROD deferred remedy implementation until the lagoons are closed and resampled and risks recalculated. Because the site was transferred as recommended and the remedy implementation deferred, this is not an issue, and the site will not be discussed further in this 5-year review.

10.4.5 Data Review and Evaluation

Current environmental monitoring under OU 10-04 is limited to ecological monitoring. As recommended in the OU 10-04 O&M report (DOE-ID 2008b), a year of sampling was added to address several issues; therefore, 6 years of sampling data have been collected, instead of 5 years as originally directed (VanHorn and Haney 2007). The sampling from 2003 through 2008 for contaminant analysis and effects information was collocated spatially and contiguously to the greatest extent possible to minimize sources of variability. Analytical data were collected from soil, subsurface soil, *Peromyscus maniculatus* (deer mice), *Artemisia tridentata* (sagebrush), and *Agropyron cristatum* (crested wheatgrass) in potentially contaminated sites and from uncontaminated background/reference areas. Analytical data also were collected from ponds designated as CERCLA sites, specifically, from sediments, surface water, and plants, as well as a background area. Effects data were collected to determine if adverse effects to plants and wildlife are occurring on the INL Site. The types of effects data that were collected annually included kidney-to-body-weight and liver-to-body-weight ratios, liver and kidney histopathology, earthworm and seedling soil toxicity testing, avian population, reptile population, plant population, small mammal population, and soil fauna. These data will be summarized and compiled in the ecological monitoring report, which is in preparation and planned to be finalized in the next year.

10.4.6 Technical Assessment

The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. According to sampling data and site inspections, all COCs are at or below action levels as defined for the actions that have taken place to date. Remedial actions have not been performed at all sites as defined by the RODs; however, at sites where contaminant concentrations prohibit free release of the site or remedial actions have yet to be implemented, ICs have been established to protect human health and the environment. ICs are in place and discussed in Section 10.5.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?

Yes. The exposure assumptions, toxicity values, and RAOs have not changed for the COCs at WAG 10 IC sites. The RAOs used at the time of the remedies are valid.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No. No new information has come to light that would call into question the protectiveness of the remedies completed under WAG 10.

Technical Assessment Summary

Phase II and Phase III remedial actions have been completed under the OU 10-04 ROD and at Site TSF-07 under the OU 10-08 ROD. Based on available data, the remedial actions at the sites have been successfully completed in accordance with the requirements in the WAG 10 decision documents. No changes in the physical conditions at the sites have occurred that would affect the protectiveness of the remedies, and there have been no changes in the toxicity factors or risk factors of the COCs under which the remedial actions were completed. Remedial actions have yet to be completed under OU 10-04 Phases I and IV and at two sites (TRA-74 and CFA-54) under OU 10-08. However, exposure pathways that could result in unacceptable risks are being controlled until remedial actions are completed.

10.4.7 Issues

No issues were identified regarding remedial actions at WAG 10.

10.4.8 Recommendations and Follow-Up Actions

No recommendations or follow-up actions are required.

10.4.9 Protectiveness Statement for Operable Unit 10-04 Phases I, II, III, and IV

The remedy at OU 10-04 is expected to be protective of human health and the environment upon completion, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled.

10.5 INL Site-Wide Institutional Controls and Operations and Maintenance

As required by the Site-wide IC/O&M Plan (DOE-ID 2010b), site inspections are conducted annually at IC sites at WAG 10. Site inspections provide a mechanism for determining if ICs are functioning as intended and identifying maintenance needs. They also provide information to aid in determining if implemented remedies are functioning as intended. Site inspectors visually evaluate site conditions and documentation of conditions on inspection checklists, review site information in the IC database, and assess access controls such as signs, markers, or fences. Depending on site-specific requirements, inspectors may also evaluate vegetative growth, examine for intrusion and subsidence, or perform radiological surveys. Annual IC and O&M reports document findings of the annual site inspections.

In general, the annual inspections at WAG 10 identified only a few issues and tracked the progress of necessary repairs. At the time of this 5-year review, site conditions were found to be acceptable. Collectively, the inspections provide evidence that remedies are functioning as intended. Significant observations include the following:

- Signs and markers are present and maintained as necessary.
- Excavations, drilling, and other site disturbances have been coordinated through the regulatory Agencies.

Table 10-5 lists all IC sites by WAG, including those sites for which ICs were removed during the 5-year review period based on some action or data evaluation. It provides an estimated date for release from ICs for each site, when calculable, and the associated decision document or other relevant reference. RODs did not establish estimated release dates from ICs for many sites. Table 10-5 lists estimated IC termination dates for those sites with adequate data. Appendixes provide supporting information (e.g., calculations).

10.5.1 Remedy Selection

The OU 10-04 ROD (DOE-ID 2002) directed the development and implementation of an INL Site-wide IC plan for all CERCLA sites at the INL that require ICs. ICs are required to protect human health and the environment until the site is released for unrestricted land use. Typically, ICs are identified either as the selected remedy in a ROD (i.e., a no further action decision) or as a component of a selected remedy (e.g., capping followed by ICs). Remedial action-IC elements are documented in various decision documents associated with the WAG under which the remedial action is performed. ICs also are applied as an initial response to potential new sites and can be the recommended remedy (i.e., no further action) via the new site identification process.

The selected remedy is presented in Section 11 of the OU 10-04 ROD. The OU 10-04 ROD directs that a comprehensive approach for establishing, implementing, enforcing, and monitoring ICs will be developed in accordance with EPA Region 10 policy (EPA 1999a) as part of the O&M Plan. The O&M Plan is the mechanism for implementing ICs at all INL CERCLA sites that require ICs. The Agencies must concur before ICs can be terminated. The following elements for the comprehensive INL Site-wide IC plan will involve procedures for controlling activities as outlined in the policy:

- A comprehensive listing of all areas or locations on the INL Site that have or will have ICs for protection of human health or the environment.
- Identification, made legally binding where appropriate, of all entities and persons, including, but not limited to, employees, contractors, lessees, agents, licensees, and invitees relevant to the INL Site ICs.
- Identification of all activities and reasonably anticipated future activities that could occur on INL CERCLA sites with ICs.
- A tracking mechanism that identifies all land areas under restriction or control. A process to promptly notify both the EPA and the State of Idaho before any anticipated change in land-use designation, restriction, land users, or activity for any IC required by a decision document.

Table 10-5. Institutional control sites and estimated institutional control termination dates.

Site Code and Description	Estimated Institutional Control Termination Date ^a	References and Comments
WAG 1		
IET-04 IET stack rubble site	2064	Appendix A. OU 1-10 ROD (DOE-1999a).
TSF-05 TSF injection well	2099	OU 1-10 ROD (DOE-ID 1999a).
TSF-06 Area 1 soil area northeast of turntable	2043	Appendix A. OU 1-10 ROD (DOE-ID 1999a).
TSF-06 Area 5 radioactive soil berm	No longer required	Appendix A. OU 1-10 ROD (DOE-ID 1999a).
TSF-06 Area 10 reactor vessel burial site	Indeterminate	Appendix A. ROD Amendment and ESD (DOE-ID 2004d).
TSF-06 Area 11 TSF-06 ditch	No longer required	Appendix A. OU 1-10 ROD (DOE-ID 1999a).
TSF-06 Area B soil area south of turntable	2013	Appendix A. OU 1-10 ROD (DOE-ID 1999a) and Remedial Action Report for OU 1-10 Sites at Test Area North (DOE-ID 2008c).
TSF-10 TSF drainage pond (TAN-782)	No longer required	Appendix A. OU 1-10 ROD (DOE-ID 1999a).
TSF-23 TSF drinking water potential contamination	2099	OU 1-10 ROD (DOE-ID 1999a) and ROD Amendment (DOE-ID 2001b).
TSF-26 TSF PM-2A tanks (TAN-710 A&B) and soils	To be determined in IC/O&M Plan revision	Appendix A. OU 1-10 ROD (DOE-ID 1999a) and Remedial Action Report for OU 1-10 Sites at Test Area North (DOE-ID 2008c). Appendix A calculates that the ICs for this site could end in 2016. This will be addressed in a revision to the IC/O&M Plan.
TSF-28 TSF sewage treatment plant (TAN-623) and sludge dry beds	Indeterminate	Appendix A. OU 1-10 ROD (DOE-ID 1999a) and Remedial Action Report for OU 1-10 Sites at Test Area North (DOE-ID 2008c).
TSF-29 TSF acid pond (TAN-735)	2036	Appendix A. OU 1-10 ROD (DOE-ID 1999a).
TSF-39 TSF transite (asbestos) contamination	Indefinite	Appendix A. OU 1-10 ROD (DOE-ID 1999a). Asbestos in gravel pit.
TSF-42 TAN-607-A Room 161 contaminated pipe	No longer required	OU 1-10 ROD (DOE-ID 1999a). Removal Action Report for TAN-607A and TAN-607 (DOE-ID 2008d).
TSF-43 RPSSA Buildings TAN-647, TAN-648, and pads	Indeterminate	Appendix A. OU 1-10 ROD (DOE-ID 1999a) documented that part of TAN-647 was operated as a RCRA interim-status storage facility.

Table 10-5. (continued).

Site Code and Description	Estimated Institutional Control Termination Date ^a	References and Comments
WRRTF-01 WRRTF burn pit	Indefinite	Appendix A. OU 1-10 ROD (DOE-ID 1999a) and Remedial Action Report for OU 1-10 Sites at Test Area North (DOE-ID 2008c). Asbestos contamination will require ICs to remain indefinitely.
TAN-607 area (includes Sites TSF-09, -18, -46, -47, -48, -53, and OU 1-10 deep soil contamination)	To be determined in IC/O&M Plan revision	Appendix A. OU 1-10 ROD (DOE-ID 1999a), ROD Amendment and ESD for V-Tanks (DOE-ID 2004d), Action Memorandum (DOE-ID 2007d), and Remedial Action Report for OU 1-10 Sites at Test Area North (DOE-ID 2008c). Appendix A calculates that the shallow excavation areas no longer require ICs, and deep excavation areas can be released in 2061. The ending of ICs for this site will be addressed in a revision to the IC/O&M Plan.
TAN-650 area	2019	Section 2.3.3.3.9.2.2. Requires ICs based on LOFT EE/CA (DOE-ID 2006d) under the OU 1-10 ROD (DOE-ID 1999a) and the Remedial Action Report for OU 1-10 Sites at Test Area North (DOE-ID 2008c).
WAG 2		
TRA-03 TRA warm waste pond (sediments)	Indefinite	Appendix B. Listed in AR as TRA-03B but not determined to be A or B in decision documents. OU 2-13 ROD (DOE-ID 1997b) and ESD (DOE-ID 2000a). Metal contamination at depth will require ICs to remain indefinitely.
TRA-04 TRA waste retention basin (TRA-712)	2310	Appendix B. OU 2-13 ROD (DOE-ID 1997b) and ESD (DOE-ID 2000a).
TRA-06 TRA chemical waste pond (TRA-701)	Indefinite	Appendix B. OU 2-13 ROD (DOE-ID 1997b) and ESD (DOE-ID 2000a). Metal contamination at depth will require ICs to remain indefinitely.
TRA-08 TRA cold waste disposal pond (TRA-702)	2021	Appendix B. OU 2-13 ROD (DOE-ID 1997b) and ESD (DOE-ID 2000a). North Pond ICs no longer required, and South Pond ICs until 2021.
TRA-13 TRA final sewage leach ponds (2) by TRA-732	2063	Appendix B. OU 2-13 ROD (DOE-ID 1997b) and ESD (DOE-ID 2000a).
TRA-15 TRA Hot Waste Tanks #2, #3, #4 at TRA-613	2260	Appendix B. OU 2-13 ROD (DOE-ID 1997b) and ESD (DOE-ID 2000a).

Table 10-5. (continued).

Site Code and Description	Estimated Institutional Control Termination Date ^a	References and Comments
TRA-19 TRA Rad Tanks 1 and 4 at TRA-630, replaced by Tanks 1, 2, 3, & 4	2360	Appendix B. OU 2-13 ROD (DOE-ID 1997b) and ESD (DOE-ID 2000a).
TRA-34 TRA north storage area	No longer required	Appendix B. OU 2-13 ROD (DOE-ID 1997b) and ESD (DOE-ID 2000a).
TRA-B TRA PCB spill at TRA-619	Indeterminate	Appendix B. OU 2-13 ROD (DOE-ID 1997b) and ESD (DOE-ID 2000a). To be determined when site demolished.
TRA-C TRA PCB spill at TRA-626	No longer required	Appendix B. OU 2-13 ROD (DOE-ID 1997b) and ESD (DOE-ID 2000a).
TRA-E TRA PCB spill at TRA-653	No longer required	Appendix B. OU 2-13 ROD (DOE-ID 1997b) and ESD (DOE-ID 2000a).
TRA-J perched water and SRPA	Indeterminate	OU 2-13 ROD (DOE-ID 1997b) and ESD (DOE-ID 2000a). ICs will terminate when GW monitoring is discontinued as presented in a subsequent 5-yr review.
TRA-M TRA sewage leach pond berms and soil contamination area	2038	Appendix B. OU 2-13 ROD (DOE-ID 1997b) and ESD (DOE-ID 2000a).
TRA-X hot tree site	No longer required	Appendix B. OU 2-13 ROD (DOE-ID 1997b) and ESD (DOE-ID 2000a).
TRA-Y brass cap area	2360	Appendix B. OU 2-13 ROD (DOE-ID 1997b) and ESD (DOE-ID 2000a).
WAG 3		
WAG 3 – Miscellaneous Sites Not Assigned a Group		
CPP-06 trench east of CPP-603 CPP-17 soil storage south of Peach Bottom fuel storage area CPP-749 CPP-22 particulate air release south of CPP-603 CPP-88 radiologically contaminated soil CPP-90 ruthenium detection CPP-95 airborne plume	CPP-06 (2033) CPP-22 (2034) CPP-17 (2046) CPP-88 (2025) CPP-90 (no longer required) CPP-95 (2021)	Appendix C. OU 3-13 ROD (DOE-ID 1999b). CPP-17 is broken into 17a and 17b which are presented with different dates for release: CPP-17a (2046) and CPP-17b (2020). This division is not presented in the AR and the more conservative date is presented.
CPP-61 PCB spill at CPP-718 transformer yard	Indefinite	Appendix C. OU 3-13 ROD (DOE-ID 1999b) and OU 3-13 ESD (DOE-ID 2004e).

Table 10-5. (continued).

Site Code and Description	Estimated Institutional Control Termination Date ^a	References and Comments
CPP-101 abandoned drum near CPP-665	Indeterminate	Not characterized. NSI-25178 (Butler 2008).
CPP-127 shallow injection well 41-CPP west of Building CPP-710	No longer required	NSI-25119 (Webber 2008) and Hutchison (2009) document the completion of abandonment of shallow injection well 41-CPP, no contaminants above levels of concern.
WAG 3 Group 1 – Tank Farm Soils (Industrial Use Area)		
CPP-96 contaminated soil in the tank farm (Sites CPP-16, -20, -24, -25, -26, -28, -30, -31, -32, 58W, -79 and -112) and adjacent to the process equipment waste evaporator building (Sites CPP-15, -27, -33, and 58)	Indeterminate	Date will be determined when the final action is implemented. OU 3-14 ROD (DOE-ID 2007e).
WAG 3 Group 2 – Soils Under Building and Structures		
CPP-02 french drain	Indeterminate	Site will be addressed when building demolished. OU 3-13 ROD (DOE-ID 1999b).
OU 3-13 Sites Under Buildings (industrial use area) Building CPP-601: CPP-80, -118, -119, -120, -121, -122, -123 Building CPP-602: CPP-86, -117 Building CPP-633: CPP-85 Building CPP-649/604: CPP-87, -89, -111	Indeterminate	Sites will be addressed when building demolished. OU 3-14 ROD (DOE-ID 2007e). CPP-111. NSI-24909 (Doornbos 2005a). CPP-117, -118, -119, -120, -121, -122 and -123. NSI-24915 (Doornbos 2005b).
WAG 3 Group 3 – Other Surface Soils		
Sites adjacent to CPP-603 CPP-01 east of CPP-603 CPP-04 -Soil around CPP-603 settling tank CPP-05 CPP-603 filter line failure CPP-08 northeast corner of CPP-603 CPP-09 contaminated soils around CPP-603 CPP-10 CPP-603 plastic pipeline break CPP-11 CPP-603 sludge release CPP-69 SFE-20 Hot Waste Tank System	2223	Appendix C. OU 3-13 ROD (DOE-ID 1999b) and OU 3-13 Group 3 Remedial Action Report Phase II (DOE-ID 2009e). CPP-69 was addressed in OU 3-13, Group 7, SFE-20 Hot Waste Tank System Remedial Action Report (DOE-ID 2009f). This document included it with the Group 3 “sites adjacent to CPP-603.” Concentrations for ICs are provided by depth: 0–10 ft (2019) and 10–21 ft (2223).

Table 10-5. (continued).

Site Code and Description	Estimated Institutional Control Termination Date ^a	References and Comments
CPP-14 sewage treatment plant	No longer required	Appendix C. OU 3-13 ROD (DOE-ID 1999b) and OU 3-13 Group 3 Remedial Action Report Phase II (DOE-ID 2009e).
CPP-19 line leak	2431	Appendix C. OU 3-13 ROD (DOE-ID 1999b) and OU 3-13 Group 3 Remedial Action Report Phase II (DOE-ID 2009e). Surface ICs no longer required), 0–10 ft (2074), and 10–13 ft (2431)
CPP-34 soil storage area northeast corner CPP	No longer required	Appendix C. OU 3-13 ROD (DOE-ID 1999b) and OU 3-13 Group 3 Remedial Action Report Phase II (DOE-ID 2009e). CPP-34 is broken into 34A and 34B but both no longer require ICs. This division is not presented in the AR.
CPP-37a gravel pit outside INTEC fence	No longer required	Appendix C. OU 3-13 ROD (DOE-ID 1999b) and Group 3 Remedial Action Report Phase I (DOE-ID 2007f).
CPP-37b landfill	2014	Appendix C. OU 3-13 ROD (DOE-ID 1999b). Note that the Remedial Action Report, Group 3 Phase I (DOE-ID 2007f) Table 13-1 was found to be incorrectly assessed. The appropriate values are found in the OU 3-13 Group 3 Remedial Action Report Phase II (DOE-ID 2009e), Table 13-2.
CPP-37c contamination southeast of CPP-37b	2056	Appendix C. Note that in the Remedial Action Report, Group 3 Phase I (DOE-ID 2007f), Table 13-1, Site 37c was found to be incorrectly assessed. The appropriate values are found in the OU 3-13 Group 3 Remedial Action Report Phase II (DOE-ID 2009e), Table 13-2.
CPP-67 former INTEC Percolation Ponds #1 and #2	No longer required	Appendix C. OU 3-13 ROD (DOE-ID 1999b) and Remedial Action Report, Group 3 Phase I (DOE-ID 2007f).
CPP-97 tank farm soil stockpiles	2029	Appendix C. OU 3-13 ROD (DOE-ID 1999b) and Remedial Action Report, Group 3 Phase I (DOE-ID 2007f),
CPP-130 buried debris beneath site CPP-03	No longer required	Appendix C. OU 3-13 ROD (DOE-ID 1999b) and OU 3-13 Group 3 Remedial Action Report Phase II (DOE-ID 2009e). IC dates were calculated for zones within the site. Both zones can be released from ICs.
CPP-135 east of building CPP-603	2207	Appendix C. NSI transmitted to Agencies (Fulton 2009) and OU 3-13 Group 3 Remedial Action Report Phase II (DOE-ID 2009e), Table 13-5.

Table 10-5. (continued).

Site Code and Description	Estimated Institutional Control Termination Date ^a	References and Comments
Industrial Use Area		
CPP-48 french drain	2065	OU 3-13 ROD (DOE-ID 1999b), Table 11-1, and OU 3-13 Group 3 Remedial Action Report (DOE-ID 2009e), Table 13-3.
OU 3-13 sites within the industrial use area CPP-13 pressurization of the solid storage CPP-35 CPP-633 decontamination spill CPP 36/91 transfer line leak from CPP-633 to WL-102 and CPP-633 blower pit CPP-124 1 1/2" PLA-2069C leak west of CPP-750 CPP-136 contamination adjacent to the CPP-633 Waste Calcine Facility engineered cap, east foundation	2214	OU 3-14 ROD (DOE-ID 2007e); OU 3-13 Group 3 Remedial Action Report (DOE-ID 2009e), Table 13-6; and OU 3-14 O&M Plan (DOE-ID 2008e). OU 3-13 Group 3 Remedial Action Report (DOE-ID 2009e), Tables 13-3 and 13-4. Note that Table 13-4 incorrectly states that concentrations are decayed for 2.3 pCi/g instead of 11.3 pCi.g. They are decayed to 11.3 pCi/g. IC dates calculated for areas within the industrial use area vary. The most restricted is presented: CPP-13 2085, CPP-35 (4–5 ft 2080) 0–5 ft (2031), CPP-36/91 (0–4 ft 2085) (>4 ft 2214), CPP-124 (>4 ft 2095). CPP-136 NSI transmitted to Agencies (Fulton 2009).
WAG 3 Group 4 – Perched Water		
CPP-83 strontium-contaminated perched water	2416	Appendix C. OU 3-13 ROD (DOE-ID 1999b).
WAG 3 Group 5 – Snake River Plain Aquifer		
CPP-23 injection well	No longer required	The plugged and abandoned well was determined to no longer be a source of groundwater contamination. The OU 3-14 ROD (DOE-ID 2007e) did not assign any remedial action or ICs to the well.
OU 3-14 groundwater and drilling institutional control area (no CERCLA site code)	2095	OU 3-14 ROD (DOE-ID 2007e).
WAG 4		
CFA-01 Landfill I CFA-02 Landfill II CFA-03 Landfill III	Indefinite	Appendix D. OU 4-12 ROD (DOE-ID 1995c). Due to the presence of asbestos at the site, ICs will remain at the site until otherwise specified.
CFA-04 mercury pond	No longer required	OU 4-12 ROD (DOE-ID 1995c) and CFA Remedial Action Report (DOE-ID 2004f).

Table 10-5. (continued).

Site Code and Description	Estimated Institutional Control Termination Date ^a	References and Comments
CFA-07 soil contamination northwest of CPP-642	Indefinite	Appendix D. OU 4-13 ROD (DOE-ID 2000b). Due to the presence of metals at the site, ICs will remain at the site until otherwise specified.
CFA-08 sewage treatment plant drain field	2114	Appendix D. OU 4-13 ROD (DOE-ID 2000b).
WAG 5		
ARA-03 pad near ARA-627 (lead sheeting)	No longer required	Appendix E. OU 5-12 ROD (DOE-ID 2000c).
ARA-06 ARA-II SL-I burial ground	2400	Beyond 2095, this burial site will be reevaluated in a subsequent 5-yr review OU 5-12 ROD (DOE-ID 2000c).
ARA-07 ARA-II seepage pit to east	2038	Appendix E. OU 5-12 ROD (DOE-ID 2000c) and OU 5-12 Remedial Action Report (DOE-ID 2005b), p. 7-10.
ARA-08 ARA-II seepage pit to west	2020	Appendix E. OU 5-12 ROD (DOE-ID 2000c) and OU 5-12 Remedial Action Report (DOE-ID 2005b), p. 7-10.
ARA-23 radiologically contaminated soils and subsurface structures in and around ARA-I and ARA-II	2120	Appendix E. OU 5-12 ROD (DOE-ID 2000c). OU 5-12 Remedial Action Report, Table 7-4 (DOE-ID 2005b). Parts of this site had estimates for release from ICs: ARA-I - 2062 ARA-II - 2032 ARA-II on basalt - 2120 Equipment washdown area - 2038 Haul road and turnaround area - 2025 Windblown area – 2025.
ARA-24 ARA-III windblown soil	Indeterminate	Appendix E. OU 5-12 ROD (DOE-ID 2000c). A date cannot be estimated due to lack of characterization.
ARA-25 contaminated soil beneath ARA-I hot cells	Indefinite	A release date cannot be estimated because both metals and radionuclides are COCs.
PBF-10 PBF reactor area evaporation pond (PBF-733)	No longer required	Appendix E. OU 5-12 ROD (DOE-ID 2000c).
PBF-12 PBF SPERT-I leach pond	No longer required	Appendix E. OU 5-12 ROD (DOE-ID 2000c).
PBF-13 PBF rubble pile	Indefinite	Asbestos site. OU 5-12 ROD (DOE-ID 2000c).
PBF-21 PBF SPERT-III large leach pond	No longer required	Appendix E. OU 5-12 ROD (DOE-ID 2000c).

Table 10-5. (continued).

Site Code and Description	Estimated Institutional Control Termination Date ^a	References and Comments
PBF-22 SPERT-IV leach pond (PBF-758)	No longer required	Appendix E. OU 5-12 ROD (DOE-ID 2000c).
PBF-26 PBF SPERT-IV lake	No longer required	Appendix E. OU 5-12 ROD (DOE-ID 2000c).
WAG 6		
BORAX-01 BORAX II through V leach pond	2075	Appendix F. OU 10-04 ROD (DOE-ID 2002). Occupational 2075 and resident 2065.
BORAX-02 BORAX I burial site	Indefinite	OU 10-04 ROD (DOE-ID 2002). Beyond 2095, the burial site will be reevaluated in a subsequent 5-yr review.
BORAX-08 BORAX ditch	No longer required	Appendix F. OU 10-04 ROD (DOE-ID 2002).
BORAX-09 BORAX II through V	Indefinite	OU 10-04 ROD (DOE-ID 2002). Beyond 2095, this burial site will be reevaluated in a subsequent 5-yr review.
EBR-08 EBR-I (WMO-703) fuel oil tank	Indefinite	OU 10-04 ROD (DOE-ID 2002). Due to the presence of petroleum products, ICs will remain until discontinued based on a subsequent 5-yr review.
WAG 7		
WAG 7 land use control area	Indefinite	Due to the presence of long-lived radionuclides, ICs will remain indefinitely.
WAG 9		
ANL-01 industrial waste pond	2028	Appendix G. OU 9-04 ROD (DOE-CH 1998).
ANL-09 interceptor canal	2048	Appendix G. OU 9-04 ROD (DOE-CH 1998).
ANL-64 lead fragments and steel shot north of MFC	Indeterminate	New site identification sent to Agencies in November 2008 (Dieter 2008).
ANL-65 lead fragments and steel shot north of MFC	Indeterminate	New site identification sent to Agencies in November 2008 (Dieter 2008).
WAG 10		
ANL-04 sanitary sewage lagoons	Indeterminate	OU 10-08 ROD (DOE-ID 2009a). During operations and closure phases, the facility operator (INL Site contractor) implements ICs and will collect samples as part of closure. Post closure, the risks will be determined under the CERCLA program and the appropriate action determined.

Table 10-5. (continued).

Site Code and Description	Estimated Institutional Control Termination Date ^a	References and Comments
CFA-54 buried waste pipe near CFA-674	Indeterminate	Interim ICs are in place. Remediation is planned under the OU 10-08 ROD (DOE-ID 2009a).
MISC-26 detonation pit between NRF and ATR Complex	No longer required	Originally identified as an OU 10-08 site, the ESD to the OU 10-04 ROD transferred the site to OU 10-04 (DOE-ID 2006a). No evidence of DMM was found and remediation was not required to achieve remediation goals for MC. The OU 10-04 Remedial Action Phase II report states that ICs are not required (DOE-ID 2009b, Section 7).
MISC-35 detonation pits north of EOCR	No longer required	Originally identified as an OU 10-08 site, the 2006 ESD to the OU 10-04 ROD transferred the site to OU 10-04 (DOE-ID 2006a). No evidence of DMM was found and the site was remediated to achieve the remediation goals for MC. The OU 10-04 Remedial Action Phase II report states that ICs are not required (DOE-ID 2009b, Section 7).
OMRE-01 OMRE Leach Pond	2039	Appendix H estimates date. No further action decision OU 10-04 ROD (DOE-ID 2002).
ORD-01 (Arco High-Altitude Bombing Range)	Indeterminate	ICs will remain for an indeterminate time because DMM may be present (DOE-ID 2002).
ORD-03 ^b (CFA-633 Naval Firing Site and Downrange Area)	Indeterminate	ORD-03 ^b encompasses many other sites. ICs will remain for an indeterminate time because DMM may be present (DOE-ID 2002).
ORD-09 (Twin Buttes Bombing Range)	Indeterminate	ICs will remain for an indeterminate time because DMM may be present (DOE-ID 2002).
ORD-21 (Juniper Mine)	Indeterminate	The Juniper Mine is located outside ORD-03 and requires ICs because of buried MCs (DOE-ID 2002).
ORD-08 ^b (NOAA) ORD-10 ^b (Fire Station II Zone and Range Fire Burn Area)	No longer required	Sites were remediated for MCs. The Remedial Action Report (DOE-ID 2009b) states that ICs will not be maintained for the individual sites, but will be addressed within ORD-03.
ORD-06 (Naval Ordnance Disposal Area)	Indeterminate	This site was remediated for MC but evidence of DMM remained. Note that the boundary of ORD-06 has been extended beyond the boundary of ORD-03. Either the boundary of ORD-03 will need to be adjusted to encompass all of ORD-06, or ICs for ORD-06 will need to be maintained separately.

Table 10-5. (continued).

Site Code and Description	Estimated Institutional Control Termination Date ^a	References and Comments
ORD-15 ^b (Experimental Field Station) ORD-24 ^b (Land Mine Fuze Burn Area)	Indeterminate	These sites were remediated for MC but evidence of DMM remained.
ORD-19 ^b (Railcar Explosion Area)	Indeterminate	Site-specific ICs are required until the site is remediated for MC and DMM. Note that ORD-25 (DMM and MC east of river) is not a separate site and is included in ORD-19 (DOE-ID 2002).
ORD-12 (Old Military Structures) ORD-13 ^b (Mass Detonation Area)	Indeterminate	Site-specific ICs are required until the site is remediated. ORD-13 encompasses ORD-12 (old military structures).
ORD-04 ^b (CFA gravel pit) ORD-05 ^b (CFA sanitary landfill area) ORD-07 ^b (explosive storage bunkers) ORD-11 ^b (Anaconda power line) ORD-14 ^b (Dairy Farm Revetments) ORD-16 ^b (DMM east of ATR Complex) ORD-17 ^b (burn area south of Experimental Field Station) ORD-18 ^b (igloo structure) ORD-20 ^b (DMM east of Army Reentry Vehicle Facility Site) ORD-22 ^b (demilitarized projectiles) ORD-26 ^b (zone east of the river) ORD-27 ^b (dirt mounds) ORD-28 ^b (craters east of INTEC)	Indeterminate	These sites are within ORD-03.
STF-02 Gun Range	No longer required	Remedial Action Report for Phase III documents lead cleanup (DOE-ID 2007c).
TRA-63 TRA-605 warm waste line	2019	OU 10-08 ROD (DOE-ID 2009a).
TRA-74 TRA-718 overhead water tank soil contamination	Indeterminate	Interim ICs are in place. Remediation is planned under the OU 10-08 ROD (DOE-ID 2009a).
TSF-07 TSF disposal pond	No longer required	Site was remediated in 2009 as a NTCRA and qualifies for unrestricted land use (Arenaz 2010)
TSF-08 Area 13B mercury spill	No longer required	Site was remediated in 1994 as a time-critical removal action. The OU 10-08 baseline risk assessment (Cahn et al. 2008) found that the remaining contamination was acceptable, and the OU 10-08 ROD (DOE-ID 2009a) determined that the site was no action.

Table 10-5. (continued).

Site Code and Description		Estimated Institutional Control Termination Date ^a	References and Comments
TSF-59 soil beneath TAN-603 northwest sump		2013	OU 10-08 ROD (DOE-ID 2009a).
a. A memorandum of non-significant change to a ROD will be required to terminate ICs in accordance with the IC/O&M Plan for those sites not previously released from ICs based on a decision document (ROD, ESD, or ROD amendment) or a remedial action report. b. These sites are within ORD-03. Based on this 5-year review, it is suggested that the next revision of the INL Site-wide IC/O&M Plan revision consolidate IC requirements under ORD-03 and discontinue maintaining or tracking ICs separately for each individual site within ORD-03. Indefinite – the contaminant of concern does not decay or degrade. Indeterminate – data are not available for estimating a date			
ANL	Argonne National Laboratory	IC	institutional control
AR	Administrative Record	IC/O&M	<i>institutional control/operations and maintenance</i>
ARA	Auxiliary Reactor Area	IET	Initial Engine Test (facility)
ATR	Advanced Test Reactor	INL	Idaho National Laboratory
BORAX	Boiling Water Reactor Experiment	INTEC	Idaho Nuclear Technology and Engineering Center
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	LOFT	Loss-of-Fluid Test (facility)
CFA	Central Facilities Area	MC	munitions constituent
COC	contaminant of concern	MFC	Materials and Fuels Complex
CPP	Chemical Processing Plant	NOAA	National Oceanic and Atmospheric Administration
DMM	discarded military munitions	NRF	Naval Reactors Facility
EBR	Experimental Breeder Reactor	NSI	new site identification
EE/CA	engineering evaluation/cost analysis	NTCRA	non-time-critical removal action
ESD	explanation of significant differences	O&M	operations and maintenance
GW	groundwater	OMRE	Organic-Moderated Reactor Experiment
		OU	operational unit
		ORD	ordnance
		PBF	Power Burst Facility
		PCB	polychlorinated biphenyl
		RCRA	Resource Conservation and Recovery Act
		ROD	Record of Decision
		RPSSA	Radioactive Parts Service and Storage Area
		SPERT	Special Power Excursion Reactor Test
		SRPA	Snake River Plain Aquifer
		TAN	Test Area North
		TRA	Test Reactor Area
		TSF	Technical Support Facility
		WAG	waste area group
		WRRTF	Water Reactor Research Test Facility

The OU 10-04 ROD also required an annual IC report until after the first 5-year review. After the INL Site-wide IC approach is well established and its effectiveness has been demonstrated, the frequency of IC monitoring reports may be modified, subject to approval by the EPA and DEQ. At a minimum, the ICs monitoring report will contain the following components:

- A description of the means employed to meet IC requirements
- A description of the means employed to meet waste-site-specific objectives, including the results of visual field inspections of all areas subject to waste-site-specific restrictions
- An evaluation of the effectiveness of the approach at meeting all WAG-wide IC requirements and waste-site-specific objectives
- A description of any deficiencies of the approach and the efforts or measures that have been or will be taken to correct problems.

ICs will reside with DOE or another government agency or until a remedy review or INL Site-wide 5-year review concludes unrestricted land use is allowable. DOE will not delete or terminate any IC without EPA and DEQ concurrence. Industrial use is anticipated to continue at the INL Site for the IC period (through 2095) and beyond 2095 for portions of the INL Site (e.g., RWMC and INTEC).

10.5.2 Remedy Implementation

Many individual sites are subject to ICs and O&M. The primary long-term objectives are to protect human health by preventing exposure to contaminants or hazardous substances and protect the environment by preventing migration of contaminants and hazardous substances left in place following remedial actions (DOE-ID 2010b). The IC/O&M Plan (DOE-ID 2010b) defines (1) IC requirements and how ICs are implemented for all response actions under the FFA/CO and (2) O&M requirements and how O&M are implemented for those sites that are operated and managed under the IC/O&M Plan.

ICs at the INL Site are physical and administrative controls that ensure protectiveness by limiting or prohibiting activities at sites that do not meet requirements for unrestricted use. Physical controls provide material means for controlling access to a site (e.g., warning signs, fences, and permanent markers). Administrative controls restrict land or resource use and include property lease or transfer requirements, government permitting, soil disturbance restrictions, and groundwater-use restrictions. Typically, ICs are identified either as the selected remedy in a ROD (i.e., a no further action decision) or as a component of a selected remedy (e.g., capping followed by ICs). ICs also are applied as an initial response to potential new sites and can be the recommended remedy (i.e., no further action) through the new site identification process.

10.5.2.1 Site-wide Institutional Control Plan. As required by the OU 10-04 ROD, the first version of the Site-wide IC Plan was finalized December 2003. It has since been updated several times: 2004 (Revision 1), 2006 for OU 3-14 (Revision 2), 2006 to change the site name (Revision 3), 2007 for OU 7-13/14 (Revision 4), 2009 for OU 10-08 (Revision 5), and 2010 (Revision 6). Beginning with Revision 4, IC and O&M requirements were combined into one INL Site-wide IC/O&M Plan. The current IC/O&M Plan defines physical and administrative ICs as described below.

10.5.2.1.1 Physical Controls—Physical ICs include warning signs, permanent markers, fences, wellhead controls, physical security, and annual assessments:

- Warning signs—IC signs are posted at most IC sites and newly identified sites as visible access restrictions to provide information about the principal hazards at the site, media of concern, a point of contact with phone number, and a warning to not disturb the area unless authorized.

- Permanent markers—Permanent markers are a second, more durable method of visible access restriction.
- Fences—Fences may be used as an additional method of physically restricting access to a site.
- Wellhead controls—Wellhead controls prevent intentional or inadvertent spread of contamination to the groundwater through the opening of an existing well. Controls include requirements to ensure that the wellhead is secured and the well is adequately marked or identified.
- Physical security—Physical security measures control access to the INL Site. Physical security measures include guard gates, security badging, and warning signs at the INL Site boundary and along state highways.
- Annual assessments—Annual IC assessments evaluate the condition of sites to ascertain whether IC mechanisms remain in place and are providing the protection required by the remedy and to identify necessary maintenance or repairs.

10.5.2.1.2 Administrative Controls—Administrative ICs include property lease and transfer requirements, site disturbance requirements (i.e., drilling and excavation controls, groundwater consumption and irrigation controls, and soil disturbance controls), and an IC site database:

- Property lease and transfer requirements—Property lease and transfer requirements ensure that DOE obtains concurrence from EPA before leasing INL Site land, notifies the state of a lease involving contamination, and provides information about contamination and restrictions in property transfer documentation.
- Site disturbance requirements—Site disturbance requirements include measures that control the process of physically disturbing the soil or penetrating the ground at a site. Specifically, management control procedures MCP-3480 and MCP-3002 identify drilling and excavation requirements and the soil disturbance process at the INL Site.
- Institutional Control Database—In 2007 in the INL Site-wide IC/O&M Plan (subsequently revised; see DOE-ID 2010b), a database was established to track the status of IC sites. The new database replaced an earlier system. It provides current and projected land use for each IC site. The IC database includes the following information:
 - CERCLA site name
 - Location of the site
 - Description of the site
 - COCs
 - ROD-selected remedy
 - Controls
 - Objective of controls
 - WAG under which ICs were developed.

10.5.2.2 Annual Reports. As required by the INL Site-wide IC/O&M Plan, site inspections are conducted annually at sites that require ICs under CERCLA. Site inspections provide a mechanism for determining if ICs are functioning as intended and identifying maintenance needs. They also provide information to aid in determining if implemented remedies are functioning as intended. Site inspectors visually evaluate site conditions and document conditions on inspection checklists, review site information in the IC database, and assess access controls (e.g., signs, markers, and fences). Depending on site-specific requirements, inspectors may also evaluate vegetative growth, examine the site for

intrusion and subsidence, or perform radiological surveys. Findings of the site inspections are documented in the annual IC/O&M reports.

Beginning in 2005, annual reports, as directed by the OU 10-04 ROD, were produced. In February 2008, the INL Site-wide IC reports were combined with INL Site-wide O&M reports for most CERCLA response actions. Annual reports from 2005 through 2009 are referenced as follows:

- Combined ICs and O&M annual reports:
 - FY 2009—RPT-672
 - FY 2008—RPT-544
- ICs only reports:
 - FY 2007—DOE-ID (2007g)
 - FY 2006—DOE-ID (2006e)
 - FY 2005—DOE-ID (2005c).

10.5.3 Operations and Maintenance

10.5.3.1 Site-wide O&M Plan. The OU 10-04 ROD required that an O&M plan be developed that contains the ICs for all INL CERCLA sites. In February 2008, the INL Site-wide IC plan was expanded to include INL Site-wide O&M requirements for most CERCLA response actions as required by the OU 10-04 ROD. Revisions 4, 5, and 6 of the IC/O&M Plan reflect this change.

This plan establishes uniform requirements of the IC remedy components of all CERCLA IC sites at the INL and specifies the O&M requirements. This plan focuses on O&M activities that are in place to address the protectiveness and integrity of CERCLA remedial measures at the INL Site. Examples of such activities are inspection of and reporting on the condition of engineered barriers and performance of radiological surveys.

This plan excludes day-to-day facility operations that occur under separate controlling documents, such as transportation of waste to ICDF, operation of the pump and treat facility and associated activities at TAN, performance of organic contamination in the vadose zone activities at RWMC, and tank farm O&M activities at INTEC.

10.5.3.2 Annual Reports. As required by the INL Site-wide IC/O&M Plan, annual inspections will be performed at those sites requiring O&M activities. The information obtained during the annual inspection is used to develop routine annual IC/O&M reports. Deficiencies are identified along with corrective actions, forecasted completion dates, and a status of each corrective action.

Beginning in 2005, annual reports, as directed by the OU 10-04 ROD, were produced. In February 2008, the INL Site-wide O&M reports were combined with INL Site-wide IC reports for most CERCLA response actions. Annual O&M reports from 2005 through 2009 are referenced as follows:

- Combined ICs and O&M annual reports:
 - FY 2009—RPT-672
 - FY 2008—RPT-544

- O&M only reports:
 - FY 2007—DOE-ID (2007h)
 - FY 2006—DOE-ID (2006f)
 - FY 2005—DOE-ID (2005d).

10.5.4 Progress Since the Last Review

In the last 5-year review (DOE-ID 2007a), an issue was identified that applies Site-wide to IC sites, as shown in Table 10-6.

Table 10-6. Actions taken since the last 5-year review for Waste Area Group 10.

Issues from Previous Review ^a	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Applies to WAG 5 and other INL sites. The EPA guidance for the free-release concentration of Cs-137 has been revised to account for the soil shielding factor included in the latest risk models. As a result, ICs at the ARA-03, PBF-22, and PBF-26 sites could be discontinued based on the new EPA guidance.	DOE, with the concurrence from the EPA and the State of Idaho DEQ, will evaluate how to best address the impact of the new guidelines on IC sites and will determine whether ICs should be discontinued at ARA-03, PBF-22, and PBF-26.	DOE	2009	IC sites where Cs-137 was the COC were reevaluated in this 5-year review. New IC termination dates were estimated. Results are reported by WAG in the body of this report. This task is complete.	January 2011
a. Issues were identified either in Appendix C of the previous 5-year review (DOE-ID 2007a) or in the addendum to Appendix C enclosed with EPA's letter of concurrence with the previous 5-year review (Opalski 2006). COC contaminant of concern DEQ Idaho Department of Environmental Quality DOE U.S. Department of Energy EPA Environmental Protection Agency IC institutional control INL Idaho National Laboratory WAG waste area group					

EPA revised their preliminary remediation goal for Cs-137 in soil, meaning that ICs at several sites could be discontinued. Because the change in the release level marked a deviation from the release level originally discussed in the RODs, a decision on the implementation of the new release level was not presented in the previous 5-year review report. DOE, with the concurrence from EPA and DEQ, determined to evaluate how to best address the impact of the new guidelines on IC sites and determine whether ICs should be discontinued prior to this 5-year review. The Agencies decided to apply the new cleanup level for sites under ICs. The new cleanup level for Cs-137 was used to estimate dates that sites across the INL Site can be released for unrestricted land use. The changes to the Cs-137 remediation goal provided by EPA, as well as other changes for other COCs, are addressed in the appendixes associated with each WAG (Appendixes A through H) and are summarized in Table 10-7. Therefore, the status of this issue is complete. The following discussion summarizes the basis for EPA's modification of the Cs-137 cleanup goal.

The Cs-137 remediation goal is a risk-based soil concentration^d. When DOE-ID started performing CERCLA risk assessments at the INL Site, EPA did not provide preliminary remediation goals for radionuclides. INL used risk-based soil concentrations provided by DEQ (Fromm 1996). In 2002, EPA provided a website with radionuclide preliminary remediation goals (EPA 2007c). The radionuclide preliminary remediation goal calculator incorporates updates to the equations and input values that are found in previous EPA guidance documents (EPA 1989, 1991a, 1991b, 2000a, 2001a).

The current Cs-137 preliminary remediation goal on EPA's website is 6.15 pCi/g at the 1E-04 risk level for a current residential scenario ("Resident Soil PRG Supporting Tables in activity (pCi) units" under "Preliminary Remediation Goals for Radionuclides" (see EPA 2007c). The historical preliminary remediation goal applied to remedial actions at the INL Site based on Fromm (1996) was 2.4 pCi/g at the 1E-04 risk level. For this 5-year review, IC termination dates were recalculated using EPA's higher remediation goal for sites under ICs for which Cs-137 is the only risk driver.^e The following text summarizes the basis for EPA's change.

EPA includes several factors that reduce the exposure in the calculations—primarily, a gamma shielding factor, an area correction factor, and an exposure time fraction as compared to the risk-based soil concentrations provided by DEQ (Fromm 1996). These factors generally reduce the amount of exposure and produce a higher preliminary remediation goal compared to Fromm (1996), as shown below.

10.5.4.1 Gamma Shielding Factor. The gamma shielding factor is the ratio of the indoor-to-outdoor external gamma radiation level. The gamma shielding factor represents shielding that buildings provide against gamma radiation. The updated EPA preliminary remediation goals for radionuclides in soil account for this shielding effect by applying the gamma shielding factor. EPA's previous gamma shielding factor default value—taken from Part B of the Risk Assessment Guidance for Superfund, Vol. I, Human Health Evaluation Manual (EPA 1991a)—assumed the external gamma radiation level indoors was 20% lower than the outdoor gamma radiation level.

Subsequently, in *Reassessment of Radium and Thorium Soil Concentrations and Annual Dose Rates* (EPA 1996b), EPA further reviewed available literature and identified numerous publications that address gamma shielding factors as applied to radioactive fallout from nuclear weapons and reactor accidents. One source of information was *Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A)* (EPA 1989), where EPA had examined experimentally measured reduction factors from fallout and found that the external gamma radiation level indoors was 20% to 40% lower (depending on construction material) than the outdoor gamma radiation level. EPA (1996) suggested a 40% reduction might be more appropriate at sites with soil contaminated with radionuclides. Based on that rationale, EPA adopted the value of 0.4 as the default gamma shielding factor in the *Soil Screening Guidance for Radionuclides* (EPA 2000a). This latest value is recommended for calculating preliminary remediation goals.

d. Risk-based concentrations for the same constituent may be defined throughout the CERCLA process—for example, a "soil screening level" may be used during risk assessment, while "preliminary remediation goal" is the term applied during the feasibility study and proposed plan. These risk-based concentrations are predecessors of the final "remediation goal." Therefore, guidance for risk-based concentrations may apply when developing remediation goals even though other terminology is used.

e. This summary of the revised IC termination date based on Cs-137 is limited to cases where Cs-137 is the only contaminant of concern. Downward adjustments to the remediation goal may be required in cases where multiple contaminants contribute to risk or preclude unrestricted land use.

Table 10-7. Changes to estimated termination dates for institutional controls at sites impacted by changes in toxicity or other risk input factors.

Site Code	Initial Termination Date ^a	Updated Termination Date ^b	References and Comments
WAG 1			
IET-04	2099	2064	Appendix A
TSF-06 Area 1	2099	2043	Appendix A
TSF-06 Area 5	2099	ICs no longer required	Appendix A
TSF-06 Area 11	2099	ICs no longer required	Appendix A
TSF-06 Area B	2054	2013	Appendix A Remedial Action Report for OU 1-10 Sites at Test Area North (DOE-ID 2008c)
TSF-10	2099	ICs no longer required	Appendix A
TSF-26	2099	To be determined in a revision to the INL Site-wide IC/O&M Plan	Appendix A Remedial Action Report for OU 1-10 Sites at Test Area North (DOE-ID 2008c)
TSF-29	2099	2036	Appendix A
TAN-607 area (includes Sites TSF-09, -18, -46, -47, -48, -53, and OU 1-10 deep soil contamination)	2042 for shallow 2102 for deep	To be determined in a revision to the INL Site-wide IC/O&M Plan	Appendix A Remedial Action Report for OU 1-10 Sites at Test Area North (DOE-ID 2008c)
TAN-650 area	2061	2019	Appendix A LOFT EE/CA (DOE-ID 2006d), Table 3
WAG 2			
TRA-04	Not determined	2310	Appendix B
TRA-06	Not determined	Indefinite	Appendix B. Site reassessed and contains metals at levels of concern
TRA-08	Not determined	ICs no longer required for north pond 2021 for south pond	Appendix B

Table 10-7. (continued).

Site Code	Initial Termination Date ^a	Updated Termination Date ^b	References and Comments
TRA-13	Not determined	2063	Appendix B
TRA-15	Not determined	2260	Appendix B
TRA-19	Not determined	2360	Appendix B
TRA-34	Not determined	ICs no longer required	Appendix B
TRA-C	Not determined	ICs no longer required	Appendix B
TRA-E	Not determined	ICs no longer required	Appendix B
TRA-M	Not determined	2038	Appendix B
TRA-X	Not determined	ICs no longer required	Appendix B
TRA-Y	Not determined	2360	Appendix B
WAG 3			
WAG 3 – Miscellaneous Sites Not Assigned a Group			
CPP-06 CPP-17 CPP-22 CPP-88 CPP-90 CPP-95	Not determined	2033 for CPP-06 2046 for CPP-17a 2020 for CPP-17b 2034 for CPP-22 2025 for CPP-88 ICs no longer required for CPP-90 2021 for CPP-95	Appendix C OU 3-13 ROD (DOE-ID 1999b) Table 11-1

Table 10-7. (continued).

Site Code	Initial Termination Date ^a	Updated Termination Date ^b	References and Comments
WAG 3 Group 3 – Other Surface Soils			
Sites adjacent to CPP-603 CPP-01, -04, -05, -08/-09, -10, -11, -69	2045 for 0–10 ft 2226 for 10–21 ft	2019 for 0–10 ft 2223 for 10–21 ft	Appendix C, Table C-5 OU 3-13 ROD (DOE-ID 1999b), Table 11-1 OU 3-13 Group 3 Remedial Action Report (DOE-ID 2009e), Table 13-5 CPP-69 was addressed in OU 3-13, Group 7, SFE-20 Hot Waste Tank System Remedial Action Report (DOE-ID 2009f). This document included it with the Group 3 “Sites Adjacent to CPP-603.”
CPP-14	2034	ICs no longer required	Appendix C, Table C-2 OU 3-13 ROD (DOE-ID 1999b), Table 11-1 OU 3-13 Group 3 Remedial Action Report (DOE-ID 2009e), Table 13-2
CPP-19	2045 for surface 2042 for 0–10 ft (Cs-137) 2435 for 10–13 ft	ICs no longer required for surface 2074 for 0–10 ft (total strontium) 2431 for 0–13 ft	Appendix C, Table C-5 OU 3-13 ROD (DOE-ID 1999b), Table 11-1 OU 3-13 Group 3 Remedial Action Report (DOE-ID 2009e), Table 13-5
CPP-37a	2011	ICs no longer required	Appendix C, Table C-1 OU 3-13 ROD (DOE-ID 1999b), Table 11-1 Remedial Action Report, Group 3 Phase I (DOE-ID 2007f), Table 13
CPP-37b	2055	2014	Appendix C, Table C-2 OU 3-13 ROD (DOE-ID 1999b), Table 11-1 Note that the Remedial Action Report, Group 3 Phase I (DOE-ID 2007f), Table 13-1, was found to be incorrectly assessed. The appropriate values are found in the OU 3-13 Group 3 Remedial Action Report (DOE-ID 2009e), Table 13-2.

Table 10-7. (continued).

Site Code	Initial Termination Date ^a	Updated Termination Date ^b	References and Comments
CPP-37c	2097	2056	Appendix C, Table C-2 Note that the Remedial Action Report, Group 3 Phase I (DOE-ID 2007f), Table 13-1, was found to be incorrectly assessed. The appropriate values are found in the OU 3-13 Group 3 Remedial Action Report (DOE-ID 2009e), Table 13-2.
CPP-67	2049	ICs no longer required	OU 3-13 ROD (DOE-ID 1999b), Table 11-1 Remedial Action Report, Group 3 Phase I (DOE-ID 2007f), Table 13-1
CPP-97	2029	ICs no longer required	Appendix C, Table C-1 OU 3-13 ROD (DOE-ID 1999b), Table 11-1 Remedial Action Report, Group 3 Phase I (DOE-ID 2007f), Table 13-1
CPP-130	2044 for Zones 1 to 7 from 0–4 ft 2023 for Zone 8 from 0–4 ft	ICs no longer required	Appendix C, Table C-5 OU 3-13 ROD (DOE-ID 1999b), Table 11-1 OU 3-13 Group 3 Remedial Action Report (DOE-ID 2009f), Table 13-5
CPP-135	2248 (from Remedial Action Report)	2207	Appendix C, Table C-5 OU 3-13 Group 3 Remedial Action Report (DOE-ID 2009f), Table 13-5
WAG 4			
CFA-08	Not determined	2114	Appendix D
WAG 5			
ARA-03	2095	ICs no longer required	Appendix E OU 5-12 ROD (DOE-ID 2000c), Table 33
ARA-07	2078	2038	Appendix E OU 5-12 Remedial Action Report (DOE-ID 2005b), p. 7-10

Table 10-7. (continued).

Site Code	Initial Termination Date ^a	Updated Termination Date ^b	References and Comments
ARA-08	2059	2020	Appendix E OU 5-12 Remedial Action Report (DOE-ID 2005b), p. 7-10
ARA-23	2095	2062 for ARA-I 2032 for ARA-II 2120 for ARA-II on basalt 2038 for equipment washdown area 2025 for haul road and turnaround area 2025 for windblown area	Appendix E OU 5-12 Remedial Action Report (DOE-ID 2005b), Table 7-4
PBF-10	2095	ICs no longer required	Appendix E
PBF-12	2095	ICs no longer required	Appendix E
PBF-21	2095	ICs no longer required	Appendix E
PBF-22	2095	ICs no longer required	Appendix E
PBF-26	2095	ICs no longer required	Appendix E
WAG 6			
BORAX-01	Not determined	2075	Appendix F
BORAX-08	Not determined	ICs no longer required	Appendix F
WAG 9			
ANL-01	Not determined	2028	Appendix G
ANL-09	Not determined	2048	Appendix G

Table 10-7. (continued).

Site Code		Initial Termination Date ^a	Updated Termination Date ^b	References and Comments	
WAG 10					
OMRE-01		Not determined	2039	Appendix H	
a. Initial IC termination date was taken from a ROD or remedial action report.					
b. A memorandum of non-significant change to a ROD will be required to terminate ICs in accordance with the IC/O&M Plan for those sites not previously released from ICs in a ROD or a remedial action report.					
ANL	Argonne National Laboratory	LOFT	Loss-of-Fluid Test (facility)	PBF	Power Burst Facility
ARA	Auxiliary Reactor Area	NSI	new site identification	ROD	Record of Decision
BORAX	Boiling Water Reactor Experiment	IC	institutional control	TAN	Test Area North
CFA	Central Facilities Area	IC/O&M	institutional controls/operations and maintenance	TRA	Test Reactor Area
CPP	Chemical Processing Plant			TSF	Technical Support Facility
EE/CA	engineering evaluation/cost analysis	OMRE	Organic-Moderated Reactor Experiment	WAG	waste area group
IET	Initial Engine Test (facility)	OU	operational unit		
INL	Idaho National Laboratory				

10.5.4.2 Area Correction Factor. The Risk Assessment Guidance for Superfund Part B model (EPA 1991a) assumes that an individual is continually exposed to a nondepleting source term with a geometry that is effectively an infinite slab. The concept of an infinite slab means that the thickness of the contaminated zone and its areal extent are so large that it behaves as if it were infinite in its physical dimensions. In practice, soil contaminated to a depth greater than about 15 cm and with an areal extent greater than about 1,000 m² will create a radiation field comparable to that of an infinite slab. To calculate soil screening levels for a residential scenario, adjusting for small areas is an important modification to Risk Assessment Guidance for Superfund Part B model because an infinite slab source produces overly conservative soil screening levels. Thus, EPA (1991a) had both a GSF and an exposure time factor to account for this. As discussed above, EPA reevaluated the gamma shielding factor and now provides an area correction factor and exposure time fraction to the model for calculating soil screening levels (EPA 2000a). The default area correction factor is 0.9 (EPA 2000a).

10.5.4.3 Exposure Time Fraction. The exposure time fraction was taken from Table 15-131 and Table 15-132 of *Exposure Factors Handbook* (EPA 1997). Historically, neither Fromm (1996) nor EPA (1991a) applied exposure time fractions because these values became available after both documents were written. EPA now applies exposure time fractions for calculating remediation goals (EPA 2000a, b).

10.5.4.4 Comparison of Calculations. To provide a better understanding of how these changes impacted the calculation of the Cs-137+D preliminary remediation goal, the calculations are compared below. Equation 10-1 presents the basic Fromm calculation for external dose for the resident and Equation 10-2 presents the EPA website basic preliminary remediation goal calculation for external dose for the resident. Table 10-8 presents the factors used in calculating the external exposure soil screening level and the changes made since the Fromm memorandum (Fromm 1996).

Without adjusting for decay over the period, the basic Fromm (1996) calculation for external exposure to the resident is:

$$RBC_{Fromm} = \frac{TR}{SF_e * CR * CF * EF * ED} \quad (10-1)$$

and the basic EPA (2001a) calculation for external exposure to the resident is:

$$PRG_{EPA} = \frac{TR}{SF_e * \frac{EF}{365(d / yr)} * ED * ACF * ET_0 * ET_i * GSF} \quad (10-2)$$

where the parameters are as described in Table 10-8.

Because both equations contain TR , SF_e , and ED , and:

$$\text{Fromm's } CR * CF * EF = (24 \text{ hr/d}) * (1.14\text{E-}04 \text{ yr/hr}) * (350 \text{ d/yr}) = 9.58\text{E-}01, \text{ and}$$

$$\text{EPA's } EF / (365 \text{ d/yr}) = (350 \text{ d/yr}) / (365 \text{ d/yr}) = 9.58\text{E-}01,$$

the difference is in the denominator of EPA's equation—the $ACF * ET_0 * ET_i * GSF$. Again, neither equation was adjusted for decay over the period.

Table 10-8. Input parameters and their default values.

Parameter (Definition)	Fromm (1996) Default Value	EPA (2001a) Default Value	Reference for EPA Default Value
TR (target cancer risk)	10^{-6} (unitless)	10^{-6} (unitless)	EPA (1991b)
SF (external exposure slope factor)	2.09E-06 (risk/yr/pCi/g)	2.55E-06 (risk/yr/pCi/g)	See text
EF (exposure frequency)	350 (d/yr)	350 (d/yr)	EPA (1991b)
ED (exposure duration)	30 (yr)	30 (yr)	EPA (1991b)
ACF (area correction factor)	Not used, assumed 1	0.9 (unitless)	ANL (1993)
ET ₀ (exposure time fraction, outdoor)	Not used	0.073 (unitless)	EPA (2000a) (pg. 2-22) EPA (2000b) (pg. 2-17) EPA (1997) (Table 15-131)
ET _i (exposure time fraction indoor)	Not used	0.683 (unitless)	EPA (2000a) (pg. 2-22) EPA (2000b) (pg. 2-17) EPA (1997) (Table 15-132)
GSF (gamma shielding factor)	Not used	0.4 (unitless)	EPA (1996)
CR (contact rate)	24 hr/d	Not used	
CF (conversion factor)	1.14E-04 yr/hr	Not used	

The HEAST 2001 slope factors for Cs-137+D are slightly greater than the HEAST 1996 used in Fromm (1996). Alone, the larger slope factor would produce a lower preliminary remediation goal (i.e., a larger slope factor equates to a greater possible risk). The small decrease in the preliminary remediation goal (about 22%) is overcome by the gamma shielding factor, area correction factor, and the exposure time factor, which increase the EPA preliminary remediation goal by approximately 55%. Therefore, though the slope factor is slightly greater, the final remediation goal is larger.

10.5.5 Data Evaluation and Review

The annual IC reports indicate that ICs and O&M actions are generally performing as intended and providing adequate protection to human health and the environment. Those few deficiencies in physical ICs that were noted during annual IC inspections (e.g., missing signs) were quickly resolved. Administrative controls, specifically, information in the IC database, were reviewed as part of each annual assessment. The abstract in each annual report states the database was revised as needed to reflect the current status of the IC sites. In developing Table 10-5 for this 5-year review, inconsistencies with documentation (e.g., annual IC reports) and other errors were noted in the IC database. First, information is not always correct in the current IC/O&M Plan (DOE-ID 2010b) and changes from one year to the next are not well annotated. Second, handling of new sites is inconsistent.

A few examples of noted deficiencies are:

- Table 1 of the latest revision of the IC/O&M Plan (i.e., DOE-ID 2010b) lists sites deleted or added since the last plan, including CPP-26, TSF-42, and CPP-58.

- CPP-26 was listed in Revision 5 (under CPP-96) but is shown as an added site in Revision 6, where the comment column does not include the more recent decision documentation concerning this site.
- Similarly, TSF-42 and CPP-58 are added in Revision 6 but were listed previously in Revision 4 and not Revision 5 without any explanation for excluding and including the sites.
- Table A-1 in the current IC/O&M Plan does not match the IC database.
- Review of the IC/O&M Plan and the IC database and assessing the protectiveness of ICs is complicated by varying language relating to ICs among RODs.

Annual reports document deficiencies found during inspections, along with corrective actions, forecasted completion dates, and a status of each corrective action. Evaluation of the annual reports indicates inconsistent tracking of corrective actions.

10.5.6 Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

No. Physical ICs are in place and functioning as intended, as concluded in annual reviews; however, the tracking mechanism and documentation exhibit discrepancies.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Yes. Revised estimates for IC termination dates did not affect the protectiveness of ICs. Other exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy remain unchanged and valid.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No. ICs remain protective at the INL Site. Additional evaluation of previously collected data produced revised estimated IC termination dates. However, the revised dates do not affect the protectiveness of the remedy.

Technical Assessment Summary

Annual reviews occur as required, and physical ICs are in place and functioning as intended. However, the tracking mechanism and documentation exhibit some discrepancies. Examination of the IC/O&M Plan, the IC database, and annual IC reports indicates inconsistent tracking, which also is reflected in the tracking of corrective actions from year to year in annual reports. Variable IC language between RODs for each WAG adds confusion.

10.5.7 Issues

Multiple inconsistencies among the IC database, IC/O&M Plan, and annual IC reports were noted and appear to be caused by a systematic deficiency in the tracking mechanism. Language concerning ICs differs in each of the individual WAG RODs, as shown in the IC/O&M Plan, further complicating evaluation in the 5-year review. Because INL Site-wide access restrictions are enforced, these inconsistencies currently do not prevent ICs from being protective.

10.5.8 Recommendations and Follow-Up Actions

The following are recommendations and follow-up actions: thoroughly validate the IC database to ensure it is an accurate tracking mechanism for all sites requiring ICs and revise the IC/O&M Plan accordingly, establish requirements to annotate annual IC reports and revisions to the IC/O&M Plan sufficient to track a site as its status changes, as part of the validation, review source documents (e.g., RODs, work plans, and remedial action reports) to ensure that IC requirements are up to date and to remove sites where ICs can be terminated, establish a process to periodically and accurately maintain the database, and with Agency concurrence, modify the IC/O&M Plan to standardize wording on ICs for consistency across the INL Site.

10.5.9 Protectiveness Statement for Operable Unit 10-04 Site-Wide Institutional Controls and Operations and Maintenance

The INL Site-wide IC remedy under OU 10-04 currently protects human health and the environment because INL Site-wide access restrictions are enforced that protect human health and the environment in the short-term. However, for the remedy to be protective in the long-term, the IC database, annual IC reports, and IC/O&M plan should be modified to achieve and maintain consistency.

10.6 TSF-07 Disposal Pond under Operable Unit 10-08

The Agencies agreed in the OU 10-08 ROD (DOE-ID 2009a) that the first 5-year review for OU 10-08 would occur in 2015, which is within 5 years after the initiation of the first remedial action. However, since remedial actions have been completed at the TSF-07 disposal pond, it is included in this 5-year review. The TSF-07 disposal pond, which was originally in WAG 1, was administratively transferred to OU 10-08 for remedy implementation.

10.6.1 Remedial Action

A 2009 NTCRA of removal and disposal successfully remediated the former pond as described below.

10.6.1.1 Remedy Selection. As outlined in the Record of Decision Test Area North Operable Unit 1-10 (DOE-ID 1999a), the selected remedy for the disposal pond was limited action. The site was administratively transferred to OU 10-08 to implement the remedy (DOE-ID 2008c). Additional data collected under OU 10-08 in 2008 identified that this remedy would not be protective and that additional action would be required. A NTCRA was conducted under OU 10-08 in summer 2009. The selected removal action was removal and disposal with ICs.

10.6.1.1.1 Removal Action Objective—The removal action objective for the TSF-07 disposal pond, as identified in the Engineering Evaluation/Cost Analysis (DOE-ID 2009c), was to limit total human health excess cancer risk to 10^{-4} for workers and future residents.

10.6.1.1.2 Cleanup Levels—The cleanup levels in the Action Memorandum (DOE-ID 2009d) were 8.4 mg/kg for mercury and 43.3 pCi/g for Cs-137. The cleanup level for Cs-137 was based on achieving 6 pCi/g in 2095. The cleanup level for mercury was based on protection of ecological receptors. Although the Cs-137 cleanup level differs from the OU 1-10 ROD (DOE-ID 1999a), it is the 10^{-4} residential risk-based level calculated using the current EPA preliminary remediation goals (EPA 2007c). The cleanup level is the same as the one established in the OU 10-08 ROD for TSF-07 (DOE-ID 2009a). This revised cleanup level includes gamma shielding for a future resident and an updated slope factor.

10.6.1.2 Remedy Implementation. Work began in summer 2009 to remove the contaminated soil. Newly excavated areas were gamma-scanned using a real-time backpack gamma spectrometry system for Cs-137, and excavation continued as necessary until the soil gamma scans were below 43.3 pCi/g. Once excavation was complete, the soil contamination area was incrementally decreased in size until remediation was complete. The removal and disposal of the TSF-07 disposal pond contaminated soil were completed on August 26, 2009, and are documented in the removal action report (DOE-ID 2010a).

Confirmation gamma-scanning for Cs-137 was performed in the excavation using the backpack system. Gamma-scanning of the 3.2 non-excavated acres (the primary and overflow spreading areas) began coincident with excavation of the known soil contamination areas.

Data collected prior to the removal indicated that mercury contamination was confined to a small area within the larger Cs-137 contaminated soil area. Therefore, using real-time field-screening for Cs-137 to guide the extent of cleanup had a high likelihood of ensuring that the cleanup levels for mercury would be achieved. Confirmation samples were collected for the entire 3.2 acres and sent to a laboratory for mercury analysis as described in the TSF-07 sampling procedure (SPR-219). Composite sampling was used for the non-excavation areas, and systematic random samples were collected from excavated areas.

Areas not excavated consisted of the southern portion of the primary pond and the overflow pond. Composite sampling in these non-excavated areas of the 3.2-acre disposal pond involved collecting six individual samples from eight sections. Each set of six individual samples was then combined into a mixing pan, and a single sample aliquot was collected for analysis. A total of eight composited confirmation samples were sent to an offsite laboratory for total mercury analysis.

In the excavated areas, 10 individual confirmation grab samples were collected for mercury analysis. These samples, consisting of both systematic random and biased samples, were sent for mercury analysis. Additional duplicate (quality control) samples were also collected and analyzed.

Gamma scan surveys were conducted throughout the entire 3.2-acre TSF-07 disposal pond site. The backpack gamma spectroscopy system with global positioning system capability was used to confirm the removal of Cs-137 contamination. All of the 3.2-acre area of the TSF-07 site following excavation measured less than the 43.3-pCi/g removal goal. Following excavation and disposal of TSF-07 soil contamination areas, the remaining Cs-137 activity over the entire 3.2-acre site ranged from nondetect to a maximum of 32.5 pCi/g.

A statistical analysis of the gamma scan data showed that the Cs-137 results do not follow any discernable distribution at the 95% upper confidence limit. Appendix C of the TSF-07 Removal Action Report (DOE-ID 2010a) summarizes the statistical data. The nonparametric distribution for the Cs-137 gamma scan data has a 95% Kaplan-Meier upper confidence limit of 4.8 pCi/g.

All mercury contamination in the TSF-07 wastewater disposal pond was remediated to less than the final removal goal of 8.4 mg/kg. The TSF-07 confirmation mercury analysis results ranged from 0.05 to 0.56 mg/kg. Duplicate samples were collected for both the composited and grab sample locations. The relative percent difference between duplicate sample results is included in Appendix B of the TSF-07 Removal Action Report (DOE-ID 2010a), Table B-1 (composite sample results) and Table B-3 (random grab sample results). The composite sample data exhibited a statistically normal distribution as shown in Appendix B, Table B-2 (and Figure B-1), and the random grab sample data do not follow any discernible distribution as shown in Table B-4 (and Figure B-2). The statistical analyses of both the mercury and Cs-137 data were generated using ProUCL (EPA 2007b).

The TSF-07 Action Memorandum (DOE-ID 2009d) states that ICs will be maintained by DOE-ID until the site can be released for unrestricted land use (no later than 2095). The Cs-137 gamma scan results using the 95% (Kaplan-Meier) upper confidence limit value of 4.8 pCi/g Cs-137 indicate that the TSF-07 site meets the criteria to be released for unrestricted land use.

Prior to remedial actions, a fence surrounded the entire 35-acre wastewater disposal pond site. As part of this project, the old fence was removed and a new fence built around the former 3.2-acre TSF-07 disposal pond site. Because cleanup was successful and no ICs are necessary, the fence is no longer required.

The following statement concerning ICs at the TSF-07 site is from an Agency-approved memorandum documenting a minor change to the OU 10-08 ROD (Arenaz 2010):

...the unrestricted land use levels have been reached through excavation for both Cs-137 and mercury. The U.S. Department of Energy, Idaho Department of Environmental Quality, and U.S. Environmental Protection Agency conclude that the discontinuation of Institutional Controls as TSF-07 is consistent with the remedy specified in the OU 10-08 ROD.

Based on the above and the complete record for this site, the Agencies determined the ICs called for in the selected remedy could be discontinued without further implementation under OU 10-08. The Agencies concluded that this action is a minor change and does not significantly or fundamentally change the remedy. The memorandum served to document this minor post-ROD change. The Agencies concluded that the selected remedy for this site is protective of human health and the environment. ICs have been discontinued for this site and 5-year reviews are no longer required.

10.6.2 Technical Assessment

The protectiveness of the remedy is examined below.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. All mercury contamination in the TSF-07 wastewater disposal pond was remediated to less than the final removal goal of 8.4 mg/kg. The site qualifies for unrestricted land use.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?

Yes.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No. No new information has come to light that would call into question the protectiveness of the removal action.

Technical Assessment Summary

The TSF-07 disposal pond removal action is complete. No ICs are needed. These were removed through a memorandum to file (DOE-ID 2010a). Post-cleanup O&M are not required. The remediated site is protective of human health and the environment and has been released for unrestricted land use.

10.6.3 Issues and Recommendations

No issues, recommendations, or follow-up actions were identified for TSF-07.

10.6.4 Protectiveness Statement for Site TSF-07

The remedy at TSF-07 is protective of human health and the environment. The TSF-07 disposal pond removal action is complete and ICs are not required.

10.7 Summary and Conclusions

WAG 10 comprises miscellaneous surface sites and liquid disposal areas throughout the INL Site that are not included within other WAGs (WAGs 1 through 9). WAG 10 also includes regional SRPA concerns related to the INL Site that cannot be addressed on a WAG-specific basis.

One issue was identified for WAG 10 relating to ICs during this 5-year review. Tables 10-9 and 10-10 summarize the issue and associated recommendations.

In accordance with EPA guidance (EPA 2001b) a comprehensive protectiveness statement for WAG 10 is not appropriate because construction is not complete. The OU 10-08 ROD was finalized near the end of this 5-year review period and remedial actions are pending. However, this review found that the individual components assessed in this 5-year review (e.g., OU 10-04 and ICs) currently are protective of human health and the environment. To ensure that ICs are protective in the long term, it is recommended that the IC database, IC/O&M Plan, and methodology for annual reports be revised for consistency to ensure the tracking mechanism for IC sites is accurate.

TSF-07 can be eliminated from further 5-year reviews because it has been remediated and qualifies for unrestricted land use (Arenaz 2010). Other WAG 10 sites can be released from ICs, as determined in the OU 10-08 ROD. This review suggests that several additional WAG 10 sites can be eliminated from further 5-year reviews based on calculated IC termination dates. These sites must be released from ICs in accordance with the process defined in the INL Site-wide IC/O&M Plan through a memorandum of non-significant change to a ROD.

For remediated munitions response sites within the boundary of ORD-03, it is suggested that ICs be maintained and tracked for ORD-03 rather than separately for individual sites. This change would be implemented in the next revision to the INL Site-wide IC/O&M Plan or via a memorandum of non-significant change.

Table 10-9. Issue for Waste Area Group 10.

Issues	Affects Current Protectiveness (Yes/No)	Affects Future Protectiveness (Yes/No)
Multiple inconsistencies among the IC database, IC/O&M Plan, and annual IC reports were noted and appear to be caused by a systematic deficiency in the tracking mechanism. Language concerning ICs differs in each of the individual WAG RODs, as shown in the IC/O&M Plan, further complicating evaluation in the 5-year review.	No	Yes

Table 10-10. Recommendations and follow-up actions for Waste Area Group 10.

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Yes/No)	
					Current	Future
Multiple inconsistencies among the IC database, IC/O&M Plan, and annual IC reports were noted and appear to be caused by a systematic deficiency in the tracking mechanism. Language concerning ICs differs in each of the individual WAG RODs, as shown in the IC/O&M Plan, further complicating evaluation in the 5-year review.	Thoroughly validate the IC database to ensure that it is an accurate tracking mechanism for all sites requiring ICs and revise the IC/O&M Plan accordingly. Establish requirements to annotate annual IC reports and revisions to the IC/O&M Plan sufficient to track a site as its status changes. With Agency concurrence, modify the IC/O&M Plan to standardize wording on ICs for consistency across the INL Site.	DOE	EPA and DEQ	September 2011	No	Yes
IC	institutional control					
INL	Idaho National Laboratory					
O&M	operations and maintenance					
ROD	Record of Decision					
WAG	waste area group					

The remainder of WAG 10 remedial action sites, no-further-action-with-ICs sites, and INL Site-wide groundwater will be addressed in the next 5-year review in accordance with requirements. The next 5-year review is expected to cover the period from 2010 through 2014.

Completed WAG 10 remedial actions have been performed in accordance with the requirements identified in the RODs. Remediation goals were achieved and ICs have been implemented at WAG 10 sites where contamination currently exists and might pose an unacceptable risk to human health or the environment. The use of ICs will preclude the inadvertent exposure of personnel and the public. The remedies completed at WAG 10 are functioning as intended. Physical conditions of the site have not changed in ways that would affect the protectiveness of completed remedies, nor have the toxicity or risk factors changed in ways that would adversely impact the levels of COCs. Remedial actions have not been completed for OU 10-04 Phases I and IV or for OU 10-08 sites CFA-54 or TRA-74. However, those remedies are expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled.

10.8 References

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11. SUMMARY AND CONCLUSIONS

This report presents the 5-year review of response actions at the INL Site implemented under CERCLA (42 USC § 9601 et seq.) and the FFA/CO (DOE-ID 1991). The purpose of this review is to evaluate implementation and performance of remedies at the INL Site to determine if they are—or will be—protective of human health and the environment. This review covers FYs 2005 through 2009, the 5-year period from October 1, 2004, through September 30, 2009. The next 5-year review is planned to evaluate FYs 2010 through 2014.

Publication of the OU 10-08 ROD (DOE-ID 2009a) at the end of FY 2009 marks a particularly significant milestone under the FFA/CO—it is the last planned ROD for the INL Site. All sites have been evaluated, and a process is in place in case new sites are discovered in the future. Comprehensive remedial investigations, feasibility studies, and RODs are complete for every portion of the INL Site, and response actions are either complete or ongoing. Thus, this is the first 5-year review to evaluate cleanup actions at the INL Site that, collectively, represent a complete response.

Nine of 10 WAGs on the INL Site are managed by DOE-ID^a and are analyzed in this report. Remedial actions are complete at WAGs 2, 4, 5, 6, and 9, with continued monitoring, maintenance, and ICs, as required. Remediation is ongoing at WAGs 1, 3, 7, and 10, and ICs are in place in the interim to manage risk. Subsections that follow summarize the review, tabulate issues, and conclude that remedies at the INL Site are—or are expected to be—protective of human health and the environment.

The INL Site is a federal facility managed by DOE. As of FY 2004, DOE consolidated the multiple 5-year reviews (excluding WAG 8) into one INL Site-wide report (DOE-ID 2007a). This report presents the second 5-year review of response actions implemented under CERCLA at the INL Site. Each of nine WAGs was evaluated using approaches developed by EPA (EPA 2001). Subsections that follow summarize the review of each WAG, tabulate progress since the last review, and list sites that qualify for unrestricted land use and can be released from ICs.

11.1 Waste Area Groups

General descriptions of 5-year review requirements follow for each WAG addressed in this 5-year review. In addition, removal actions and ongoing actions under WAG 10 may remain relevant to individual WAGs in future 5-year reviews.

WAG 1 - TAN—Remediation is ongoing, with two OUs subject to 5-year review: OU 1-07B and OU 1-10. The OU 1-07B selected remedy (DOE-ID 1995) addresses aquifer contamination through in situ bioremediation, pump-and-treat technology, monitored natural attenuation, and monitoring. OU 1-10 is the comprehensive remedy for TAN. It focused on remediation of surface sites through removal and disposal, containment, and ICs.

WAG 2 - ATR Complex—Remediation is complete at the ATR Complex. The OU 2-13 ROD (DOE-ID 1992) identified a combination of containment, removal and disposal, monitoring, and ICs to address unacceptable risk. Portions remain subject to 5-year review.

WAG 3 - INTEC—Remediation is ongoing at WAG 3, comprising a complex mixture of interim and final actions under two overlapping OUs, OU 3-13 and 3-14 (DOE-ID 1999, 2007b). The OU 3-13 selected remedy was subdivided into seven groups, two of which were interim actions that subsequently

a. The DOE Pittsburgh Naval Reactors Office Idaho Branch Office manages WAG 8 (Naval Reactors Facility), and the Idaho Operations Office manages everything else at the INL Site.

were addressed under OU 3-14. Together, the two OUs include an integrated selected remedy involving excavation, containment, construction and O&M of the ICDF, monitoring, and ICs.

WAG 4 - CFA—Remediation is complete at CFA. Containment remedies for three landfills and the sewage treatment plant drainfield remain subject to O&M, ICs, and 5-year review.

WAG 5 - ARA, PBF, and CITRC—Remediation is complete at WAG 5. Review focused on groundwater monitoring, a containment decision for a landfill, and IC and O&M requirements.

WAG 6 - BORAX and EBR-I—Remediation is complete at WAG 6. Containment remedies and ICs were examined in this review.

WAG 7 - RWMC—Remediation is ongoing at RWMC, focusing on the Subsurface Disposal Area radioactive waste landfill. Major elements of ongoing remediation include retrieving buried waste, extracting organic vapors from the subsurface, and monitoring the underlying vadose zone and aquifer.

WAG 8 - Naval Reactors Facility—WAG 8 is evaluated separately under the authority of DOE-Idaho Branch Office and is not addressed in this report.

WAG 9 - MFC—Remediation is complete at MFC. This review evaluated containment remedies and ICs.

WAG 10 - INL Site-wide—Remediation is ongoing under OUs 10-04 and 10-08. Review focused on INL Site-wide O&M and ICs, including discarded military munitions areas, soil sites contaminated with munitions constituents, and INL Site-wide ecological monitoring.

11.2 Progress Since the Last Review

Table 11-1 lists issues that were identified in Appendix C of the previous 5-year review (DOE-ID 2007a) or were identified by EPA in their addendum to Appendix C attached to their letter of concurrence (Opalski 2006). The table also lists recommendations associated with each issue and summarizes the subsequent outcome.

Table 11-1. Actions taken at the Idaho National Laboratory Site since the last 5-year review.

Issues from Previous Review ^a	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
WAG 1—Test Area North					
Establish and maintain the vegetative cover on WAG 1 OU 1-10 WRRTF burn pits II and IV.	Revegetation and weed control measures are implemented in accordance with established O&M requirements. Affected areas will be reseeded with appropriate seed mix for the sites.	DOE	November 2009	The area was reseeded in October 2004 (DOE-ID 2008a). Subsequent inspections show revegetation is successful and sufficient (DOE-ID 2006, 2007c). This task is complete.	October 2004
WAG 2—Advanced Test Reactor Complex					
Diesel fuel is present in perched aquifer well PW-13, OU 2-13 (Opalski 2006).	Continue annual monitoring to track concentration of diesel in the perched aquifer and the rate of removal via the petroleum traps.	DOE	Annually until next 5-year review	Annual monitoring and recovery of the diesel fuel in the perched water wells has been performed since the previous 5-year review. Results demonstrate that the floating product thickness has diminished since the petro traps were installed in 2004 (e.g., RPT-651). Monitoring and maintenance requirements and protocol for continuing or discontinuing monitoring and product recovery were incorporated into the FSP and its associated data quality objectives, published March 2007 (DOE-ID 2007d). This task is complete.	March 2007
Establish and maintain desirable vegetation on the native soil covers for the chemical waste pond, the sewage leach pond, and the sewage leach pond soil contamination area (DOE-ID 2007a).	Revegetation and weed control measures are implemented in accordance with established O&M requirements. Affected areas will be reseeded with appropriate seed mix for the sites.	DOE	November 2007	Vegetative growth on the sewage leach pond cover and the chemical waste pond cover has been monitored annually in accordance with O&M requirements (DOE-ID 2010a). Vegetation is becoming established without reseeding. Inspection results are discussed in the annual IC/O&M reports, with the latest published in December 2009 (RPT-672) and in the body of this document.	December 2009

Table 11-1. (continued).

Issues from Previous Review ^a	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
This task is complete.					
WAG 3—Idaho Nuclear Technology and Engineering Center					
The northern perched water zone has persisted following relocation of the percolation ponds in 2002.	The northern perched water zone is being addressed under OU 3-13 Group 4.	DOE	March 2008	Interim actions to reduce perched water were completed under OU 3-13 Group 4, and further steps to reduce perched water were identified in the OU 3-14 ROD (DOE-ID 2007b). Implementation under OU 3-14 began in June 2008 under an RD/RA Work Plan (DOE-ID 2008b).	June 2008
This task is complete.					
Tc-99 is present in the SRPA two times its derived MCL. Observed concentrations are higher than predicted.	This is being assessed in the OU 3-14 RI/FS. The draft OU 3-14 ROD, scheduled for submittal in December 2006, will contain groundwater monitoring and modeling results and will specify the proposed groundwater remedy.	DOE	June 2006 release draft proposed plan	The OU 3-14 RI/BRA was published in April 2006 (DOE-ID 2006a). Modeling results indicated that peak Tc-99 concentrations had most likely already occurred before 2005 and that Tc-99 levels would decline below the MCL (900 pCi/L) well before 2095. Groundwater monitoring results since 2005 are consistent with the modeling and have shown nearly a 50% decline in the maximum Tc-99 concentration over the past 4 years (DOE-ID 2010a).	April 2006
This task is complete.					
WAG 4—Central Facilities Area					
VOCs are present in perched aquifers (per EPA [Opalski 2006]).	Continue annual monitoring to determine if concentrations of VOCs reflect variability in concentration or a migrating front.	DOE	Annually until next 5-year review	Soil vapor samples were collected annually and compared to trigger values. Soil gas concentrations have consistently been less than the trigger values, and VOCs have not been detected in groundwater. Therefore, additional actions to mitigate vapor contaminants into groundwater are not necessary, as concluded in RPT-645 in July 2009. Monitoring continues in	July 2009

Table 11-1. (continued).

Issues from Previous Review ^a	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
				accordance with requirements (DOE-ID 2009b). This task is complete.	
Nitrate concentration in the SRPA exceeds the MCL (per EPA [Opalski 2006]).	The source of nitrates is known. Continue monitoring to determine if concentrations of nitrates (as nitrogen) will decline to less than the MCL by 2095.	DOE	Annually until next 5-year review	Annual monitoring yielded nitrate concentrations ranging from 15.3 to 18.2 mg/L-N in CFA-MON-A-002 and from 8.3 to 24 mg/L-N in CFA-MON-A-003. No distinct temporal trend is evident (RPT-645). Monitoring and reporting continue in accordance with requirements (DOE-ID 2009b). Monitoring continues. See Table 11-4.	Annually since the last 5-year review
Subsidence was identified at the CFA Landfill III that compromised the integrity of the cover, creating the potential to allow surface water to contact the waste and potentially carry contaminants into the SRPA (DOE-ID 2007a).	The area of subsidence will be filled and repaired in accordance with established O&M requirements for the CFA landfills.	DOE	November 2006	The area of subsidence was repaired in 2004 and again in July 2008 (RPT-544). Topographic surveys were performed annually, following the repairs, in accordance with the O&M Plan (DOE-ID 2010a). This task is complete.	July 2008
WAG 7—Radioactive Waste Management Complex					
OCVZ (VVET) is operating with PRGs that were updated in 2005. These PRGs are a range of carbon tetrachloride concentrations that span Regions A and B, Zones 1–3 in the vadose zone. The PRGs are documented in the <i>Data Quality Objectives Summary Report for Operable Unit 7-08 Post-Record of Decision Sampling</i> (INEEL 2005).	OCVZ is being evaluated in the context of the entire SDA in the OU 7-13/14 RI/FS.	DOE	April 2008	The Comprehensive ROD for OU 7-13/14 (DOE-ID 2008c) superseded the OCVZ ROD for OU 7-08 (DOE-ID 1994). The OU 7-13/14 ROD identifies remediation goals for OCVZ. The Work Plan for Phase 1 of the OU 7-13/14 selected remedy (DOE-ID 2010b) defers shutdown strategies for OCVZ until Phase 3. This task is complete.	September 2008 August 2009

Table 11-1. (continued).

Issues from Previous Review ^a	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
As active extraction continues, the measured subsurface carbon tetrachloride concentrations need to be compared to the PRGs to determine the effectiveness of the extraction operation. If subsurface concentrations are approaching the PRGs, a decision to shut down the operation for rebound needs to be made. The PRGs need to be assessed to determine whether adjustments are needed, and these remediation goals should be referred to as final remediation goals.					
The volume of retrieved waste that will require treatment to meet waste acceptance criteria for the WIPP is unknown, resulting in complications in preparing the cost estimates for Stage III operations and in determining compliance approaches for ARARs for OU 7-10 (Pit 9).	This issue is internal to ICP and does not impact the protectiveness of the remedy. Standard estimating practices will be followed to develop a cost estimate for the Stage III operations.	DOE	Not applicable	This topic should not have been identified as an issue in the previous 5-year review because it does not affect current or future protectiveness. The Comprehensive ROD for WAG 7, OU 7-13/14 (DOE-ID 2008c) superseded the OU 7-10 ROD (DOE-ID 1993), eliminating Stage III and selecting an alternate approach for retrieval. This issue is eliminated from further consideration.	September 2008
RAOs, ARARs, and the treatment train identified in the OU 7-10 ROD need to be updated.	This issue will be discussed between the Agencies and the ICP contractor.	DOE	November 2008	The Comprehensive ROD for OU 7-13/14 superseded the OU 7-10 ROD and established RAOs, ARARs, and treatment strategies for waste retrieved from the SDA. This task is complete.	September 2008

Table 11-1. (continued).

Issues from Previous Review ^a	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Nitrate concentration in vadose zone is trending upward at Pad A (per EPA [Opalski 2006]).	Evaluation of this trend will be performed as part of the Site-wide RI/FS.	DOE	2009	The OU 10-08 RI/BRA (Cahn et al. 2008) evaluated nitrate in the aquifer. See Section 10.4.4. This task is complete.	April 2008
Nitrates continue to be detected in the vadose zone. The significance of these detections should be evaluated.	The significance of the detections is being evaluated in the context of the entire SDA in the OU 7-13/14 RI/FS.	DOE	November 2008	The OU 7-13/14 RI/BRA (Holdren et al. 2006) evaluated the significance of nitrate detections and considered all sources of nitrate in the SDA, including Pad A. Nitrate is widespread in the subsurface at RWMC. Nitrate was identified as a COC and is being addressed by the OU 7-13/14 selected remedy. This task is complete.	September 2008
WAG 9—Materials and Fuels Complex					
The sanitary lagoon site (ANL-04) was administratively transferred to OU 10-08 to facilitate closure of WAG 9 and allow for the completion of the WAG 9 Remedial Action Report.	The sanitary lagoon site (ANL-04) was transferred from WAG 9 to WAG 10 OU 10-08 in 2005. This transition will be documented in the OU 10-08 ROD.	DOE	July 2009	The OU 10-08 ROD (DOE-ID 2009a) documented the administrative transfer. This task is complete.	July 2009
WAG 10-INL Site-wide					
Applies to WAG 5 and other INL sites. The EPA guidance for the free-release concentration of Cs-137 has been revised to account for the soil shielding factor included in the latest risk models. As a result, ICs at the ARA-03, PBF-22, and PBF-26 sites could be discontinued based on the new EPA guidance.	DOE, with the concurrence from the EPA and the State of Idaho DEQ, will evaluate how to best address the impact of the new guidelines on IC sites and will determine whether ICs should be discontinued at ARA-03, PBF-22, and PBF-26.	DOE	2009	IC sites where Cs-137 was the COC were reevaluated in this 5-year review. New IC termination dates were estimated. Results are reported by WAG in the body of this report. This task is complete.	January 2011

Table 11-1. (continued).

Issues from Previous Review ^a	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Nitrate concentration in vadose zone is trending upward at Pad A (per EPA [Opalski 2006]).	See WAG 7.	See WAG 7.	See WAG 7.	See WAG 7.	See WAG 7.
The sanitary lagoon site (ANL-04) was administratively transferred to OU 10-08 to facilitate closure of WAG 9 and allow for the completion of the WAG 9 Remedial Action Report.	See WAG 9.	See WAG 9.	See WAG 9.	See WAG 9.	See WAG 9.

a. Issues were identified either in Appendix C of the previous 5-year review (DOE-ID 2007a) or in the addendum to Appendix C enclosed with EPA's letter of concurrence with the previous 5-year review (Opalski 2006).

ARAR	applicable or relevant and appropriate requirement	ICP	Idaho Cleanup Project	ROD	Record of Decision
BRA	baseline risk assessment	INL	Idaho National Laboratory	RWMC	Radioactive Waste Management Complex
CFA	Central Facilities Area	MCL	maximum contaminant level	SDA	Subsurface Disposal Area
COC	contaminant of concern	O&M	operation and maintenance	SRPA	Snake River Plain Aquifer
DEQ	Department of Environmental Quality (Idaho)	OCVZ	organic contamination in the vadose zone	VOC	volatile organic compound
DOE	Department of Energy	OU	operable unit	VVET	vapor vacuum extraction and treatment
EPA	Environmental Protection Agency	PRG	preliminary remediation goal	WAG	waste area group
FS	feasibility study	RAO	remedial action objective	WIPP	Waste Isolation Pilot Plant
FSP	field sampling plan	RI	remedial investigation	WRRTF	Water Reactor Research Test Facility
IC	institutional control				

11.3 Institutional Control Sites

This 5-year review included a thorough examination of IC sites to estimate IC termination dates. Table 11-2 lists those sites currently maintained under ICs that now qualify for unrestricted land use, suggesting that ICs can be terminated at these sites through a memorandum of nonsignificant change to a ROD in accordance with the process defined in the INL Site-wide IC/O&M Plan (DOE-ID 2010a).

Table 11-2. Sites requiring a memorandum for release from institutional controls.

Waste Area Group	Site Code	Site Description
WAG 1	TSF-06 Area 5	Radioactive soil berm
WAG 1	TSF-06 Area 11	Ditch
WAG 1	TSF-10	TSF drainage pond (TAN-782)
WAG 1	TSF-42	TAN-607-A Room 161 contaminated pipe
WAG 2	TRA-08	Cold Waste Disposal Pond (TRA-702) north pond
WAG 2	TRA-34	North Storage Area
WAG 2	TRA-C	PCB spill at TRA-619
WAG 2	TRA-E	PCB spill at TRA-653
WAG 2	TRA-X	Hot tree site
WAG 3	CPP-14	Sewage treatment plant south of CPP-664
WAG 3	CPP-23	CPP injection well MAH
WAG 3	CPP-37a	Gravel pit outside INTEC fence
WAG 3	CPP-67	Former percolation ponds
WAG 3	CPP-90	CPP-709 ruthenium detection
WAG 3	CPP-97	Tank farm soil stockpiles
WAG 3	CPP-130	Buried debris within Site CPP-03
WAG 5	ARA-03	ARA-I lead sheeting pad near ARA-627
WAG 5	PBF-10	PBF Reactor Area evaporation pond PBF-733
WAG 5	PBF-12	SPERT I leach pond
WAG 5	PBF-21	SPERT III large leach pond
WAG 5	PBF-22	SPERT IV leach pond PBF-758
WAG 5	PBF-26	SPERT IV lake adjacent to PBF-758
WAG 6	BORAX-08	BORAX ditch
BORAX	Boiling Water Reactor Experiment	
CPP	Chemical Processing Plant	
INTEC	Idaho Nuclear Technology and Engineering Center	
PBF	Power Burst Facility	
PCB	polychlorinated biphenyl	
SPERT	Special Power Excursion Reactor Test	
TSF	Technical Support Facility	
WAG	waste area group	

11.4 Issues and Recommendations

Recommendations produced during this 5-year review relate to issues identified in technical assessments based on a potential to affect protectiveness. Table 11-3 lists issues identified in this review; Table 11-4 provides recommendations and suggested implementation schedules.

Table 11-3. Issues identified in this 5-year review for the Idaho National Laboratory Site.

Issues		Affects Current Protectiveness (Yes/No)	Affects Future Protectiveness (Yes/No)
WAG 1—Test Area North			
TCE concentrations have not decreased as expected at aquifer monitoring well TAN-28 downgradient of the hot spot.		No	Yes
Cs-137 concentrations have been increasing at the hot spot and Sr-90 concentrations remain high in the hot spot and several locations in the medial zone.		No	Yes
The monitoring strategy may not be adequate for evaluating plume expansion.		No	Yes
Available information is not sufficient to estimate an end date for ICs at Site TSF-28.		No	Yes
Available information is not sufficient to estimate an end date for ICs at Site TSF-43.		No	Yes
WAG 4—Central Facilities Area			
Nitrate concentrations in the aquifer continue to exceed the maximum contaminant level at two downgradient monitoring wells.		No	Yes
WAG 9—Materials and Fuels Complex			
The new site identification process for two sites, ANL-64 and ANL-65, was initiated and left incomplete. Therefore, these sites were not added to the IC database or addressed in the IC/O&M Plan or annual reports.		No	Yes
WAG 10—Site-wide			
Multiple inconsistencies among the IC database, IC/O&M Plan, and annual IC reports were noted and appear to be caused by a systematic deficiency in the tracking mechanism. Language concerning ICs differs in each of the individual WAG RODs, as shown in the IC/O&M Plan, further complicating evaluation in the 5-year review.		No	Yes
IC	institutional control	TCE	trichloroethene
O&M	operation and maintenance	WAG	waste area group
ROD	Record of Decision		

Table 11-4. Recommendations and follow-up actions for issues identified in this 5-year review for the Idaho National Laboratory Site.

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Yes/No)	
					Current	Future
WAG 1—Test Area North						
TCE concentrations have not decreased as expected at aquifer monitoring well TAN-28 downgradient of the hot spot.	Prepare a test plan to address the TCE concentration issue at Well TAN-28 via a rebound test and vadose zone vapor monitoring.	DOE	EPA and DEQ	Submit a draft test plan in FY 2011	No	Yes
Cs-137 concentrations have been increasing at the hot spot, and Sr-90 concentrations remain high in the hot spot and several locations in the medial zone.	Prepare a test plan to address radionuclide concentrations in the hot spot via a rebound test.	DOE	EPA and DEQ	Submit a draft test plan in FY 2011	No	Yes
The monitoring strategy may not be adequate for evaluating plume expansion.	Prepare a test plan to increase monitoring frequency to yearly rather than once every 3 years at Wells TAN-57 and GIN-4. If TCE concentrations at either well or TAN-56 exceed 10 µg/L, install a downgradient monitoring well.	DOE	EPA and DEQ	Submit a draft test plan in FY 2011	No	Yes
Available information is not sufficient to estimate an end date for ICs at Site TSF-28.	Sample TSF-28 to obtain data for estimating an end date for ICs.	DOE	EPA and DEQ	Before the next 5-year review	No	Yes
Available information is not sufficient to estimate an end date for ICs at Site TSF-43.	Sample TSF-43 to obtain data for estimating an end date for ICs.	DOE	EPA and DEQ	Before the next 5-year review	No	Yes
WAG 4—Central Facilities Area						
Nitrate concentrations in the aquifer continue to exceed the maximum contaminant level at two downgradient monitoring wells.	Continue to monitor and assess nitrate trends annually. If concentration trends do not begin to decline over the next 5-year review period, the Agencies will consider additional steps to re-evaluate the persistence of nitrate in the aquifer. The additional steps may include evaluation of	DOE	EPA and DEQ	Annually until the next 5-year review	No	Yes

Table 11-4. (continued).

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Yes/No)	
					Current	Future
	additional nitrate sources and evaluation of the release mechanism of the original source(s) in order to implement an applicable remedy to meet the remedial action objective.					
WAG 9—Materials and Fuels Complex						
The new site identification process for two sites, ANL-64 and ANL-65, was initiated and left incomplete. Therefore, these sites were not added to the IC database or addressed in the IC/O&M Plan or annual reports.	Finish processing the new site identification form and identify responses in accordance with the process established in the OU 10-08 ROD.	DOE	EPA and DEQ	September 2011	No	Yes
Waste Area Group 10—Site-wide						
Multiple inconsistencies among the IC database, IC/O&M Plan, and annual IC reports were noted and appear to be caused by a systematic deficiency in the tracking mechanism. Language concerning ICs differs in each of the individual WAG RODs, as shown in the IC/O&M Plan, further complicating evaluation in the 5-year review.	Thoroughly validate the IC database to ensure that it is an accurate tracking mechanism for all sites requiring ICs and revise the IC/O&M Plan accordingly. Establish requirements to annotate annual IC reports and revisions to the IC/O&M Plan sufficient to track a site as its status changes. With Agency concurrence, modify the IC/O&M Plan to standardize wording on ICs for consistency across the INL Site.	DOE	EPA and DEQ	September 2011	No	Yes
CFA	Central Facilities Area	IC	institutional control	ROD	Record of Decision	
DEQ	Department of Environmental Quality (Idaho)	INL	Idaho National Laboratory	TCE	trichloroethene	
DOE	Department of Energy	MCL	maximum contaminant level	WAG	waste area group	
EPA	Environmental Protection Agency	O&M	operation and maintenance			
FY	fiscal year	OU	operable unit			

11.5 Protectiveness Statements

Completed remedies at the INL Site are protective of human health and the environment. Ongoing remedies are expected to be protective of human health and the environment upon completion, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled. Remedies comply with decision documents and are functioning as intended. O&M occur in accordance with requirements, and ICs are in place and effective. The following subsections repeat the individual protectiveness statements for each major component of the remedial response at the INL Site.

11.5.1 Waste Area Group 1 Protectiveness Statements

The remedy at OU 1-07B is currently protective of human health and the environment. Follow-up actions documented in this review to address WAG 1 issues will ensure the remedy remains protective for the long term. An in situ bioremediation rebound test, vadose zone vapor monitoring at the hot spot, and increased monitoring at distal zone wells will provide additional information on whether the in situ bioremediation remedy is functioning as intended and whether the monitored natural attenuation remedy will be protective in 2095. These additional activities will occur before the next 5-year review. In the meantime, groundwater remediation will continue and ICs are in place to control exposure pathways that could result in unacceptable risks. The three components of the remedy have been implemented in accordance with the schedules stated in the appropriate remedial action work plans and are making progress toward achieving RAOs.

The remedy at OU 1-10 is protective of human health and the environment. Responses are complete in accordance with the OU 1-10 ROD and action memoranda. Those sites that do not qualify for unrestricted land use are managed appropriately under the INL Site-wide IC/O&M Plan.

11.5.2 Waste Area Group 2 Protectiveness Statement

Because the remedial actions at all OUs in WAG 2 are protective, the site is protective of human health and the environment. Ongoing inspections and perched water and groundwater monitoring indicate that the OU 2-13 remedies are functioning as intended in the decision documents, and the overall remedy remains protective of human health and the environment.

11.5.3 Waste Area Group 3 Protectiveness Statements

The remedy at OU 3-13 Group 1 is expected to be protective of human health and the environment upon completion of the OU 3-14 response. All of the OU 3-13, Group 1 interim remedial actions have been completed.

The remedy at OU 3-13 Group 2 is expected to be protective of human health and the environment upon completion, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled. Group 2 sites compose a deferred action that consists of implementing ICs and soil excavation and capping. The remedy associated with these sites is functioning as intended in the decision document.

The remedy at OU 3-13 Group 3 Phase I (Sets 1, 2, and 3) is protective of human health and the environment. These remedial actions have been completed. The Group 3 Phase I Remedial Action Report has been approved. No changes in the physical conditions of these sites have occurred that would affect the protectiveness of the remedy.

The remedy at OU 3-13 Group 3 (Phases I and II) is protective of human health and the environment. The remedial actions for Group 3 have been completed. The Group 3 Phase I and Phase II

Remedial Action Reports have been approved. No changes in the physical conditions of these sites have occurred that would affect the protectiveness of the remedy.

OU 3-13 Group 4 was closed out by the Group 4 Remedial Action Report. See the Protectiveness Statement in Section 4.8.8 of this report.

OU 3-13 Group 5 was closed out by the Group 5 Remedial Action Report. See the Protectiveness Statement in Section 4.9.8 of this report.

The remedy at OU 3-13 Group 6 is protective of human health and the environment. The remedial actions for Group 6 have been completed. No changes in the physical conditions of these sites have occurred that would affect the protectiveness of the remedy.

The remedy at OU 3-13 Group 7 is protective of human health and the environment. The remedial actions for Group 7 have been completed. No changes in the physical conditions of these sites have occurred that would affect the protectiveness of the remedy.

The remedy at OU 3-14 is expected to be protective of human health and the environment upon completion, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled. OU 3-14 remedial actions are being implemented according to the established schedule. Although OU 3-14 remedial actions are only partially complete at this time, the actions to date are functioning as intended in the decision document, and monitoring results indicate that the OU 3-14 remedy will be protective.

The remedy at ICDF is expected to be protective of human health and the environment upon completion, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled. ICDF has been in operation since September 16, 2003, providing a cost-effective treatment and disposal unit for CERCLA cleanup at the INL Site in accordance with the requirements set forth in the OU 3-13 ROD. Compliance with the requirements set forth in the ICDF Complex RD/RA Work Plan and various ICDF waste acceptance criteria ensures protection of human health and the environment, including the SRPA.

Based on the removal of contaminated buildings and structures as NTCRA and implementation of ICs, as necessary, in accordance with the selected remedy for WAG 3 sites in CPP-88 for the OU 3-13 ROD or in the industrial-use area and the recharge control zone for the OU 3-14 ROD, the selected remedy with respect to the NTCRA sites remains protective of human health and the environment.

11.5.4 Waste Area Group 4 Protectiveness Statement

The remedy at OU 4-13 is expected to be protective of human health and the environment, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled. Based on the review of monitoring data and site inspection reports, the remedies are functioning as intended by the OU 4-13 ROD. Previously declining groundwater levels are noted; however, the monitoring network continues to be adequate for assessing the protectiveness of remedies at WAG 4. Nitrate in two downgradient wells continue to exceed the MCL, but the surface soil at the source of contamination was removed in 2003, and groundwater concentrations are expected to respond favorably.

11.5.5 Waste Area Group 5 Protectiveness Statement

The remedy at OU 5-12 is protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled. Remediation has been completed at all WAG 5 sites, and remedies are functioning as intended.

11.5.6 Waste Area Group 6 Protectiveness Statement

Because the remedial actions at all OUs in WAG 6 are protective, the site is protective of human health and the environment. Those sites with containment remedies or that require ICs are maintained and managed in accordance with the INL Site-wide IC/O&M Plan.

11.5.7 Waste Area Group 7 Protectiveness Statement

The remedy at OU 7-13/14 is expected to be protective of human health and the environment upon completion, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled.

The comprehensive selected remedy is ongoing at RWMC. Individually and collectively, all elements of the remedial action (e.g., targeted waste retrieval, OCVZ, and land-use controls) currently protect human health and the environment and are functioning as intended in the OU 7-13/14 ROD. Ongoing maintenance and ICs preclude prolonged direct contact with contamination. Current operational and monitoring data indicate that the remedy is functioning as required to achieve cleanup goals. Upon completion, the OU 7-13/14 remedy is expected to be protective of human health and the environment. In the interim, exposure pathways that could result in unacceptable risk are being controlled, and monitoring of the vadose zone and aquifer will continue for the foreseeable future.

Following completion of Phases 1 and 2, an evapotranspiration surface barrier will be designed and constructed over the entire Subsurface Disposal Area under Phase 3. Phase 3 also will include tasks that prepare for transitioning the site to long-term management and control after the cap is constructed and the remedy is declared operational and functional. The long-term effectiveness of the remedy will be verified by monitoring and will be assessed in future 5-year reviews.

11.5.8 Waste Area Group 9 Protectiveness Statement

The remedy at OU 9-04 is protective of human health and the environment. Remediation goals were achieved and ICs are in place. Remedies are functioning as intended by decision documents.

11.5.9 Waste Area Group 10 Protectiveness Statements

The remedy at OU 10-04 is expected to be protective of human health and the environment upon completion, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled.

The INL Site-wide IC remedy under OU 10-04 currently protects human health and the environment because INL Site-wide access restrictions are enforced that protect human health and the environment in the short term. However, for the remedy to be protective in the long term, the IC database, annual IC reports, and IC/O&M plan should be modified to achieve and maintain consistency.

The remedy at TSF-07 is protective of human health and the environment. The TSF-07 disposal pond removal action is complete and ICs are not required.

11.6 Next Review

The INL Site remains subject to statutory 5-year reviews to ensure that containment remedies remain effective and that ongoing remedies are completed in accordance with requirements. The next INL Site-wide 5-year review will cover FYs 2010 through 2014 and is scheduled for completion by 2015.

11.7 References

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RPT-651, 2009, *Annual Groundwater Monitoring Status Report for Waste Area Group 2 for Fiscal Year 2009*, Rev. 1, Idaho Cleanup Project, October 2009.

RPT-672, 2009, *INL Sitewide Institutional Controls and Operations and Maintenance Annual Report – FY 2009*, Rev. 1, Idaho Cleanup Project, December 2009.

Appendix A

Waste Area Group 1—Test Area North Supporting Analysis

Appendix A

Waste Area Group 1—Test Area North Supporting Analysis

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ACRONYMS

ANPP	Aircraft Nuclear Propulsion Program
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
cpm	counts per minute
D&D	decontamination and decommissioning
DOE	Department of Energy
EPA	Environmental Protection Agency
FSP	field sampling plan
HTRE	Heat Transfer Reactor Experiment
IC	institutional control
IET	Initial Engine Test
INL	Idaho National Laboratory
NTCRA	non-time-critical removal action
OU	operable unit
PRG	preliminary remediation goal
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
RPSSA	Radioactive Parts Security Storage Area
RWMC	Radioactive Waste Management Complex
SVOC	semivolatile organic compound
TAN	Test Area North
TSF	Technical Support Facility
UCL	upper confidence limit
VOC	volatile organic compound

Waste Area Group 1—Test Area North Supporting Analysis

A-1. INTRODUCTION

The risk assessment performed in the Comprehensive Remedial Investigation/Feasibility Study (RI/FS) for Operable Unit (OU) 1-10 (DOE-ID 1997) compared concentrations to slope factors provided in the U.S. Environmental Protection Agency (EPA) *Health Effects Assessment Summary Tables (HEAST)* (EPA 1994) and used preliminary remediation goal (PRGs) developed for use at the Idaho National Laboratory (INL) Site (Fromm 1996). Since that time, EPA has provided updated slope factors and PRGs for radionuclides on the EPA website (<http://epa-prgs.ornl.gov/radionuclides/>) (EPA 2010a). These changes were discussed in Appendix A of the last 5-year review (DOE-ID 2007), but, because they remained protective, the new values were not incorporated into any site-specific evaluation. Though radionuclides are commonly the only contaminant of concern (COC) at Test Area North (TAN) sites, other changes have been made in the values used in risk assessment. These changes are addressed in this reevaluation.

The first group of sites addressed includes those sites associated with the TAN-607 non-time-critical removal action (NTCRA). The group of sites with institutional control (IC) termination dates impacted by these changes includes sites remediated under the OU 1-10 Record of Decision (ROD) (DOE-ID 1999) (TSF-06, Area B, TSF-26, and TAN-607 NTCRA area including TSF-09/18, TSF-46, TSF-47, TSF-48, and TSF-53). The second group of sites addressed in this appendix are those no further action IC sites impacted by changes to toxicity and other risk values. These sites include IET-04, TSF-06 Area 1, TSF-06 Area 5, TSF-06 Area 10, TSF-06 Area 11, TSF-10, TSF-28, TSF-29, and TSF-43.

A-2. SITES ASSOCIATED WITH THE TAN-607 NON-TIME-CRITICAL REMOVAL ACTION

The group of sites associated with the TAN-607 NTCRA includes TSF-06, Area B, TSF-26, TAN-607 NTCRA area including TSF-09/18, TSF-46, TSF-47, TSF-48, and TSF-53. Information about ICs for these sites after remediation for Cs-137 is presented in Tables 7-11 and 7-12 of the Remedial Action Report for OU 1-10 Sites at Test Area North (DOE-ID 2008a). The sites remediated under the OU 1-10 ROD requiring the continuation of ICs are shown in Table A-1. As noted earlier, the final soil removal of the V-Tanks area excavation was performed under the TAN-607 NTCRA. The ICs for the TAN-607 area encompass several sites; ICs are implemented for these sites as a single group rather than by individual sites.

Table A-1. Summary of institutional controls for remediation sites and NTCRA.

Site	Scenario	Contaminant Remaining	Measurement Date	Date Decayed to Less Than 2.3 pCi/g	Date Decayed to Less Than 6 pCi/g
TAN-607/607A NTCRA ^a	0–10 ft	5.05 pCi/g Cs-137	2007	2039	2007
area including TSF-09/18, TSF-46, TSF-47, TSF-48, and TSF-53	>10 ft	20.42 pCi/g Cs-137	2007	2102	2061
TAN-623/711 NTCRA area including TSF-28		Cs-137	NA	NA	Unknown
TAN-650 ^b	>10 ft	8.3 pCi/g Cs-137	2005	2061	2019
TSF-06 Area B	0–10 ft	7.14 pCi/g Cs-137	2005	2054	2013
TSF-26 soils	0–10 ft	7.88 pCi/g Cs-137	2004	2058	2016
WRRTF-01	0–10 ft	Asbestos ^c	2004	NA	NA

a. Tank V-4 and its contents were removed and sent off-Site for treatment and disposal. The location of TSF-19 was within the TSF-46 site and the general V-Tanks area excavation and, as such, the residual soil is addressed as part of that site. The OU 1-10 Remedial Action Report (DOE-ID 2008a) assigned the completion of the soil remediation for the sites listed to the TAN-607 NTCRA.

b. TAN-650 is included in the table for purposes of completeness. TAN-650 was subject to a NTCRA that achieved the Cs-137 remediation goal; however, ICs are required because residual concentrations preclude unrestricted use and unlimited access. This concentration was taken from Table 3 of the LOFT EE/CA (DOE-ID 2006).

c. A date for removal of ICs at WRRTF-01 cannot be estimated because asbestos is present at this site. EPA has a new “Framework for Investigating Asbestos-Contaminated Superfund Sites” (EPA 2008); however, the sampling at this site is not appropriate to EPA (2008), and the new guidance has no impact on the WRRTF-01 site.

EE/CA engineering evaluation/cost analysis
EPA Environmental Protection Agency
FRG final remediation goal
LOFT Loss of Fluid Test (facility)
NA not applicable
NTCRA non-time-critical removal action
OU operable unit

A-2.1 TAN-650

The ROD for TAN OU 1-10 (DOE-ID 1999) established the remedial action objective to reduce risk from external radiation exposure from Cs-137 to a total excess cancer risk of less than 1 in 10,000 for a hypothetical resident 100 years in the future from the year 1995. The *Final Removal Action Report for the LOFT Facility* (DOE-ID 2008b) documents the completion of the NTCRA, stating that the OU 1-10 remedial action objective will be met by 2095. The Engineering Evaluation/Cost Analysis for Decommissioning of TAN-630 and TAN-650 at Loss of Fluid Test Facility (DOE-ID 2006) identified approximately 0.155 Ci of radionuclides that would be left within the facility upon completion of demolition based upon the radionuclide inventory estimated to be present in 2005. Most of this contamination was expected to be present in piping systems between 4.6 and 9.1 m (15 and 30 ft) bgs. Approximately 87% of these radionuclides were Cs-137, 9% Co-60, and 3.76% Sr-90. All of the other radionuclides totaled approximately 0.24%. The streamlined risk assessment included in the Loss of Fluid Test Facility Engineering Evaluation/Cost Analysis (DOE-ID 2006) estimated that approximately 1.07 pCi/g of Cs-137 would remain in 2095, which would allow unrestricted land use. Using these same values, the Cs-137 concentration in 2005 at the time of the risk assessment would have been 8.3 pCi/g

Cs-137. Cs-137 remaining would decay to the level (2.3 pCi/g Cs-137) established in the OU 1-10 ROD as being equivalent to the 1E-04 level in 56 years. Under the OU 1-10 ROD, ICs could be removed from this site in 2061. The change of the remediation goal to 6 pCi/g Cs-137 suggests ICs can be removed in 2019. ICs are implemented in the INL Site-wide Institutional Control and Operations and Maintenance (IC/O&M) Plan (DOE-ID 2010).

A-3. IET-04—INITIAL ENGINE TEST STACK RUBBLE SITE

The Initial Engine Test (IET) stack rubble site (IET-04) contains buried rubble from the IET exhaust stack (part of TAN-712) and monitoring vault (TAN-713) that were demolished in 1986. See Figures A-1 through A-5. The IET exhaust stack and adjacent monitoring vault were built in the 1950s for the Aircraft Nuclear Propulsion Program (ANPP). In support of the ANPP, the Heat Transfer Reactor Experiments (HTREs) were conducted at the IET Facility from 1956 to 1961. This program involved testing nuclear-driven turbojet engines and exhausting them through a long stainless steel duct and up the brick-lined concrete exhaust stack. No filtering media were used for the exhaust effluents other than an electrostatic precipitator. The stack was made of concrete, with firebrick lining, and was 45.7 m (150 ft) high, 9.1 m (30 ft) in diameter at the base, and tapering to 4.6 m (15 ft) in diameter at the top. The exhaust duct was also considered part of TAN-712, but was removed (including the portion of the stainless steel duct inside the stack) and shipped to the Radioactive Waste Management Complex (RWMC) for disposal. The monitoring vault was a concrete slab with an aboveground staircase leading to an underground concrete room, approximately 3.7×3.7 m (12×20 ft), located north of the stack (see Figures A-1 and A-2).

A-3.1 Characterization

Radiological characterization of the IET Facility conducted in 1982 involved direct radiation and smear surveys of all buildings, structures, equipment, and systems. All systems, tanks, structures, and equipment known or found to be contaminated were sampled, and the samples were analyzed to identify radionuclides and to determine relative concentrations and distribution. This characterization is documented in two reports: *Radiological Characterization of the TAN-IET Facility* (Koeppen et al. 1982) and *IET Facility Radiological Characterization* (Smith and Koeppen 1982). Both reports present the same information concerning contaminant levels found in the stack and the monitoring vault during the 1982 sampling event. Note that these reports included a table presenting data analyzed by Exxon (i.e., Table 1 in Koeppen et al. [1982] and Table 4-6 in Smith and Koeppen [1982]) (see Figure AA-1 in Appendix AA). This table documents sampling that appears to be from the stack bottom but is not discussed in the text. The text contains no information about the date of collection or analysis concerning these data. However, the concentrations presented appear to be similar to those results from the 1982 sampling.

Smears taken during the 1982 characterization, from the outside of the stack, did not indicate contamination at levels of concern. The external stack readings were less than 200 dpm/100 cm² for beta-gamma and less than 20 dpm/100 cm² for alpha (see Table 13 of Koeppen et al. [1982]).

During the 1982 characterization, an access cover at the base of the exhaust stack was removed to allow entrance into the interior of the stack for surveys and sample collection. The entire bottom of the exhaust stack was covered with 5–8 cm (2–3 in.) of a black, moist, granular substance. A direct radiation survey with a Geiger-Mueller monitor inside the stack revealed a general area field of 3 mR/hour, at waist level, over the entire floor. Samples collected from the substance at the bottom contained measureable amounts of Co-60 (up to 113 pCi/g), Sr-90 (up to 1,610 pCi/g), Cs-137 (up to 7,490 pCi/g), and U-235 (up to 39.8 pCi/g), as shown in Table A-2.

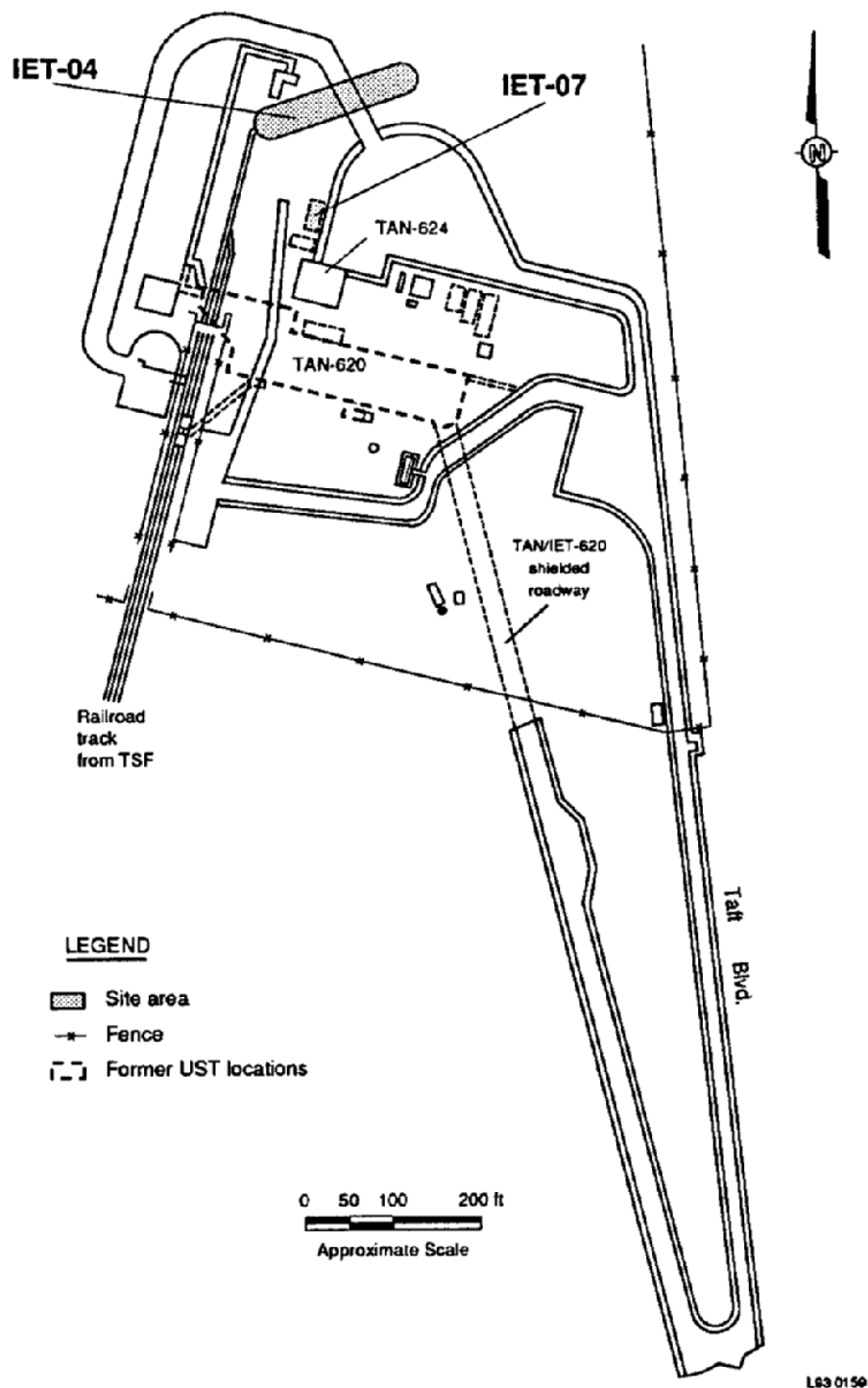


Figure A-1. Location map of the Initial Engine Test area at Test Area North (Stoll 1987).

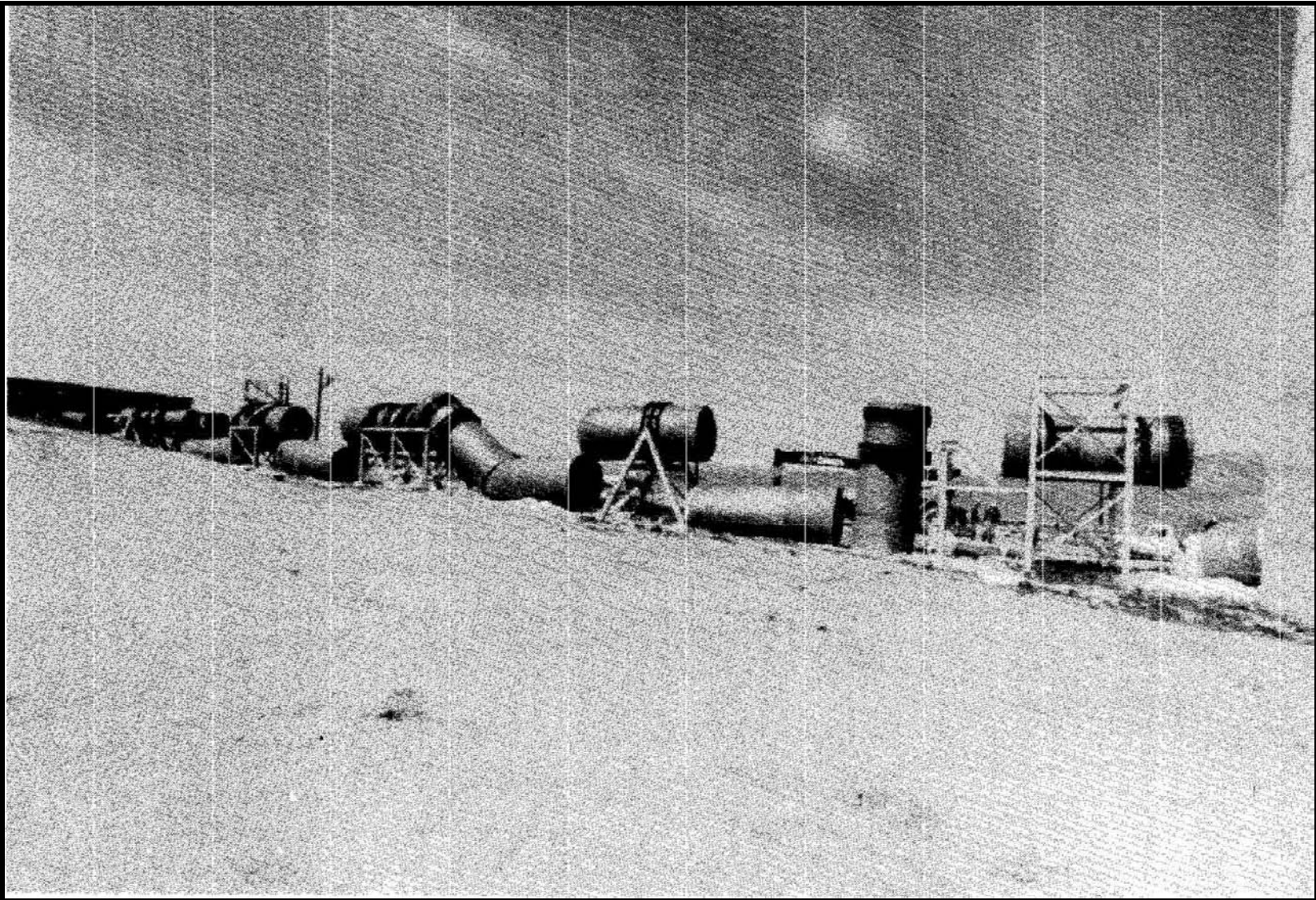


Figure A-2. Exhaust duct sections (Figure 7 from the Deactivation and Decommissioning Report [Stoll 1987]).

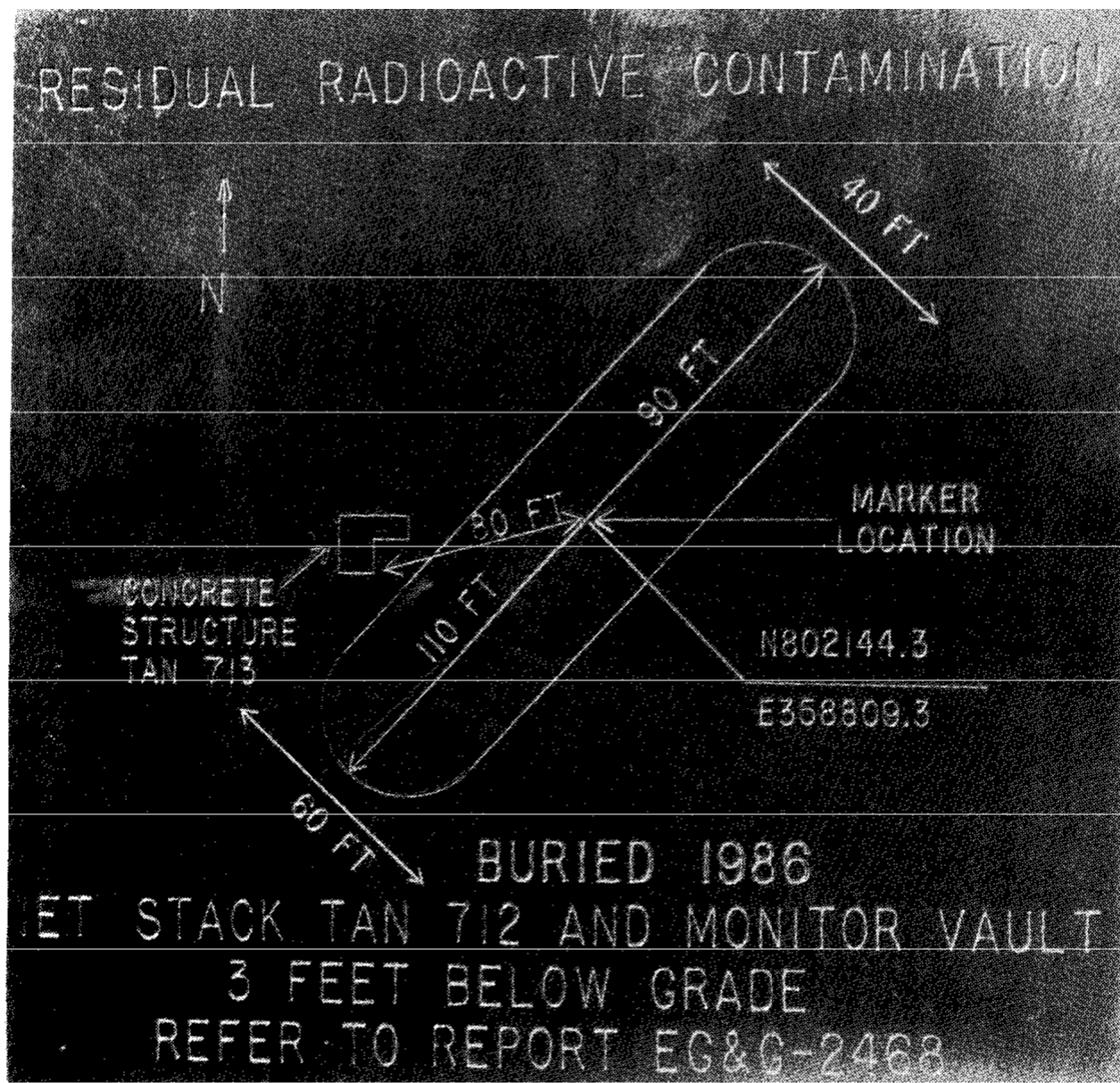


Figure A-3. Monument from the Initial Engine Test stack, TAN-712, and monitoring vault (from the Deactivation and Decommissioning Report [Stoll 1987]).



Figure A-4. Photo of the Initial Engine Test stack showing excavated base, supports, and trench (IAEA 2005).



Figure A-5. Photo of the horizontally collapsed Initial Engine Test stack in trench (IAEA 2005).

Table A-2. Sampling of floor debris from the Initial Engine Test exhaust stack, as recorded in Table 14 of the Radiological Characterization Report.^a

Stack Sample ID	Weight (g)	Gamma Activity				Delayed Neutron		Beta	
		Co-60 (pCi/g)	±	Cs-137 (pCi/g)	±	U-235 (pCi/g)	±	Sr-90 (pCi/g)	±
Bottom #6	0.4158	67	26	4,490	160	19.2	0.2	—	
Bottom #7	0.4307	113	41	6,280	190	33	0.3	—	
Bottom #8 all over	0.1667	100	40	7,490	260	39.8	0.4	—	
Wall #9 scrapings	0.3014	<26		584	50	11.7	0.1		
Bottom, all over	1.2473	—		—		—		1,610	80

a. Koeppen et al. (1982).

ID identification number
 — not measured

The Decontamination and Decommissioning (D&D) Plan for IET (Yrene and McCusker 1986) states that, because of the nature of the deposits found at the base of the exhaust stack during the 1982 radiological characterization, it was decided to further characterize the inside of the stack as much as practical. Other than the D&D Plan for IET, documentation of this sampling was not found. The D&D Plan states that entry was made to the inside of the stack at ground level during January 1985 to obtain physical samples of material deposited onto the stack firebrick liner. Samples were taken circumferentially from the inside surface the stack, as shown in Figure 5 of the D&D Plan (see Figure A-6). The samples were analyzed and documented, and results are presented in Table A-3. Though not specifically discussed in the D&D Plan, the values associated with the numbers are assumed to be heights from the stack floor bottom. Two samples were also radiochemically analyzed for Sr-90 and total uranium. Results of this analysis, as presented in Table A-3, indicate measureable accumulations of both.

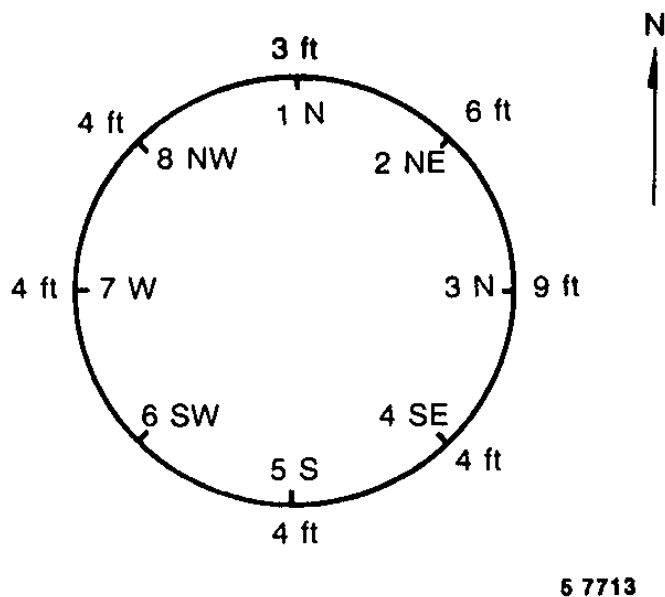


Figure A-6. Locations of 1985 brick liner sampling of the Initial Engine Test stack (Figure 5 from Yrene and McCusker [1986]).

Table A-3. Sample analysis results from the 1985 Initial Engine Test brick liner.^a

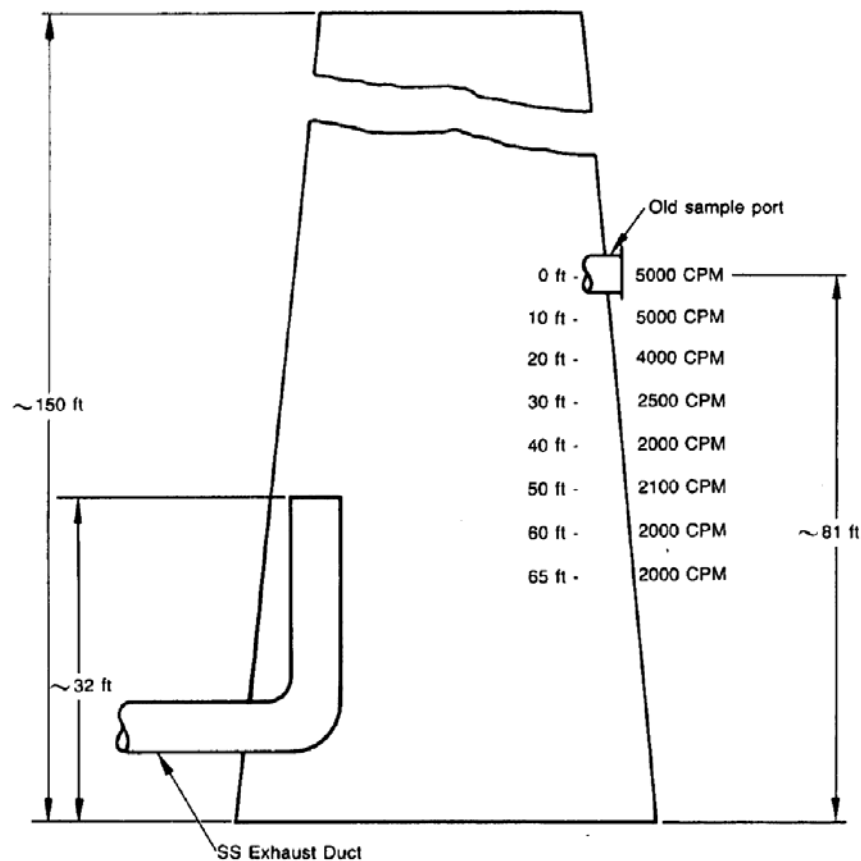
Sample Stack ID	Mass (g)	Co-60 (pCi/g)	Cs-137 (pCi/g)	Gross Alpha (pCi/g)	Sr-90 (pCi/g)	Total Uranium (pCi/g)
#1N	36	0.3	170	—	—	—
#2NE	45	0.6	190	80 ±20	13 ±2	13.4 ±0.4
#3E	34	0.4	110	—	—	—
#5S	48	0.4	190	—	—	—
#7N	60	0.4	190	—	—	—
#8NW	43	1.3	240	110 ±20	36 ±5	46 ±1

a. Yrene and McCusker (1986).

ID identification number

— not measured

At this time, activity also was measured in the inside surface of the stack, using a Ludlum 2-A instrument. The instrument was calibrated to add 19.8 m (65 ft) of signal cable between the sensor and readout meter. Readings were taken at various stations, as shown in Figure A-7. The D&D Plan states that a reading taken at the top of the inside of the stack indicated 500 cpm.



5 7714

Figure A-7. Internal radiation measurements of the Initial Engine Test stack.

The D&D Plan concluded that these results, coupled with results from the isotopic analyses, indicate that radioactivity appears to be concentrated at the base of the stack, and, to a lesser degree, at some length between the base and the top. This report goes on to state that the activity at the bottom of the stack would be reduced during decommissioning to less than present wall activity levels before any demolition of the stack by physically removing the 6 to 8 cm (2 to 3 in.) of deposited material.

The D&D Plan includes an attachment titled: "Environmental Evaluation for Decontamination and Decommissioning of the IET Facility and IET Hot Waste Line" (EG&G 1985). This document presents a table of concentrations as compared to a radiation concentration guide. These radiation concentration guides were most likely from guidance established by the Energy Research and Development Administration (ERDA 1977). Note that no mention is made of how or where the concentrations were obtained. This table is presented in Figure AA-2 in Appendix AA and appears comparable to those reported from more documented sources.

The stack and vault were decommissioned in 1986. During cleanup inside the exhaust stack, some particles of silver were discovered in sand beneath the subfloor. However, after sampling and an extraction procedure toxicity test, it was determined that the silver was not leachable. The existence of silver, therefore, was not considered a hazardous waste (Stoll 1987). The report of this analysis was not found in available documentation. Some poorly documented sampling was performed, as presented in Figure A-8.

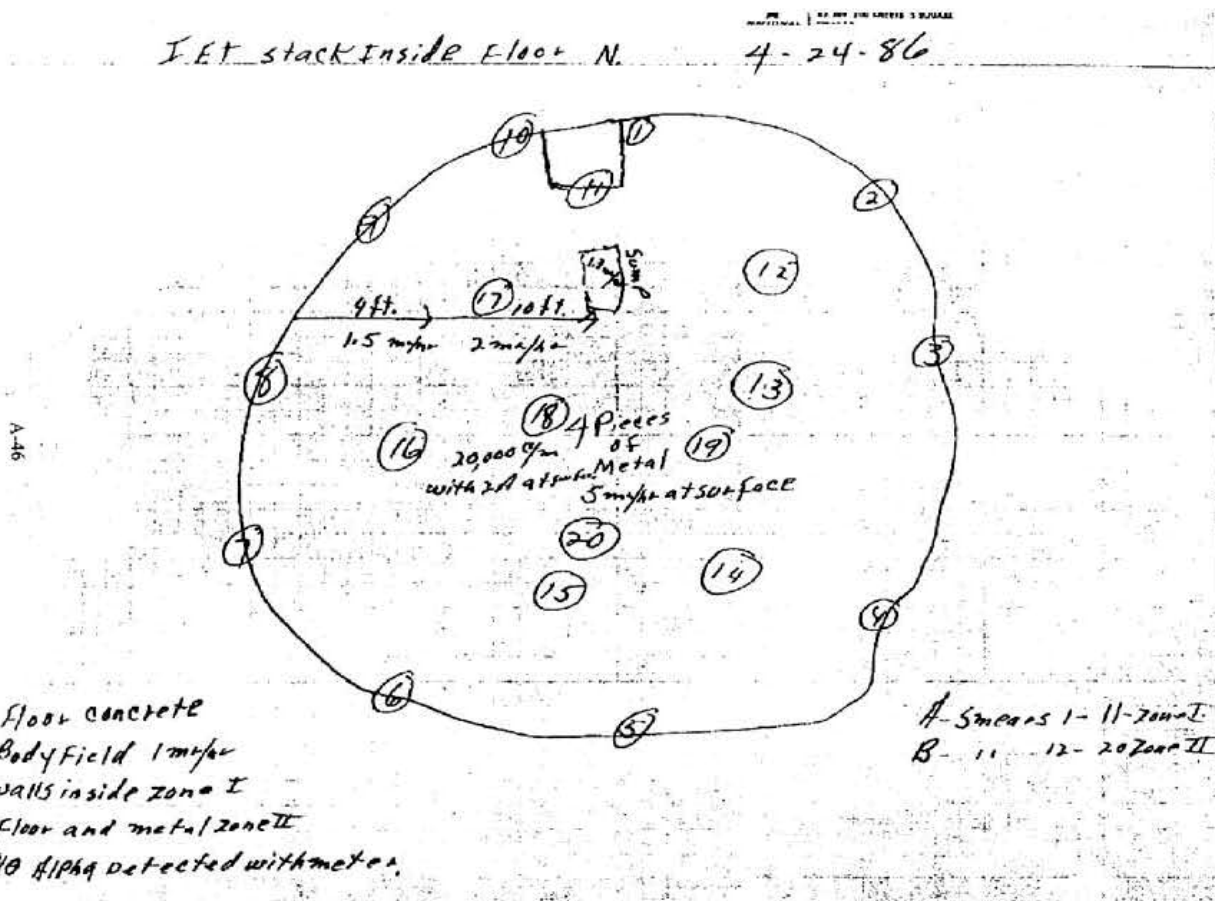


Figure A-8. Sketch and descriptors of the inside floor north of the Initial Engine Test stack, April 24, 1986 (Appendix A of INEL [1994a]).

The 1987 D&D Report (Stoll 1987) does discuss the activities that occurred. However, more detail was found in an International Atomic Energy Agency report, *Dismantling of Contaminated Stacks at Nuclear Facilities* (IAEA 2005), which states:

...the plan was to decontaminate to a level such that the contamination left in the rubble and buried stack would decay to agreed upon release levels (1 mSv/a to a maximally exposed individual) within an IC period of 100 years. Following decontamination of the stack interior and confirmation of the amount and types of contamination remaining, a trench would be dug out from the base of the stack, and high explosives would be used to drop the stack into the trench. The felled stack would then be rubble and buried in place. A permanent marker would be installed and the area monitored as necessary to prevent intrusion until the radionuclides decayed to release levels. Thus plans were made for the partial decontamination and explosive demolition of the IET stack.

Decontamination of the stack was accomplished by first shoveling loose debris and a sludge-like material from the bottom of the stack. This material consisted mostly of dirt, which had settled to the concrete base of the stack over the years. The material was lightly contaminated (about 0.12 mSv/h) with Co, Cs and Sr. The next step in the decontamination process was to vacuum the base and interior walls of the stack to remove further loose material. Following this, a pressurized sandblasting unit was used to clean the interior of the stack. Following sandblasting, the interior of the stack was again vacuumed to remove sand and loose contamination. Surface radiation surveys were then conducted to determine if spots or areas of contamination had been missed during the decontamination operation. Samples of concrete from the interior of the stack were then removed and analyzed in a laboratory to determine residual isotopes and their concentrations. When it was determined that any isotopes remaining in the wall of the stack would decay to release levels within the defined time period (see above), permission was given to proceed with explosive demolition of the stack. It should be noted that almost all of the original contamination existed within the bottom 5 m of the stack. This made decontamination relatively easy since only the bottom 5 m needed to be cleaned.

Without including details from the International Atomic Energy Agency Report (IAEA 2005), the 1987 D&D Report verifies that radioactively contaminated deposits from inside the exhaust stack base were removed using a high-efficiency particulate air filter vacuum, placed in plastic bags, and sent to RWMC (Stoll 1987).

Before demolition, soil was excavated from approximately half the stack foundation, and a large trench (18 m wide $\times$ 61 m long $\times$ 6.1 m deep [60 ft wide $\times$ 200 ft long $\times$ 20 ft deep]) was excavated radially, to the northeast, from that part of the foundation. The stack, exposed foundation, and trench are shown in Figure A-4. Holes were then drilled into the stack base and supporting concrete piles; after the stack collapsed horizontally into the trench (see Figures A-4 and A-5), any remaining base was pushed into the trench. The entire trench was then backfilled with clean topsoil, and the area was graded and seeded with crested wheatgrass.

The monitoring vault (TAN-713) was a concrete slab with an aboveground staircase leading to an underground concrete room that measured approximately 3.6 $\times$ 6.1 m (12 $\times$ 20 ft). Interior components of the monitoring vault were surveyed for gamma-emitting radionuclides (i.e., Co-60, Cs-137, and U-235)

before removal (see Figure AA-3). By the time decommissioning began, water had collected in TAN-713 from an undetermined source, and sludge had collected on the floor. Sampling indicated that the water was relatively clean, with levels lower than 0.1 pCi/ml of Co-60, Cs-137, and U-235. Samples of the sludge indicated 0.9 pCi/g of Co-60 and 11.0 pCi/g of Cs-137 (Yrene and McCusker 1986). The liquid was pumped out and handled as clean water or processed as contaminated liquid, depending on survey results. Rust and sludge from external surfaces of equipment and inside samples lines had concentrations at 4.4 pCi/g of Cs-137 and 2.7 pCi/g of U-235. All removable contamination (including rust and sludge) was removed from the monitoring vault during the decommissioning process. The concrete structure and associated components (e.g., door) were demolished, surveyed, and packaged for shipment to RWMC, the Waste Experimental Reduction Facility, or the Central Facilities Area sanitary landfill as deemed appropriate, based on survey results. Nearly all of the waste generated from the monitoring vault qualified as clean and was shipped to the sanitary landfill. The concrete structure of the monitoring vault that was verified free of radioactivity was collapsed into itself with a demolition and buried in place 1 m (3 ft) below ground surface (bgs) (Stoll 1987).

The entire area was graded and seeded. From descriptions in the D&D Plan, both the stack rubble and monitoring vault rubble appear to be buried over 1 m (3 ft) deep. The area of the stack rubble is estimated to be 510 m³ (18,000 ft³), and the area of the monitoring vault is estimated to be 27 m³ (960 ft³) (Stoll 1987). The monument placed on the site is shown in Figure A-3.

Some uncertainty remains regarding potential risk from the primary radioactive COCs (i.e., Cs-137, Co-60, Sr-90, and U-235) because, after decommissioning, these COCs were not characterized. Specifically, the amount, distribution, and chemical and/or physical nature of the radioactive COCs at the site are not well known. The only evidence of sampling after decommissioning is presented at the end of Appendix A of the OU 1-05 Track 2 Summary Report (INEL 1994a). The handwritten memo regarding the TAN Radioactive Parts Security Storage Area (RPSSA) surface radiation survey, performed May 26, 1993, is presented in Figure A-9; however, the memo does not provide much useful information as evidenced in the lack of information on individual smears. These data could not be found. There is no evidence of hazardous constituents associated with the stack, monitoring vault, or surrounding soil (INEL 1994a, Appendix A).

In summary, the 1986 decommissioning activities most likely removed the bulk of the radioactivity identified at the base on the former stack. Any residual radioactive contamination is thought to be distributed uniformly throughout the burial site and would likely be fixed or adsorbed to the rubble material.

A-3.2 Risk History

The initial assessment of the IET-04 rubble site was performed in September 1986 (Saint-Louis 1986). This assessment was also included as an appendix in the OU 1-05 Track 2 Summary Report. The Track 2 Field Sampling Plan (FSP) (Meyer et al. 1993) states that Waste Area Group 1 managers from the U.S. Department of Energy (DOE) Idaho Field Office, EPA, and the Idaho Department of Health and Welfare reviewed available information regarding contaminant concentrations and types, site conditions, and exposure pathways and determined that IET-04 did not present an unacceptable risk to human health and that additional data collection was not necessary. A risk evaluation for the known COCs at IET-04 was completed and presented in Appendix A, of the Track 2 Report Summary (INEL 1994a). Results indicated that sufficient concentrations of each COC were present at the site to pose an unacceptable risk in both the occupational and residential scenarios but that the pathways might be incomplete. With concurrence by the Federal Facility Agreement and Consent Order (DOE-ID 1991) project managers, no further action was determined for this site. This decision was documented in the *Track 2 Decision Statement for OU 1-05 Radioactive Contamination Sites* (DOE-ID 1996).

PROJECT : TAN-PPSSA Surface Radiation Survey
DATE : 5-26-93
ANALYSTS: S.W. Peterson, D.W. McBride
OPERATORS

The following items are N/A - sample ID number, time - sample collected,
Type of analysis, preservation. No samples collected as per SOP -
EM-FM -
Calibration of field instrumentation by HPIL - HAD 440A calibration date
3-10-93 Serial # 131257

Background : 1VRM 0.015 at gate to PPSSA

Locations	(mR/hr) CONTACT	(mR/hr) 3 Feet	Locations	(mR/hr) CONTACT	(mR/hr) 3 Feet
1	0.36	0.07	* 20	2.01	0.03
2	0.39	0.07	* 21	2.82	0.04
3	0.77	0.06	22	1.03	0.14
4	1.61	0.08	23	0.60	0.28
5	0.50	0.04	24	0.44	0.52
	0.62	0.04	X 25	31.70	5.30
7	0.05	0.04	X 26	3.30	1.10
* 8	19.2	0.37	27	0.82	0.11
* 9	19.5	0.46	X 28	11.5	4.5
10	0.67	0.03	X 29	5.1	2.4
11	0.12	0.03	X 30	19.2	4.8
12	0.39	0.15	X 31	27.4	5.3
13	0.45	0.04	X 32	11.9	3.5
14	1.36	0.17	33	1.4	0.2
15	0.31	0.08	34	0.16	0.07
16	0.26	0.00	35	0.18	0.07
17	0.30	0.09	36	0.20	0.07
* 18	3.18	0.17	37	0.93	0.12
* 19	3.70	0.09	38	≥ 0.04	EVALUATED NPPA
			39	0.02 to 0.03	

Continued on Page

Read and Understood By

Signed McBride Date 5-26-93 Signed _____ Date _____

Figure A-9. Handwritten memo regarding Test Area North Radioactive Parts Security Storage Area surface radiation survey conducted May 26, 1993.

The OU 1-10 RI/FS (DOE-ID 1997) states that IET-04 contains only buried material with fixed surface contamination. This fixed contamination was considered to be inaccessible to human and ecological receptors at the sites; therefore, the site was only discussed in the baseline risk assessment and ecological risk assessment uncertainty sections within the OU 1-10 RI/FS. The OU 1-10 RI/FS also incorrectly assumed that the stack is 3 to 5 m (10 to 15 ft) below clean soil. It is clear from the D&D Report (Stoll 1987) that only 0.9 m (3 ft) of clean soil lies above the rubble. Clean soil may be deeper in some locations, but not necessarily throughout the site. Therefore, both industrial and residential pathways could be impacted.

This site is included in Table 12-2 of the OU 1-10 ROD (DOE-ID 1999). Table 12-2 states:

...places this site in with a group of sites where risk is either not completely characterized, calculated risk or known remaining contamination does not allow unrestricted land use (the current residential risk is >IE-04 or HI greater than 1), or requires ICs until site is further dispositioned. Institutional controls will be provided until 2099 or until the risk is <IE-04 as documented in a 5-year review.

A-3.3 Estimating Release Date

The OU 1-10 RI/FS mistakenly stated that the contamination at this site was below depths of concern for both occupational and residential scenarios. Based on the review of historical information available for this site, the worst-case scenario is that the contamination is within 0.9 m (3 ft) of the surface. To develop values for estimating a date when ICs could be removed from this site, contamination was assumed present in the 1- to 1.1-m (3- to 3.5-ft) range. This is a conservative assumption because the contamination should be fixed, and the depth of contamination should be less than 15 cm (0.5 ft). Maximum concentrations detected on the walls of the building were used to calculate depth-weighted exposure-point concentrations. This is conservative because the maximum was used in the calculation; however, after decommissioning, the concentrations would be reduced. The calculation for the depth-weighted average exposure-point concentration is presented in the OU 1-10 RI/FS. Because of the depth of contamination, 20 bins are used instead of 10; however, this should not change the basis of the approach. Table A-4 presents the concentrations used, and Table A-5 presents the results of the calculations. As shown, Cs-137 is the only contaminant remaining of concern. Because of the nature of the contamination, the limiting exposure is the worker. By 2064, the Cs-137 at the site will have decayed to levels acceptable for release for both the resident and the worker (see Table A-5), suggesting ICs could be removed from the site in 2064.

A-4. TSF-03 BURN PIT

In 2001, additional sampling and analysis were performed to ascertain whether additional COCs that might not have been evaluated during the remedial investigation needed to be considered. Based on the sample results, a human health risk evaluation was conducted and showed dioxins and furans, in addition to lead, in the burn pit soil. As documented in the 2003 Explanation of Significant Differences for OU 1-10 (DOE-ID 2003a), the remedial action was changed from placement of a native soil cover to excavation of the soil and disposal at the Idaho CERCLA Disposal Facility.

In 2004, the soil and debris were excavated from the burn pit. The extent of the excavation was initially based on visual evidence of the burn pit layer and the underburden. Clean soil was stockpiled for later use. X-ray fluorescence field analysis confirmed that the excavation had removed the lead-contaminated soil. Confirmation soil sampling was conducted, and the samples were analyzed to confirm that soil above the final remediation goal and ROD-identified contaminants (i.e., lead, dioxins, furans, polychlorinated biphenyls, and chromium) had been removed. Field screening for gamma

Table A-4. Concentrations used for the depth-weighted calculations.

Depth (ft)	Co-60 (pCi/g)	Cs-137 ^a (pCi/g)	Sr-90 ^a (pCi/g)	U-235 ^a (pCi/g)
0–0.5	0	0.82	0.49	0.5
0.5–1	0	0.82	0.49	0.5
1–1.5	0	0.82	0.49	0.5
1.5–2	0.655 ^b	306.9 ^b	19.58 ^c	11.7 ^b
2–2.5	0	0	0	0.5
2.5–3	0	0	0	0.5
3–3.5	0	0	0	0.5
3.5–4	0	0	0	0.5
4–4.5	0	0	0	0.5
4.5–5	0	0	0	0.5
5–5.5	0	0	0	0.5
5.5–6	0	0	0	0.5
6–6.5	0	0	0	0.5
6.5–7	0	0	0	0.5
7–7.5	0	0	0	0.5
7.5–8	0	0	0	0.5
8–8.5	0	0	0	0.5
8.5–9	0	0	0	0.5
9–9.5	0	0	0	0.5
9.5–10	0	0	0	0.5

a. Assumed background concentrations throughout soil profile, as appropriate.

b. Concentrations found in wall scraping #9 were sampled in 1982 (Koeppen et al. 1982). The value was decayed for Cs-137 (from 584 pCi/g) and for Co-60 (from 26 pCi/g).

c. This value for Sr-90 was decayed from the 36-pCi/g concentration found in wall scraping #8NW, sampled in 1985 (Yrene and McCusker 1986).

Table A-5. Depth-weighted average exposure-point concentration calculations.

Depth Range (ft)	Contaminant of Concern	Exposure-Point Concentration (pCi/g)	Current Worker PRG at 1E-04 (pCi/g)	Date Decayed below PRG	Depth Range (ft)	Exposure-Point Concentration (pCi/g)	Current Resident PRG at 1E-04 (pCi/g)	Date Decayed below PRG
0–4	Co-60	0.082	6.02	NA	0–10	0.033	3.61	NA
0–4	Cs-137	38.67	11.3	2064	0–10	15.47	6	2052
0–4	Sr-90	4.68	1,080	NA	0–10	1.87	23.1	NA
0–4	U-235	1.9	39.8	NA	0–10	1.06	19.5	NA

NA Not applicable. All these values are below the 1E-05 level for current exposure.
PRG preliminary remediation goal

radiation also was performed. Results of soil samples and a risk comparison concluded that the primary contaminants had been removed, and the site could be released for unrestricted use. A pre-final inspection was conducted with the Agencies on June 25, 2004. Contaminated soil and debris excavated from the burn pit were disposed of at Idaho CERCLA Disposal Facility. The excavation was backfilled and compacted with clean stockpiled soil and soil from the TAN gravel pit. The backfilled excavation was contoured, and 15 cm (6 in.) of topsoil was placed over the surface. Revegetation of the TSF-03 burn pit was completed in late fall 2004. ICs for the site are no longer required.

A-5. TSF-06 AREA 1—SOIL AREA NORTHEAST OF TURNABLE

The largest portion of TSF-06 is contained between the railroad tracks on the west, the TSF-06 ditch on the south, and roadways on the north and east. This area, shown in Figure 4-10 of the OU 1-05 Track 2 Summary Report (INEL 1994a), encompasses Areas 1 and 13a and a portion of Area 6.

Area 1 is a large, open, soil area used since the 1950s for storage of radioactively contaminated equipment. The equipment left uncovered resulted in soil contamination because of exposure to precipitation and wind that transported radioactive particles off the equipment and into the soil. Radionuclides (i.e., Cs-137, Co-60, and Sr-90) are the primary contaminants resulting from storage operations at this site. Metals typically associated with radioactive processes at TAN may also be present (primarily mercury). Also included in Area 1 is a portion of the rail system, designated Area 13a. The railroad was built to support the ANPP. From the mid-1960s to 1987, under the ANPP, HTRE test assemblies were transported through the Technical Support Facility (TSF) area on the railroad track system and stored on the track near TAN-647. Mercury, used as shielding for reactors in the test assemblies, reportedly leaked onto the ground; onto the railroad equipment, during transport; and, on two occasions, was spilled during operations.

TSF-06 Area 5, TSF-06 Area 11 (A & B), and TSF-06 Area 10 are within the outer boundary of TSF-06 Area 1 but are addressed separately. Sampling for mercury contamination near the railroad was addressed as TSF-08. The radionuclide contamination in the area near the railroad track was broken out into TSF-06 Area 6. Area 6 on the east side of the northern track is included in TSF-06 Area 1 for this assessment.

Based on sampling results of the Track 2 investigation, the surficial boundary dimensions of Area 1 are estimated to be approximately 183×122 m (600×400 ft) ($22,325$ m² [$240,000$ ft²]) (INEL 1994a). The depth of the radioactively contaminated interval at the site is conservatively estimated to be 3 m (10 ft) because there is no evidence of contamination being present at greater depth. Two radioactive waste lines are known to run parallel to the roadway west of TAN-607 at a depth of approximately 1.5 m (5 ft), according to a 1982 report; however, the actual depth may be different. There is no evidence that these now-abandoned waste lines leaked, and the Voluntary Consent Order program flushed the lines in 2006. Therefore, the assumption is conservative, that is, concentrations of radioactive contaminants detected at the surface are the same at 3 m (10 ft) bgs. If contamination is present at the site as a result of windblown deposition or from run-off from contaminated equipment stored uncovered in the area, the highest concentrations of contaminants would be expected in the surface soil. Figures A-10 through A-12 give locations of these sites.

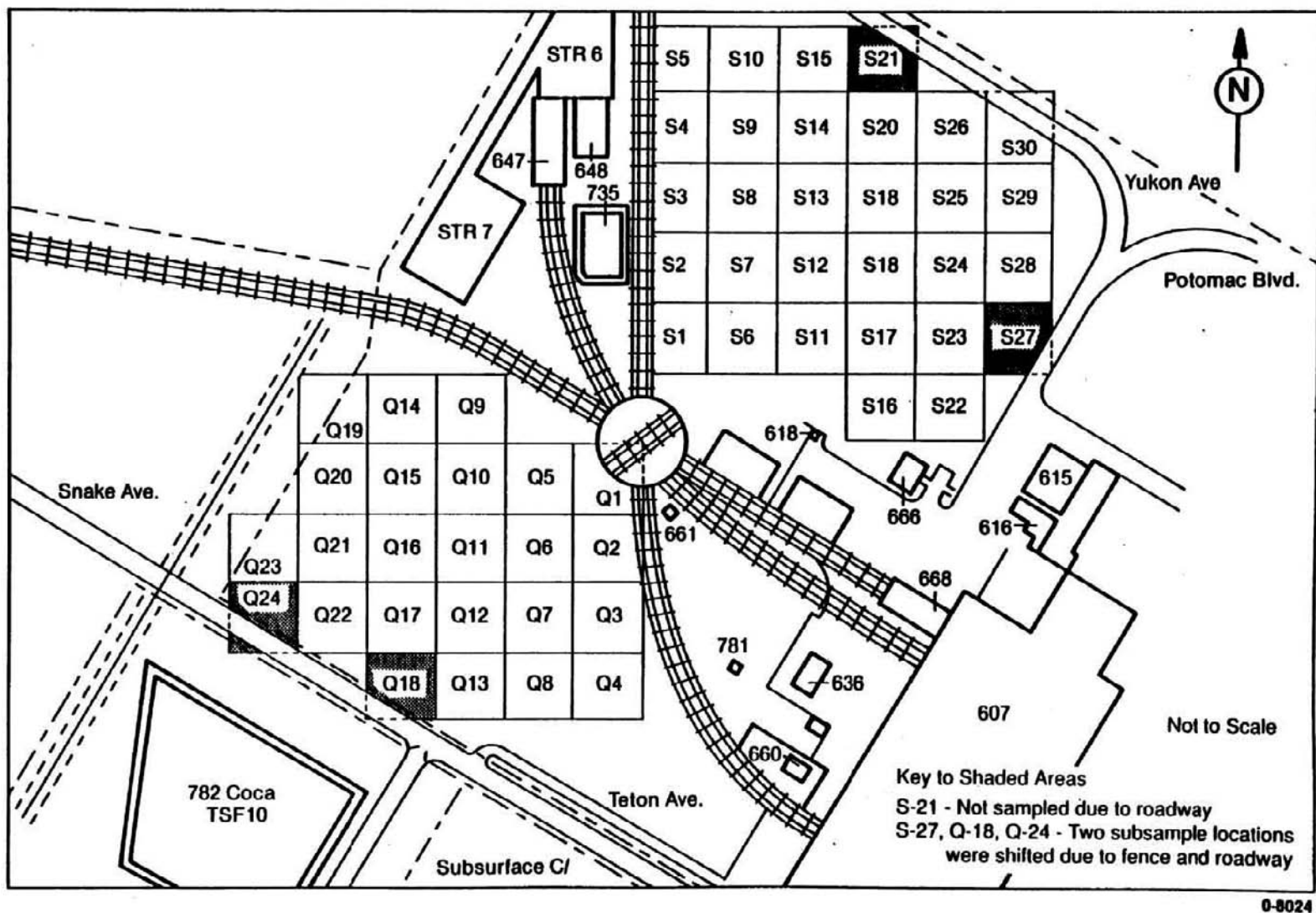


Figure A-10. Sample grid map of the Test Area North support facility area (Sections S and Q) (Clark and McQuary 1984).

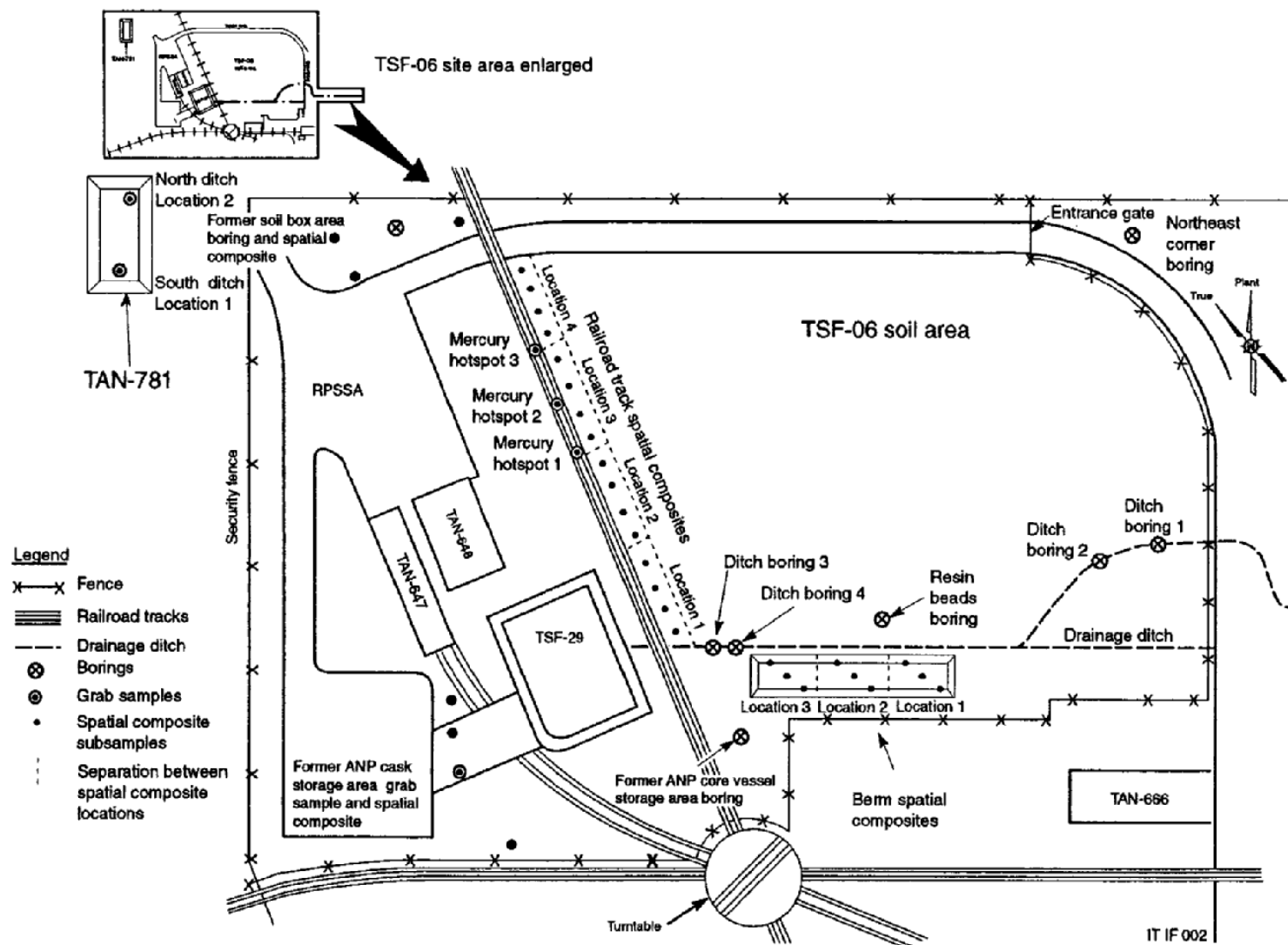


Figure A-11. Track 2 environmental samples collected from within the TSF-06 soil area, the Radioactive Parts Security Storage Area, and the TAN-781 pond (INEL 1994a).

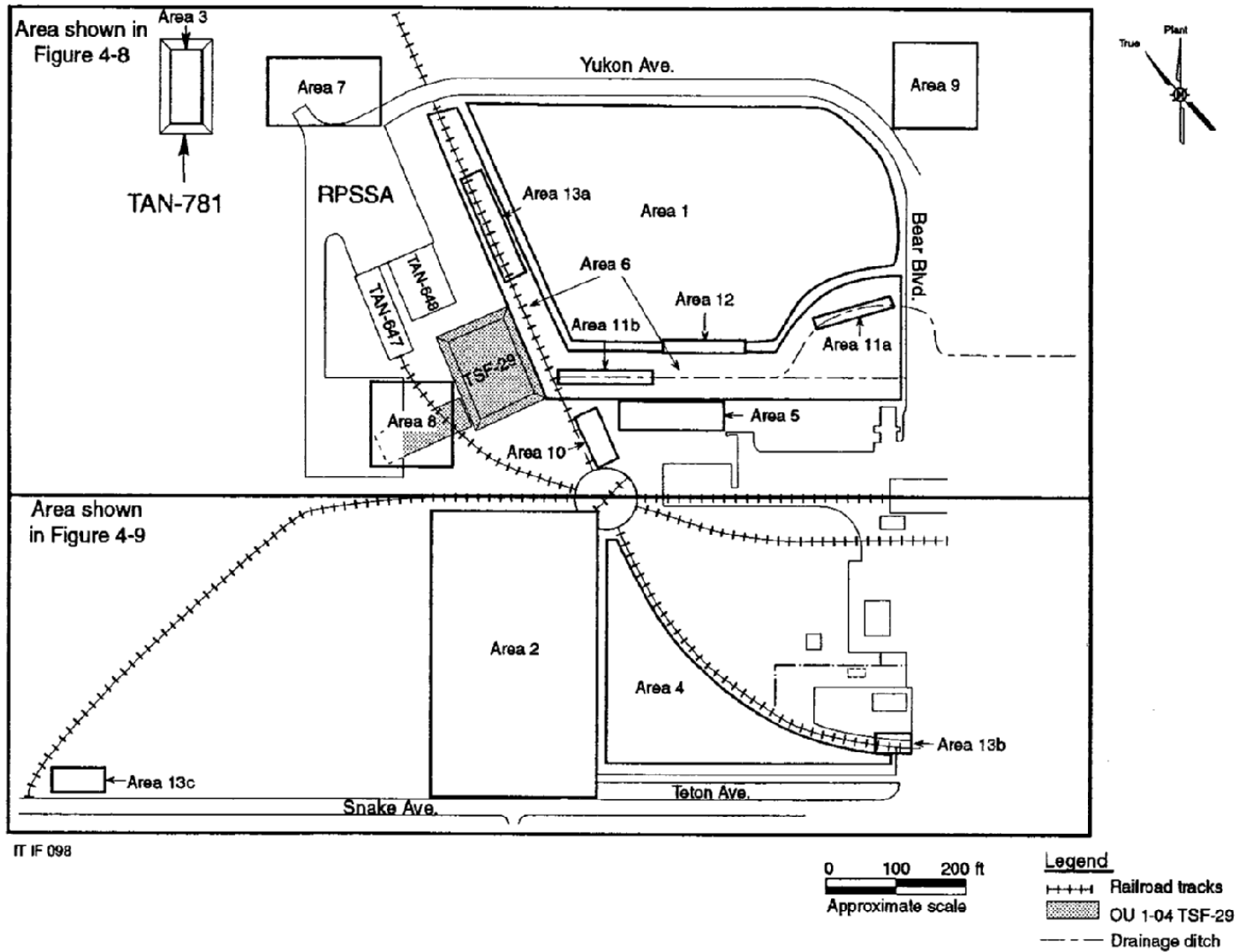


Figure A-12. Revised TSE-06 site boundaries and main areas of concern (INEL 1994a).

A-5.1 Sampling

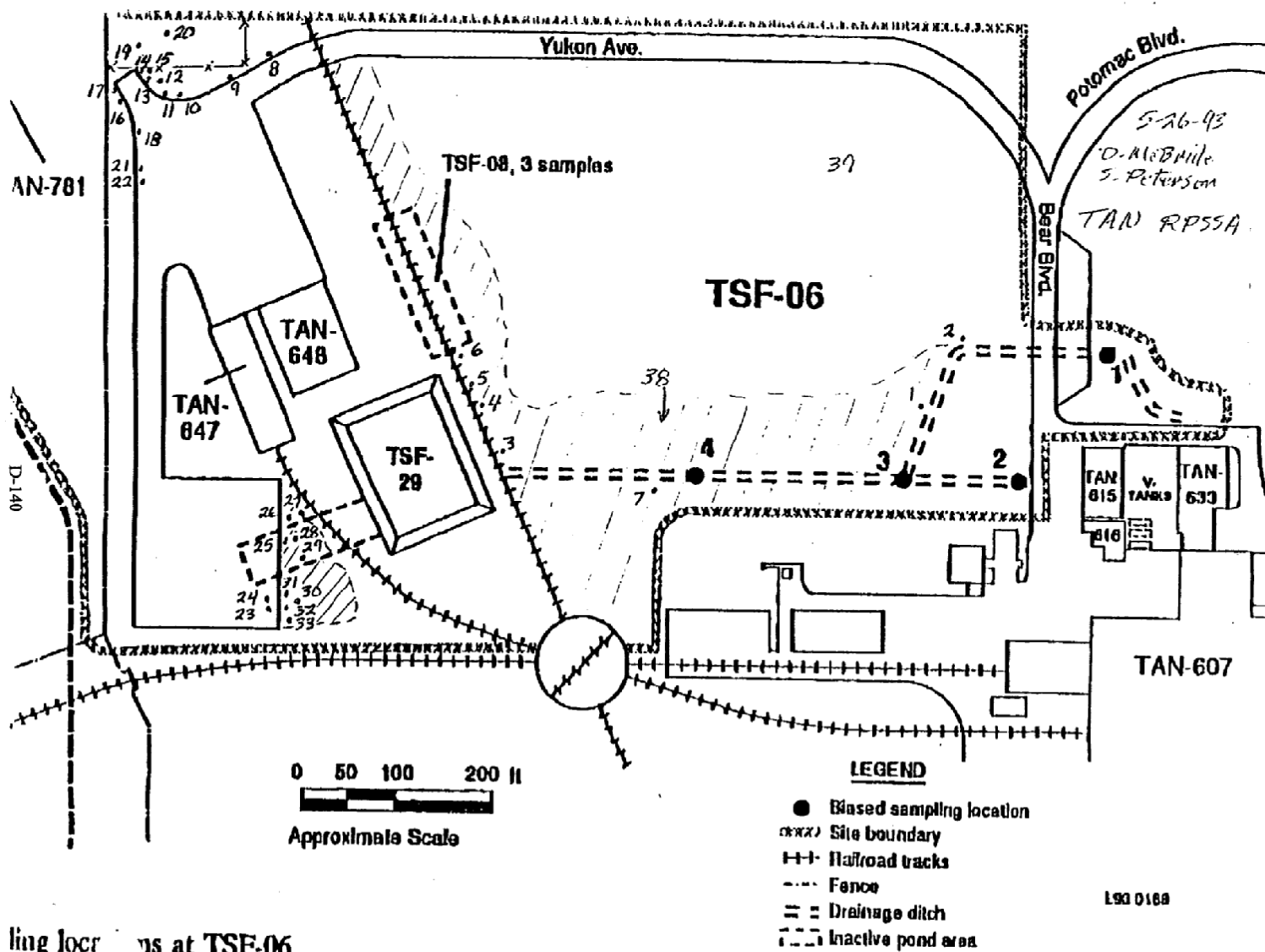
A large portion of Area 1 was characterized in 1983. TSF-06 Area 1 was gridded into 15.2-m (50-ft) squares (see Figure A-10). The total counts in each direction were noted and recorded (Clark and McQuary 1984). The average count for the north–south and east–west readings was calculated for each square. The characterization indicated widespread surface contamination with radioactive particles reading up to 200 mR/hour of beta/gamma radiation (Clark and McQuary 1984). Cs-137 activities in four surface soil samples, collected in the main area of TSF-06 Area 1, ranged from 28.4 to 56.5 pCi/g. Co-60 was measured at 0.23 to 4.09 pCi/g. Sr-90 was measured at 0.6 to 5.4 pCi/g (Clark and McQuary 1984). Random particle samples were also collected (locations shown in Figure A-11). These particles ranged from $2.01\text{E}+05$ to $5.3\text{E}+05$ pCi/g Cs-137.

In 1989, data (that appear to have been counted in 1991) were collected to support preparation of the Preliminary Assessment Data Document (Martin et al. 1992). Samples were transported to the Idaho National Engineering Laboratory (now INEL) Mobile Radiological Laboratory, located at the Test Reactor Area (now the Advanced Test Reactor Complex), for testing gamma-emitting radionuclides by gamma spectroscopy. Results of gamma spectrometry indicate that most of the samples collected at Area 1 contained elevated activities of Cs-137. Concentrations reported for thorium and uranium assume that the total chain of Th-232 and U-238, respectively, are present in equilibrium, which is generally the case in environmental soils. The concentration of thorium and uranium daughters observed is multiplied by the number of daughters in the chain; thus, the reported concentration indicates the total activity present without presenting each individual nuclide in the chain. Most of the surface soil in Grids Q and S appear to be contaminated (see Figure A-10). All samples from these two grids contain cesium at concentrations above those observed in background samples.

A radiation field-screening survey, using vehicle-mounted detectors, was performed on May 26, 1993, at the TSF-06 soil area (Appendix D, Section 6, of INEL [1994a]) as part of the Phase I investigation to support the OU 1-05 Track 2 investigation, in accordance with the OU 1-04/05 FSP (Meyer et al. 1993). Radiation hot spots were identified using a vehicle-mounted monitor and then pinpointed with a handheld instrument. All measurements were recorded in mR/hour. Hot spots measuring higher than 5 mR/hour were further delineated with a Ludlum 14-C handheld instrument. Background radiation levels were measured at less than 0.015 mR/hour.

The 1993 survey detected an elevated zone of radiation along the TSF-06 ditch (i.e., higher than 0.04 mR/hour, ranging from 0.04 to 0.39 mR/hour) and the east side of the northward trending railroad tracks (i.e., higher than 0.04 mR/hour, ranging from 0.50 to 1.61 mR/hour). The large open area of TSF-06, between Yukon Avenue and the ditch, had low radiation levels, ranging from 0.02 to 0.03 mR/hour. Several radioactive particles were detected during the survey, either within the TSF-06 ditch or along the eastern side of the railroad tracks. Locations of these surveys are shown in Figure A-13.

Based on results of the 1993 survey, four composite surface soil samples, from 0 to 0.5 m (0 to 1.5 ft) bgs, were collected from along the railroad tracks in what is assumed to be the area designated as Area 6 (see Figure A-11). The area sampled extended from the drainage ditch leading to the TSF-29 pond north to where the railroad tracks cross the road. The samples—each comprised of four subsamples collected along a transect 30.5 m (100 ft) long, lying 4.6 m (15 ft) east of the railroad tracks—were analyzed for gross alpha activity, gross beta activity, and gamma-emitting radionuclides. In the four samples, activities of Cs-137 ranged from 4.38 to 16.3 pCi/g, and activities of Co-60 ranged from nondetect to 1.08 pCi/g. Gross beta activities ranged from 27 to 57 pCi/g. Three surface grab samples were also collected from the soil 0.6 to 0.8 m (2 to 2.5 ft) below the railroad tracks, in the portion of track bordering TSF-06 Area 1 on the west. Cs-137 was detected in the three samples (designated as Area 13a) at activities ranging from 0.43 to 3.99 pCi/g. Co-60 was not detected in these samples.



ling locations at TSF-06.

Figure A-13. Schematic of Test Area North facilities and TSF-06.

Track 2 sampling also associated with TSF-06 Area 1 included shallow drilling (up to 2.1 m [7 ft] deep) and sampling in the resin beads location. Field screening data from the boring detected no alpha radiation, no volatile organic compounds (VOCs) above prescribed action levels, no mercury contamination, and no beta/gamma concentrations above 100 cpm. Analytical results from subsurface samples showed no concentrations for gross alpha contamination at any of the soil-boring areas and no concentrations above background for beta/gamma contamination (INEL 1994a).

A-5.2 Risk Decision

The TSF-06 areas are somewhat complicated in that those areas included under Area 1 have changed from assessment to assessment. The OU 10-06 Removal Action Engineering Evaluation/Cost Analysis (Jessmore et al. 1995) and the OU 1-05 Track 2 Summary Report (INEL 1994a) assessed a group of sites as TSF-06 Area A. Area A included Areas 1, 6, and 10, and radionuclides only for Areas 5 and 13a. Area A is not discussed in the OU 1-10 RI/FS (DOE-ID 1997); instead, TSF-06 Area 1 is defined as encompassing Areas 1, 13a, and a portion of Area 6, east of the railroad track (DOE-ID 1997). This combination of areas is assessed in this reevaluation.

Table 12-1 of the OU 1-10 ROD states that this site has a current residential risk of 1E-03, current occupational risk of 2E-04, and future residential risk of 2E-04. Table 12-2 of the OU 1-10 ROD (DOE-ID 1999) states:

Risk at this site is either not completely characterized, calculated risk or known remaining contamination does not allow unrestricted land use (the current residential risk is $>1\text{E-}04$ or HI greater than 1), or requires ICs until site is further dispositioned. Institutional controls will be provided until 2099 or until the risk is $<1\text{E-}04$ as documented in a 5-year review.

Risk assessment results presented in Tables B-65 through B-72 of the OU 1-10 RI/FS (DOE-ID 1997) indicate that Cs-137 (9E-05) and U-238 (3E-05) were the site-specific COCs for the residential scenario. Co-60 (1E-05 from external exposure) and Cs-137 (2E-04 from external exposure) were the only site specific COCs for the current occupational scenario.

A-5.3 Estimated Release Date

A review of the OU 1-10 RI/FS results showed U-238 was not indicated as a COC in the OU 1-05 Track 2 Summary Report (INEL 1994a), so data for U-238 were reviewed to determine the reason. U-238 is not a concern because Martin et al. (1992) states that the gamma spectral analysis indicated that surface soil at TAN contained the naturally occurring isotopes thorium, uranium, and potassium (K-40). Concentrations reported for thorium and uranium assume that the total chain of thorium and uranium, respectively, are present in equilibrium, which is generally the case in environmental soil. The concentration of thorium and uranium daughters observed is multiplied by the number of daughters in the chain; thus, the reported concentration indicates the total activity present without presenting each individual nuclide in the chain (Martin et al. 1992). Therefore, the values presented should not have been used to evaluate U-238 as an individual radionuclide. The report also indicates that concentrations of the U-238 decay chain that were assessed are within background values at TSF-06 Area 1 (Martin et al. 1992). Therefore, U-238 is removed as a COC from this site.

Table A-6 presents information of the sampling performed for those locations included within TSF-06 Area 1, the number of samples, and the maximum decayed values. The maximum concentration of Co-60 detected during each sampling event has now decayed below both the EPA PRGs for 1E-04 risk for the residential (3.6 pCi/g) and occupational (6.0 pCi/g) worker. All 41 results (decayed to 2010) were

assessed for a 95% upper confidence limit (UCL) for Cs-137 on the mean, using EPA ProUCL (EPA 2009), which indicates that the 95% UCL on the mean for Cs-137 at the site is 12.6 pCi/g. The ProUCL results are presented in Appendix AA, Table AA-1. This concentration will have decayed below the occupational worker EPA PRG for Cs-137 at 1E-04 risk (i.e., 11.3 pCi/g) by 2015. This concentration will decay to below the EPA PRG for Cs-137 for the resident at 1E-04 risk (i.e., 6 pCi/g) by 2043, suggesting that ICs could be removed from this site in 2043. Cs-137 is the only remaining COC at this site.

Table A-6. Summary of data collected at TSF-06 Area 1 (decayed to 2010).

Sampling Event	Number of Samples	Cs-137 Decayed Maximum (pCi/g)	Co-60 Decayed Maximum (pCi/g)
1983 sampling	5	31.1	0.23
1989 sampling	28	20.7	0.34
1993 Track 2 sampling—Area 6	4	11.3	0.13
1993 Track 2 sampling—Area 13a	4	2.76	ND
ND nondetect			

A-6. TSF-06 AREA 5—RADIOACTIVE SOIL BERM

The Area 5 soil berm measures approximately 0.9 m (3 ft) high, by 45.7 m (150 ft) long, and by 3 m (10 ft) wide, as shown in Figure 4-17 from INEL (1994a). This may be the berm created in 1986 when a 137-m² (5,000-ft²) area in the southeastern portion of TSF-06 was scraped clean to allow construction of two new storage pads (INEL 1994a). The most probable contaminants associated with the berm are primarily radionuclides (i.e., Cs-137, Co-60, and Sr-90) and mercury in the surface soils used to create the berm. These are the contaminants most commonly detected in association with radioactive processes at TAN and in sampling events at other areas within TSF-06.

A-6.1 Sampling

During the 1993 Track 2 investigation, three surface samples were obtained by gridding the berm into three grids and collecting and compositing three subsamples from each grid. Results of the gamma spectroscopy and gross alpha and beta analyses of the samples indicate Cs-137 activities ranged from 11.0 to 13.4 pCi/g. The maximum gross alpha and beta activities detected were 26.0 and 40.0 pCi/g, respectively (INEL 1994a).

Table 4-1 of the OU 1-05 Track 2 Summary Report (INEL 1994a) presents the field data recorded from the surface soil sample locations in TSF-06 Area 5. Table 4-2 of the OU 1-05 Track 2 Summary Report lists the surface soil samples shipped from TSF-06 Area 5 for analysis.

A-6.2 Risk Decision

Table 12-1 of the OU 1-10 ROD states that this site has a current residential risk of 3E-04, a current occupational risk of 1E-04, and a future residential risk of 1E-04. Table 12-2 of the OU 1-10 ROD (DOE-ID 1999) states:

Risk at this site is either not completely characterized, calculated risk or known remaining contamination does not allow unrestricted land use (the current residential risk is >1E-04 or HI greater than 1), or requires ICs until site is further dispositioned. Institutional controls will be provided until 2099 or until the risk is <1E-04 as documented in a 5-year review.

Risk assessment results presented in Tables B-65 through B-72 of the OU 1-10 RI/FS (DOE-ID 1997) indicate that Cs-137 was the only site-specific COC. The depth of the radioactively contaminated interval at the site was estimated to be the height of the berm (i.e., 0.9 m [3 ft]) because no sampling and analysis results define the depth of contamination (INEL 1994a). The depth-weighted average exposure-point concentrations for Cs-137 presented are:

- 13.4 pCi/g for the 0- to 15-cm (0- to 0.5-ft) depth
- 10.05 pCi/g for the external exposure to the worker (0 to 1.2 m [0 to 4 ft] deep)
- 4.02 pCi/g for the residential scenario (0 to 0.9 m [0 to 10 ft] deep).

The calculation for the depth-weighted average exposure-point concentration is presented in the OU 1-10 RI/FS.

A-6.3 Estimated Release Date

The depth-weighted average exposure-point concentrations presented in the OU 1-10 RI/FS were decayed to 2010 and are presented in Table A-7. OU 1-10 used a comprehensive approach to assessing fugitive dust and groundwater exposure. Exposure to groundwater or fugitive dust was not a concern for Cs-137 at concentrations observed across the waste area group. Therefore, as shown in Table A-7, Cs-137 concentrations at this site have decayed to below a risk-based level of concern, suggesting that ICs at this site could be removed.

Table A-7. Decayed depth-weighted average exposure-point concentrations for TSF-06 Area 5.

Scenario	Depth Range (ft)	Concentration in 1993 (pCi/g) ^a	Decayed to 2010 (pCi/g)	EPA PRG at 1E-04 Risk (pCi/g)
Air	0–0.5	13.4	9.28	NA
Worker	0–4	10.05	6.96	11.3
Resident	0–10	4.02	2.78	6.0
Groundwater	NA	4.02	2.78	NA

a. Assumed counted in 1994.

EPA Environmental Protection Agency

NA not applicable

PRG preliminary remediation goal

A-7. TSF-06 AREA 10—REACTOR VESSEL BURIAL SITE

TSF-06 Area 10 is just northeast of the railroad turntable and is the burial location of two reactor vessel storage units. The storage units are large metallic underground storage tanks buried on end with a large opening cut into the tank end wall at the ground surface. These metallic storage tanks are assumed

to be 3 m (10 ft) deep or deeper because the HTRE reactor vessels and shield plugs stored in the units were 3 m (10 ft) in length. In 1993, personnel associated with the project were interviewed. These interviews are recorded in Appendix D, Section 5, of the OU 1-05 Track 2 Summary Report (INEL 1994a). Late in the ANPP, two of the ANPP reactor core vessels were stored underground, northeast of the turntable. This location was chosen because it allowed the core vessels to be removed from the HTREs and placed in protective storage, using a railcar-mounted crane. The core vessel was attached to a “plug” that provided radiation protection, power, and cooling systems to the core vessel during storage. A small, removable roof shed, resembling a dog house, was then placed over the plug assembly within the storage tank to add additional weather protection.

During removal of one of the core vessels, the crane winch failed, and the core began free-falling. The equipment operator tried to apply a winch brake, but the momentum of the core vessel and plug assembly almost pulled the crane over. The equipment operator released the winch brake, and the core vessel and plug assembly hit the ground and broke apart. The plug remained attached to the crane and did not move. However, the core vessel bounced around on the surface of the ground and then fell back down into the storage unit. The area was cleared of personnel because of the unknown nature of how the core vessel would respond without the cooling and power systems supplied by the plug (Appendix D, Section 5, of INEL [1994a]). The damaged core vessel was not recovered because there was no easy way to reach the core vessel.

The historical account presented in Appendix D, Section 5, of the OU 1-05 Track 2 Report indicates that the core vessel should not contain any radioactive fuel. The HTREs were always transferred to the Hot Shop in TAN-607, where the fuel was removed from the reactor core vessel for examination. The core vessels were then returned to the HTREs and then placed in casks or underground storage units.

The depth at which the vessels are buried is unknown, although a 1993 geophysical survey did confirm the presence of two large metallic objects buried at a moderate 3- to 3.6-m (10- to 12-ft) depth (INEL 1994a). On the basis of the geophysical survey results, Area 10 is estimated to be approximately 15.2×15.2 m (50×50 ft).

Soil at the site was characterized during the Track 2 investigation with a single boring. A grab sample from the soil surface at the boring location and a vertical sample from soil composited from the entire borehole from 0 to 1.7 m (0 to 5.7 ft) were collected and sent to an analytical laboratory for gross alpha, gross beta, and gamma spectroscopy analyses. The composite sample was also submitted to a laboratory for Contract Laboratory Program metals analysis. Results of the Track 2 sample analysis indicate no radioactive contamination above expected background levels in shallow soil at the site (INEL 1994a).

Soil below and around the reactor vessel storage units has not been sampled, making an estimate about the nature and extent of contamination at the site difficult. Generally, reactor vessels do not contain radioactive contamination in a form that is easily released. Core vessels become activated during reactor operations, and the radioactivity becomes fixed in the vessel structure. Unless the vessel is corroding, the radioactivity will not migrate and presents a hazard only as a fixed source of radiation exposure. The reactor vessel buried in Area 10 is contained in a metallic storage unit, making corrosion and subsequent migration of contaminants even less likely. Radiation levels and specific radionuclides associated with the reactor vessel are unknown; thus, the potential external exposure from the buried vessel to a receptor at the ground surface can not be estimated.

Risks associated with the irradiated core vessel were not evaluated in the OU 1-10 RI/FS (DOE-ID 1997) because of a lack of information about the irradiated core vessels. Concentrations of radionuclides and metals in the soil above the burial site were screened during the contaminant screening

process detailed in Section 6 of the OU 1-05 Track 2 Summary Report (INEL 1994a). This site was retained because of the external risk associated with the burial site.

The 2004 ROD Amendment and Explanation of Significant Differences (DOE-ID 2004) documents modifications and clarifications to the remedial actions for the reactor vessel burial site (i.e., TSF-06 Area 10). The original selected remedial actions for these sites were documented in the Final ROD for OU 1-10 (DOE-ID 1999). For the reactor vessel burial site, an Explanation of Significant Differences was necessary because public comments and internal reviews revealed the need to reclassify this site as no further action (from its previous listing as no action) and to apply appropriate ICs. Table 11-4 of the ROD Amendment (DOE-ID 2004) indicates that risk at TSF-06 Area 10 precludes unrestricted land use and, therefore, requires ICs. ICs will be maintained until the site qualifies for unrestricted use as documented in a 5-year review.

A-8. TSF-06 AREA 11—TSF-06 DITCH

The TSF-06 ditch, which runs east–west through TSF-06, originates at the north end of buildings TAN-607, -615, -616, and -633. Area 11 is shown on Figure A-12. The TSF-06 Area 11 site is referred to as Areas 11a and 11b in some of the documentation. These two locations within the ditch were identified as having elevated levels of contamination. Figure A-12 presents the location of these two areas. An earthen berm obstructs the flow of water from the TSF-09 area into the ditch. The ditch, which empties into the TSF-29 pond, directs storm-water run-off from the TSF-06 site into the pond. The ditch, which is approximately 270 m (900 ft) long, consists of two arms originating in the TSF area. At one time, the north arm was intersected by the ditch in TSF-09. On the basis of the 1993 sampling and analysis results for the TSF-09 V-Tanks (INEL 1994a), contaminants expected to be associated with Area 11 were radionuclides (primarily Cs-137, Co-60, and Sr-90), metals (especially mercury and cadmium), and organic compounds (primarily trichloroethane and tetrachloroethene).

A-8.1 Sampling and Remediation

Past radiation surveys indicate substantial beta/gamma contamination in the approximately 270 m (900 ft) of ditch in the TSF-06 site. During a 1983 characterization, two locations within the ditch were sampled. Two grab samples were collected from the surface: 12.7 cm (5 in.) bgs and 25.4 cm (10 in.) bgs. The ditch sampling near the railroad track registered concentrations of Cs-137 ranging from 9.8 to 30.3 pCi/g (Clark and McQuary 1984). The ditch sampling near the fork of the ditch had concentrations of Cs-137 ranging from 38.6 to 345 pCi/g (Clark and McQuary 1984). Figures A-4 and A-5 show the results of this analysis.

In June 1993, the TSF-06 east–west-trending drainage ditches were surveyed as part of the Track 2 investigation. As shown in Section 4.6 of the OU 1-05 Track 2 Summary Report (INEL 1994a), two locations within the ditch were identified as having elevated concentrations of radionuclides. As part of the Track 2 investigation, four shallow borings were placed at locations in the ditch where field screening had indicated elevated beta/gamma activities (INEL 1994a). Only surface soil grab samples from the four borings were sent to an analytical laboratory for analysis. As shown in Table 4-3 of the OU 1-05 Track 2 Report, the field screening did not indicate any organic, mercury, or radioactive contamination below the surface. The field screening also did not indicate any organic or mercury contamination at the surface. Results of the sample analysis indicate elevated beta, alpha, and gamma radiation in the surface soil of the ditch.

This area was remediated as part of the OU 10-06 effort in 1996 (Jessmore et al. 1995). Locations contaminated above the OU 10-06 PRGs were targeted for remediation during the 1996 OU 10-06 removal action, including TSF-06 Areas 11a (east hot spot) and 11b (west hot spot). Field survey

instruments were used to guide excavation with respect to radionuclides only. After excavation was deemed complete, based on field survey results, soil sampling with radionuclide analyses was performed to determine whether PRGs had been met. Approximately 229.4 m³ (300 yd³) of soil was removed from those areas, and the area was contoured to grade. Twelve verification surface soil samples (0 to 10.2 cm [0 to 4 in.]) were collected. Four of the 12 had concentrations higher than the OU 10-06 PRG of 16.7 pCi/g for Cs-137, ranging from 0.88 to 92 pCi/g. Results of this sampling are presented in the Koeppen (1996) Limitations and Validation Report.

A-8.2 Risk Decision

Table 12-1 of the OU 1-10 ROD states that TSF-06 Area 11 has a current residential risk of 3E-04, a current occupational risk of 1E-04, and a future residential risk of 1E-04. Table 12-2 of the OU 1-10 ROD (DOE-ID 1999) states:

Risk at this site is either not completely characterized, calculated risk or known remaining contamination does not allow unrestricted land use (the current residential risk is >1E-04 or HI greater than 1), or requires ICs until site is further dispositioned. Institutional controls will be provided until 2099 or until the risk is <1E-04 as documented in a 5-year review.

The contaminant screening process is presented in Section 6 and Table B-12 of the OU 1-10 RI/FS (DOE-ID 1997). Risk assessment results presented in Tables B-65 through B-72 of the OU 1-10 RI/FS (DOE-ID 1997) were reviewed; Cs-137 was the only site-specific COC.

A-8.3 Estimated Release Date

Using the OU 10-06 post-remediation sampling data, EPA ProUCL was used to develop a 95% UCL on the mean (41.5 pCi/g) for the concentrations detected from sampling from the 0- to 0.3-m (0- to 1-ft) range. The ProUCL results are presented in Appendix AA, Table AA-2. These results were then used to develop a depth-weighted average exposure-point concentration. For the 0- to 3-m (0- to 10-ft) range (used in the residential scenario), the depth-weighted average exposure-point concentration was calculated as 4.15 pCi/g. For the 0- to 1.2-m (0- to 4-ft) range used in the worker scenario, the depth-weighted average exposure-point concentration was calculated as 10.38 pCi/g. These calculations assumed that no Cs-137 was present at depth. This was verified in sampling performed as part of the Track 2 investigation (see Table 4-3 of INEL [1994a]). As shown in Table A-8, Cs-137 has decayed to a level below a risk based level of concern, suggesting that ICs at this site could be removed.

Table A-8. Decayed depth-weighted average exposure-point concentrations for TSF-06 Area 11.

Scenario	Depth Range (ft)	Concentration in 1996 (pCi/g) ^a	Decayed to 2010 (pCi/g)	EPA PRG at 1E-04 Risk (pCi/g)
Worker	0–4	10.38	7.70	11.3
Resident	0–10	4.15	3.08	6.0

a. Assumed as having been counted in 1997.

EPA Environmental Protection Agency
PRG preliminary remediation goal

A-9. TSF-10—DRAINAGE POND

TSF-10 is a drainage pond located at the western end of TSF. The pond was originally designed as an infiltration pond. Historical information indicates that the pond was usually dry, though the pond received intermittent surface water run-off and occasional discharges of monitoring well purge water.

The TSF-10 pond was built before 1958. When constructed, the pond was $36.6 \times 71.6 \times 2.1$ m ($120 \times 235 \times 7$ ft), with an approximate capacity of $5,700 \text{ m}^3$ ($1.5\text{E}+06$ gal). The surface area of the pond was increased in 1967; however, the volume was actually reduced with the installation of a corrugated metal pipe overflow drain. The overflow drain decreased the depth by 0.7 m (2.3 ft), with a corresponding reduction in capacity to approximately $5,300 \text{ m}^3$ ($1.4\text{E}+06$ gal). However, personnel report that this overflow drain has never been used. Other modifications to TSF-10 (also completed in 1967) included installation of a 0.3-m (1-ft) corrugated metal pipe from the TSF-29 acid pond and a 0.3-m (1-ft) drain along the west side of TAN-607, both of which discharge to TSF-10. According to personnel, there has never been enough water to create overflow from TSF-29 to TSF-10.

Other sources of discharge to TSF-10 include storm drains along the eastern and southern sides of TAN-607 and drains adjacent to Buildings TAN-636 and TAN-660. Ditches around TAN-609 and TSF-26 drain to TSF-10 through a culvert located on the eastern side of the pond. The southeast corner of TSF-10 received effluent from the Sewage Plant Lift Station (TAN-655) when the lift station backed up or was not operating. Process knowledge and sampling data about the sites that drain to the pond indicate that radionuclides, metals, and possibly VOCs and semivolatile organic compounds (SVOCs) may have been discharged to the pond.

A-9.1 Sampling

In 1988, a DOE soil sampling program was conducted at TSF-10 (INEL 1994a). During this program, four soil samples were collected at discrete intervals from each of three different boring locations within the TSF-10 pond. Soil samples were collected from the east-central portion of the pond, the southwest corner of the pond, and the south-central portion of the pond. Concentrations of manganese and Cs-137 were greater than background values; however, no VOCs, SVOCs, or alpha/beta-emitting radionuclides were detected. These data are presented in Appendix G, Section 4, of the OU 1-05 Track 2 Summary Report (INEL 1994a).

On May 4 and 5, 1993, the TSF-10 pond was surveyed for alpha, beta, and gamma radiation. Results of this survey are presented in Appendix G, Section 2, of the OU 1-05 Track 2 Summary Report. The radiation survey was conducted on 0.3-m (10-ft) grids established across the entire base of the pond (over 300 locations). No radioactive contamination was detected at higher than 100 counts above background (INEL 1994a).

A-9.2 Risk Decision

Table 12-1 of the OU 1-10 ROD (DOE-ID 1999) states that radiation field surveys at TSF-10 detected no evidence of contamination, and site visits showed no evidence of stressed vegetation. Metals and low-level radionuclide contamination may be present. Current residential risk is $2\text{E}-04$, current occupational risk is $3\text{E}-05$, and future residential risk is $1\text{E}-04$.

Table 12-2 of the OU 1-10 ROD states:

Risk at this site is either not completely characterized, calculated risk or known remaining contamination does not allow unrestricted land use (the current residential risk is $>1\text{E-}04$ or HI greater than 1), or requires ICs until site is further dispositioned. Institutional controls will be provided until 2099 or until the risk is $<1\text{E-}04$ as documented in a 5-year review.

Risk assessment results presented in Tables B-65 through B-72 of the OU 1-10 RI/FS (DOE-ID 1997) were reviewed. Risk to the current occupational worker is from external exposure to Cs-137 ($3\text{E-}05$). Risk to the resident is from exposure to groundwater. A total future hazard index of 2.0 (from manganese) is presented in Table B-70 of the OU 1-10 RI/FS (hazard quotient = 1.0) from homegrown produce and groundwater exposure. Based on updated values available from EPA (e.g., slope factors and PRGs), this site was reviewed to estimate when ICs could be terminated.

A-9.3 Reevaluation of Risk

Although the reference dose has not been reviewed for manganese since 1997 (EPA 2010b), the concentrations calculated for PRGs from the various EPA regions has changed. Therefore, baseline risk assessment results were reviewed for this COC. This review indicated that this site has a total hazard index for the future resident of 2.0 (Table B-70 from DOE-ID [1997]). Contributions to the future residential hazard index include the hazard quotient of 1.0 calculated for the homegrown produce scenario for a manganese concentration of 681.3 mg/kg.

The contribution of manganese to the total future residential hazard index was reviewed. The screening approach accepted at the INL Site should have eliminated manganese as part of the screening step (VanHorn and Stacey 2004). The maximum concentration of 953 mg/kg is well below the residential EPA PRG of 1,800 mg/kg (ORNL 2010). Consequently, manganese should be eliminated as a concern at this site.

Concentrations of Cs-137 are evaluated in this assessment to estimate when ICs at the site can be terminated. The risk from external exposure to the current occupational worker is $3\text{E-}05$.

A-9.4 Estimated Release Date

With the elimination of manganese as a concern at this site, a date for terminating ICs at this site can be calculated. Cs-137 concentrations at the site are taken from the DOE Environmental Survey Report Data for TSF-10 (Appendix G, Section 4, of the OU 1-05 Track 2 Summary Report [INEL 1994a]). Concentrations detected in the four grab samples collected in 1989 ranged from 0.098 to 6.3 pCi/g. Assuming that the samples were counted in 1990, the maximum concentration has decayed to 3.98 pCi/g as of 2010, suggesting ICs at this site could be terminated.

A-10. TSF-28—SEWAGE TREATMENT PLANT

TSF-28 is the Sewage Treatment Plant that provided primary and secondary treatment for all TSF sanitary waste. Until 1972, treated effluent from the Sewage Treatment Plant was disposed of in the TSF-05 injection well. Since 1972, the effluent has been routed to a lift station in TAN-655 and pumped to the TSF-07 disposal pond. The sludge that accumulates in the dry beds was periodically (every 2 to 3 years) removed and disposed of either at the Central Facilities Area landfill or RWMC. In addition to sanitary sewage from buildings at TSF, waste released to the Sewage Treatment Plant in the past included

a number of process waste streams. One of these waste streams included paints, solvents, and thinners from the TAN-604 paint shop, which were treated in the TSF-11 clarifier pits.

Table 12-1 of the ROD (DOE-ID 1999) states that detected levels of Co-60 and Cs-137 were determined to pose an acceptable risk. The Track 2 decision statement determined that the site needed further evaluation; however, a verbal agreement between the Agencies (i.e., DOE, EPA, and Idaho Department of Environmental Quality) during preparation of the OU 1-10 RI/FS classified the site as no further action in the RI/FS and proposed plans. Further sample data are needed to document this determination and to perform a risk assessment to quantify the site risk.

Table 12-2 of the OU 1-10 ROD states:

Risk at this site is either not completely characterized, calculated risk or known remaining contamination does not allow unrestricted land use (the current residential risk is >IE-04 or HI greater than 1), or requires ICs until site is further dispositioned. Institutional controls will be provided until 2099 or until the risk is <1E-04 as documented in a 5-year review. This site cannot be further evaluated for released until sampling is performed.

A-11. TSF-29—ACID POND

The TSF acid pond (TSF-29) is an unlined drainage pond located northwest of the railroad turntable at TSF and within the boundaries of the OU 1-05 TSF-06 soil area and the RPSSA (Figure A-13). The structure number associated with the acid pond is TAN-1707. The original pre-1958 pond, the post-1958 pond, and the associated infiltration ditch were constructed to handle discharge of cool (nonradioactive) liquid waste. The pond area has received surface-water run-off from the entire northwestern quadrant of TSF as well as the OU 1-05 TSF-06 soil and TSF-09 V-Tank areas. Surface water enters the pond from the northeast and east through a drainage ditch that enters the southeastern corner of the pond.

A-11.1 Soil Sampling

Field screening was performed and samples were collected at TSF-29 in accordance with the OU 1-04/05 FSP (Meyer et al. 1993). Three areas were investigated: the pre-1958 pond, the post-1958 pond, and the active pond.

A-11.1.1 Pre-1958 Pond

The original pre-1958 pond was constructed about 1954, with an east–west orientation, and was approximately $9.1 \times 45.7 \times 0.5$ m deep ($30 \times 150 \times 1.5$ ft deep). The TSF-29 pond was reoriented in 1959 to allow railroad access to two new buildings, TAN-647 and TAN-648. The original pond was backfilled, and the new pond was excavated to the northeast (see Figure A-13). The new pond was $15.2 \times 39.6 \times 1.2$ m deep ($50 \times 130 \times 4$ ft deep), with the long axis reoriented north–south. In 1961, the ANPP was cancelled, thus eliminating the need for the TSF-29 pond. The TSF-29 pond was apparently enlarged to $30.5 \times 39.6 \times 1.2$ m deep ($100 \times 130 \times 4$ ft deep) after 1967 as part of flood control measures (INEL 1994b). At the same time, a corrugated metal pipe that directs potential overflow to the OU 1-05 TSF-10 drainage pond was installed 0.6 m (2 ft) above the pond bottom. By 1972, the TSF-29 pond was no longer needed for flood control because of the addition of numerous dikes and surface water ponds at TSF (i.e., OU 1-06, TSF-07; OU 1-05, TSF-10; and OU 1-04, TSF-31). The TSF-29 pond was backfilled in the mid-1970s with an estimated $1,274 \text{ m}^3$ ($45,000 \text{ ft}^3$) of radioactively contaminated soil as part of a hot spot removal program at TAN. The scope of the cleanup, the type of activities, and the volume of the

waste involved are unknown. However, a brief discussion about these cleanup activities is provided in Appendix G, Section 1, Attachment 5, of the OU 1-04 Track 2 Summary Report (INEL 1994b).

As discussed in the OU 1-10 RI/FS (Section 4 of DOE-ID [1997]), most of the pre-1958 pond is now overlain by Area 8, the cask storage site. Therefore, the pre-1958 pond was included as part of TSF-06 Area 8 in the OU 1-10 RI/FS. This evaluation includes the post-1958 pond in Site TSF-29 from OU 1-04 (see Section 4.1.5.1 of DOE-ID [1997]).

Results from sampling of the post-1958 and active ponds are presented in the following subsections.

A-11.1.2 Post-1958 Pond

Field screening did not detect any VOCs at the post-1958 pond site above the Track 2 investigation action limits. No visible evidence of SVOC contamination was observed (i.e., stains or discoloration). Therefore, VOCs and SVOCs were eliminated from consideration at the site. No soil samples were above background; therefore, metals were eliminated from consideration at the site. Six surface soil samples from five locations were analyzed for gross alpha and beta activity (see Table 7.5 of INEL [1994b]). Gross alpha activities ranged from 7.6 (± 3.1) to 30 (± 5) pCi/g. These activities are at or near INL Site background values for gross alpha activity of 15.8 to 23.8 pCi/g. Further analyses, using alpha spectroscopy, were completed on the soil sample from TSF-29 with the highest gross alpha activity to determine whether any alpha-emitting radionuclides might be present at the site. Radionuclides detected using alpha spectroscopy were evaluated in the OU 1-10 RI/FS and were eliminated as a concern (DOE-ID 1997).

Gross beta activities ranged from 26 (± 3) to 32 (± 3) pCi/g. These activities are below INL Site background values for gross beta activity of 25.4 to 38.0 pCi/g; therefore, beta-emitters were eliminated from consideration at the post-1958 pond. Gamma spectroscopy analysis was performed on one surface soil sample, which was found to contain Cs-137 at 0.91 (± 0.09) pCi/g.

Five surface soil samples were submitted to the Radiation Measurements Laboratory for a 20-minute gamma screening (see Table 7-4 of INEL [1994b]). Cs-137 was detected in the samples, with activities ranging from 0.98 (± 0.13) to 16.1 (± 1.2) pCi/g. Co-60 was detected in one of the samples at 1.5 (± 0.17) pCi/g. Thus, Cs-137 and Co-60 were retained for the risk evaluation of the post-1958 pond.

A radiation field-screening survey was performed on May 24, 1993, at the post-1958 TSF-29 acid pond (see Appendix G, Section 2, of INEL [1994b]), as part of the Phase I investigation in accordance with the OU 1-04/05 FSP (Meyer et al. 1993). Radiation survey measurements were taken from across the entire bottom of the post-1958 acid pond, on a 3-m (10-ft) grid pattern (shown in Figure 7-3 of INEL [1994b]). The active portion of the acid pond was not surveyed because it contained water (the water was sampled and analyzed for the Track 2 Investigation). On May 24, 1993, radiation measurements in the acid pond ranged from a minimum of 120 cpm to a maximum of 20,000 cpm (Appendix G, Section 2, of INEL [1994b]).

Radiation measurements in the TSF-29 drainage ditch, located west of the railroad tracks between the outfall from TSF-06 and the active portion of the pond, ranged from a minimum of 150 cpm to a maximum of 8,000 cpm (Appendix G, Section 2, of INEL [1994b]).

Seven areas of elevated activity were detected in the post-1958 TSF-29 acid pond (excluding the gravel area), with activities ranging from 1,000 to 10,000 cpm (Appendix G, Section 2, of INEL [1994b]). An activity level of 8,000 cpm was detected in a mud crack in the drainage ditch. One culvert and one

pipe had beta/gamma activity of 4,800 and 4,500 cpm, respectively. One area of contaminated gravel was detected. The gravel pile contained tar paper, a shovel, and wood.

The OU 1-04 Track 2 Summary Report (INEL 1994b) determined that field-screening data from 125 sample locations in the pond (including the hot spots) contained a total of 34,520 cpm with an average of 676 cpm; 95% of 4,377 cpm can be calculated from the available data. The soil mass, in grams, analyzed by the field detector can be estimated by using the 5.1-cm (2-in.) -diameter area seen by the detector and assuming an effective depth of 15.2 cm (6 in.) (i.e., shielding depth for the hot particles). Dividing the activity by the soil mass gives an estimate of the 95% of the radionuclide concentration in the post-1958 TSF-29 pond. The approach to calculate a concentration from the counts per minute is documented in Appendix G, Section 6, of the OU 1-04 Track 2 Summary Report (INEL 1994b).

Because access to statistical software was limited, the OU 1-04 Track 2 Summary Report assumed that the survey data were normally distributed to calculate a 95% UCL for Cs-137. The counts per minute data were reevaluated using EPA ProUCL software to calculate a 95% UCL on the mean of 1,607 cpm for data collected in 1993 (see Appendix AA, Table AA-3). As shown, the data do not follow a discernable distribution, and nonparametric statistics are suggested. Given the approach to calculate a concentration from the counts per minute data, the 95% UCL on the mean for Cs-137 was 10.4 pCi/g, as shown in Equation (A-1):

$$95\% \text{ UCL} = (1,607 \text{ cpm}/0.1)/2.22 \text{ pCi/dpm} = 15.62 \text{ pCi/g} \quad \text{Equation (A-1)}$$

Where

Cs-137 = 2/3 total: 10.4 pCi/g

Co-60 = 1/3 total: 5.2 pCi/g.

A-11.1.3 Active Pond Field

At the active pond area, screening did not detect any VOCs, and no visible evidence of SVOC contamination was observed. Therefore, VOCs, SVOCs, and metals were eliminated from consideration at the site. Two surface soil samples (one sample and one duplicate) from one location at the active pond were analyzed for gross alpha and beta (see Table 7-5 of INEL [1994b]). Gross alpha activities ranged from 24 (± 4) to 25 (± 5) pCi/g. The OU 1-04 Track 2 Summary Report (INEL 1994b) stated that these activities were at or near INL Site background values. Therefore, alpha-emitters were eliminated from consideration at the site. Gross beta activities ranged from 32 (± 3) to 36 (± 3) pCi/g. The OU 1-04 Track 2 Summary Report stated that these activities are at or near INL Site background values for gross beta activity of 25.4 to 38.0 pCi/g; therefore, beta-emitters were eliminated from consideration at this site.

The two surface soil samples (one sample and one duplicate) from one location at the active pond were submitted to the Radiological Measurements Laboratory for a 20-minute gamma screening (see Table 7-4 of INEL [1994b]). Cs-137 was detected in the samples, with activities ranging from 4.7 (± 0.4) to 4.8 (± 0.5) pCi/g. The active pond is within the area of the post-1958 pond and was included within that area in the risk assessment.

Water samples from the active pond were collected and analyzed for VOCs, SVOCs, metals, and gross alpha and gross beta activity and were subjected to gamma spectroscopy (see Table 7-6 of INEL [1994b]). No VOCs were detected. SVOCs were either undetected or the data were unusable, except for two unknown SVOCs reported at estimated concentrations of 440 and 5 g/L. (Note that the spiked sample recoveries were not within control limits.) The OU 1-04 Track 2 Summary Report found that metals were

within regulatory levels; therefore, all COCs associated with water in the active pond were eliminated from consideration in the risk assessment.

A-11.2 Risk Decision

The TSF-29 site was assessed in the OU 1-04 Preliminary Scoping Track 2 Summary Report (INEL 1994b), the OU 10-06 Removal Action Engineering Evaluation/Cost Analysis (Jessmore et al. 1995), and the OU 1-10 RI/FS (DOE-ID 1997). Each assessment identifies slightly different COCs; however, all the assessments found the site to have risks higher than 1E-04 to the resident from external exposure to Cs-137. Table 12-1 of the OU 1-10 ROD (DOE-ID 1999) states that the site investigations, field surveys, and soil data indicate that random, isolated, radioactive particles are present in the backfilled soil. Current residential risk is 3E-04, current occupational risk is 1E-04, and future residential risk is 1E-04.

Table 12-2 of the OU 1-10 ROD also indicates, for sites including TSF-29, that calculated risk or known remaining contamination does not allow unrestricted land use (the current residential risk is higher than 1E-04, or hazard index is greater than 1). For these sites, ICs will be required until 2099 or until the risk is lower than 1E-04, as documented in a 5-year review.

The site-specific risk to the current occupational worker is from external exposure to Cs-137 (1E-04). The site-specific risk to the resident is primarily due to external exposure to Cs-137. Based on updated values available from EPA (e.g., slope factors and PRGs), this site was reviewed.

A-11.3 Estimated Release Date

In the risk assessment performed in the OU 1-10 RI/FS, concentrations were compared to slope factors provided by the *Health Effects Assessment Summary Table (HEAST)* (EPA 1994) and used PRGs developed for use at the INL Site (Fromm 1996). Cs-137 was determined to be the COC because of external exposure. Since that time, EPA has provided updated slope factors and PRGs for radionuclides presented on the EPA website (<http://epa-prgs.ornl.gov/radionuclides/>) (EPA 2010a). These were discussed in Appendix A of the last 5-year review report (DOE-ID 2007), but, because they remained protective, the new values were not incorporated into any site-specific evaluation. To estimate an IC termination date for this site, the concentrations found at the site in the past were decayed and compared to the newer EPA PRG values in Table A-9.

Table A-9 presents the maximum concentrations detected or the 95% UCL on the mean, as calculated (see text above for discussion). The 95% UCL on the mean was not presented for those data sets that ProUCL did not recommend for the process. Because of access to limited statistical software, the OU 1-04 Track 2 Summary Report (INEL 1994b) assumed that the survey data were normally distributed to calculate a 95% UCL for Cs-137. The approach used to calculate a concentration from the counts per minute is documented in Appendix G, Section 6, of the OU 1-04 Track 2 Summary Report. As discussed above, the counts per minute data were reevaluated using the EPA ProUCL software to calculate a 95% UCL on the mean. As shown in Table AA-3 in Appendix AA, the data do not follow a discernable distribution, and the nonparametric statistics are suggested. Using the newly calculated 95% UCL, and given the approach to calculate a concentration from the counts per minute data, the 95% UCL on the mean for Cs-137 was 10.4 pCi/g. This value has decayed below the residential PRG at 1E-04 by 2018. The maximum for the post-1958 pond soil samples collected in 1993 was 16.1 pCi/g. This concentration will decay below 6.0 pCi/g by 2036, suggesting ICs at this site can be terminated in 2036.

Table A-9. Calculated 95% upper confidence limit or maximum of data for the TSF-29 post-1958 pond decayed.

Sample Type and Location	Concentration (pCi/g)	Type of Sample Collected in 1993	Decayed to 2010 (pCi/g) ^a	Date Decayed to Less Than 2.3 pCi/g	Date Decayed to Less Than 6.0 pCi/g
Maximum 20-minute gamma scan from post-1958 pond	16.1	Boring 3 (Sample #T2915801R4)	10.9	2078	2036
Maximum gamma spectroscopy from post-1958 pond	0.91	Boring 4 (Sample #T2916201R4)	0.62	NA	NA
Calculated 95% UCL from May 24, 1993, surveys (pCi/g) in post-1958 pond	10.4	125 sample locations across post-1958 pond	7.1	2062	2018

a. Assumed counted in 1993, for this calculation.

b. EPA PRGs for the outdoor worker equal 11.3 pCi/g at the 1E-04 risk level, and PRGs for the indoor worker equal 25.3 pCi/g at the 1E-04 risk level.

EPA Environmental Protection Agency
NA not applicable
PRG preliminary remediation goal
UCL upper confidence limit

A-12. TSF-43—RADIOACTIVE PARTS SECURITY STORAGE AREA

RPSSA, located in the northwestern portion of the TSF area, contained two buildings (i.e., TAN-647 and TAN-648), their concrete pads, and asphalt pads surrounding the buildings. The buildings were constructed in the early 1950s. In 1991, the Federal Facility Agreement and Consent Order (DOE-ID 1991) identified that Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC § 9601 et seq.) Site TSF-43 consists of the TAN-647 and TAN-648 buildings and pads. The area is marked with perimeter fencing and warning signs. Some of the radiologically contaminated soil in the area resulted from movement of Stationary Low-Power Reactor No. 1 debris into the Hot Shop, and some particles were measured as high as 50 rad/hour-1 beta near contact (ORAU 2005). The site is in a fenced-off, controlled-access area.

A Track 1 study was performed on the site in 1993 (EG&G 1994). This assessment identified that a potential existed for loose contamination migrating from the pads as well as the issue of fixed contamination at this location. The Track 1 Report includes the record of a conversation with R. L. Jackson, a health physicist for the TAN facilities. According to Jackson, past surveys conducted at RPSSA did not show any loose contamination on the boxes or the storage pads. Any contamination currently present on the surrounding soils is a result of past activities. In the past, items stored on the pads may not have been adequately covered, resulting in loose contamination coming off of the storage items and onto the pads and surrounding soil. Potential sources of the contamination were the open-air storage of radiologically contaminated components in the area, the storage of radioactively contaminated reactor vessels and components on the adjacent railroad tracks, the IET Project, Stationary Low-Power Reactor No. 1 cleanup, and past TAN Decontamination Shop and Hot Shop activities. TSF-43 has been partially decontaminated several times in the past. According to personnel interviews, mercury was found at RPSSA and was removed by TAN radiological control technicians (see Attachment 2 of EG&G [1994]).

Personnel interviews documented in the Track 1 report (EG&G 1994) indicate that surfaces of the surrounding concrete and asphalt pads were radioactively contaminated; however, no direct samples of the pads have been collected to verify the types or concentration levels of these contaminants (Attachment 2 of EG&G [1994]). Field surveys of the pad, conducted as part of the TSF-06 radioactive soil area Track 2 project in May 1993, indicated that the pads have low levels of contamination in the 0.02- to 0.03-mrem/hour range (less than 180 cpm). Radioactively contaminated particles (from 0.05 to 31.7 mrem/hour or approximately 180 to 50,000 cpm) were found on the northern and southern sections of the pads or in the soil near the pads. These data are presented in Appendix AA (Figures AA-4 and AA-5), as taken from the Track 1 report.

The contaminated surface areas at TSF-43 were resurfaced with asphalt in summer 1993 as part of a TAN facilities project to upgrade roads in the RPSSA area (see Attachment 2 of EG&G [1994]).

The OU 1-10 RI/FS did not assess this site evaluation in the risk assessment because part of TAN-647 was, at that time, a Resource Conservation and Recovery Act (RCRA) (42 USC § 6901 et seq.) interim storage unit (Lewis et al. 1996). The 1999 ROD (DOE-ID 1999) documented that part of TAN-647 was still being operated as a RCRA interim status storage facility.

In 2003, TAN-647 was closed under the Idaho Hazardous Waste Management Act/RCRA Closure Plan (DOE-ID 2003b). The approved Closure Plan for the TAN-647 Solid Waste Storage Facility describes decontamination of TAN-647 surfaces, including the floor, walls, and adjacent asphalt pad, with methods including vacuuming, mopping, wiping, or low-pressure washing. The activities and review for closure are included in the Hazardous Waste Management Act/RCRA Closure Certification for the TAN-647 Solid Waste Storage Facility (Mascarenas 2003).

In spring 2004, the metal structures were removed by the D&D Program, leaving the concrete foundations in place. The Notice of CERCLA Disturbance (ICP 2004) states that the foundations would be subject to ICs as part of TSF-43. The asphalt pads were not disturbed. As discussed, the RCRA closure activities have been certified as complete. This closure did not address radioactive contamination in the remaining section of TSF-43 or beneath the pads. Residual radioactive contamination is expected under the asphalt pads surrounding the buildings and may be fixed within the concrete of the building foundations (ICP 2004).

A date for terminating ICs at this site cannot be determined because of the lack of adequate characterization.

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Appendix AA

Waste Area Group 1—Supporting Risk Information

Appendix AA

Waste Area Group 1—Supporting Risk Information

FIGURES

AA-1. Exxon Nuclear Idaho analysis of the test pad north drain, the exhaust stack bottom, and the hot waste tank for gross beta, gross alpha, Sr-90, U-235, Pu-238, Pu-239/240, and Am-241	A-53
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Table 1. EXXON NUCLEAR IDAHO COMPANY, INC., ANALYSIS (pCi/g)^f

	Gross Beta	Gross Alpha	⁹⁰ Sr	Alpha Spectrometry			
				²³⁵ U	²³⁸ Pu	^{239,240} Pu	²⁴¹ Am
Test Pad North Drain	14 ± 3	5 ± 2	8 ± 1	2.5 ± 0.4	0.07 ± 0.02	0.06 ± 0.02	<0.3
Exh. Stack Bottom	17800 ± 800	1700 ± 100	10400 ± 200	178 ± 7	0.34 ± 0.02	1.36 ± 0.04	0.2 ± 0.1
Hot Waste Tank	360 ± 20	22 ± 3	22 ± 2	<0.1	<0.02	<0.01	<0.2

	Gamma Spectrometry		
	⁶⁰ Co	¹³⁷ Cs	²³⁵ U
Test Pad North Drain	*	*	*
Exh. Stack Bottom	125 ± 8	8760 ± 80	131 ± 23
Hot Waste Tank	*	563 ± 22	*

* No values reported.

Figure AA-1. Exxon Nuclear Idaho analysis of the test pad north drain, the exhaust stack bottom, and the hot waste tank for gross beta, gross alpha, Sr-90, U-235, Pu-238, Pu-239/240, and Am-241 (Koeppen et al. [1982]; also presented in Table 4-6 of Smith and Koeppen [1982]).

TABLE 1. WASTE CHARACTERIZATION OF IET STACK AND ASSOCIATED RCGS

<u>Nuclide (Half-life)</u>	<u>Concentration (pCi/g)</u>			<u>Approximate time to meet guide (yr)</u>
	<u>IET Stack</u>	<u>RCG</u>	<u>% of guide</u>	
Co 60 (5 yr)	5.6 E-1	5E+1	1.1	— ^a
Sr 90 (29 yr)	2.8 E+1	2E+1	140	38
Cs 137 (30 yr)	2.4 E+2	2E+2	120	42
U 235 + U238 ($>10^6$ yr)	2.2 E+1	2E+2	11	— ^a
 <u>a. Currently meets guide.</u>				

Figure AA-2. Waste characterization of the Initial Engine Test stack and associated radiation concentration guides (from Attachment 1 of the Deactivation and Decommissioning Plan (Yrene and McCusker 1986)).

Table 3. Liquid and sludge samples from sumps and building TAN-713 (pCi/ml or pCi/g).

Building	Description (key) ^a	Sump Location/ Description	Sample Volume	Gamma Spectroscopy		
				⁶⁰ Co (1173 keV)	¹³⁷ Cs (662 keV)	²³⁵ U (186 keV)
620	Equipment room (10)	N.E. corner	540 ml	<0.1 ⁽¹⁾	<0.1	<0.1
	Diesel room (4)	S.W. corner	540 ml	<0.1	<0.1	<0.1
	Equipment room (10)	Waste #302	540 ml	<0.1	<0.1	<0.1
	Equipment room (10)	Sewage #301	540 ml	<0.1	<0.1	<0.1
	Tunnel (17/18)	W. end	540 ml	<0.1	<0.1	<0.1
	Stairway (26)	Bottom of stairway	540 ml	<0.1	<0.1	<0.1
	Service room (28)	N.E. corner	540 ml	<0.1	<0.1	<0.1
	Change room (33)	S.E. corner	540 ml	<0.1	<0.1	<0.1
	Change room (33)	S.W. corner	540 ml	<0.1	<0.1	<0.1
	Coupling station (27)	N. side	540 ml	<0.1	<0.1	<0.1
625	Fuel trans. bldg.	N.W. corner	540 ml	<0.1	<0.1	<0.1
627	Tank bldg.	S. side	540 ml	<0.1	<0.1	<0.1
713	Monitoring vault (liquid)	N/A	540 ml	<0.1	<0.1	<0.1
	Monitoring vault (sludge)	N/A	142 g	0.9 ± 0.3	11.0 ± 0.9	0.9 ± 0.2
	Rust and sludge from external surface of equip- ment and inside sample lines	N/A	207 g	<0.2	4.4 ± 0.5	2.7 ± 0.3

^a. Key numbers refer to Figures 2-2 and 2-3.

Figure AA-3. Liquid and sludge samples from sumps and TAN-713 (also included in Table 17 Koeppen et al. [1982]). Note does not include the filter results presented in Koeppen et al. (1982).

TABLE 1(a). TAN/TSF-1 SOIL SAMPLE RESULTS^a [Gamma Ray Activity (pCi/g)]

Sample	¹³⁷ Cs	¹³⁴ Cs	⁶⁰ Co	¹⁵⁵ Eu	¹⁵⁴ Eu
Random Surface Samples					
Soil I-13	56.5 ± 0.5	--	(4.3 ± 0.5)E-1	--	--
Soil J-14	45.7 ± 0.7	--	4.09 ± 0.09	--	--
Soil K-13	32.2 ± 0.2	--	2.92 ± 0.06	--	--
Soil L-12	28.4 ± 0.5	--	(2.3 ± 0.2)E-1	--	--
Ditch Samples					
By Culvert					
Surface	10 ± 0.1	--	--	--	--
5" below surface	30.3 ± 0.4	--	(2.7 ± 0.3)E-1	--	--
10" below surface	9.8 ± 0.1	--	4.9 ± 0.1	--	--
Near Stake N300 E650 ^b					
Surface	38.6 ± 0.5	--	(4.3 ± 0.4)E-1	--	--
5" below surface	345 ± 3	--	3.14 ± 0.09	--	--
10" below surface	114 ± 2	--	(8.3 ± 0.6)E-1	--	--
Random Particle Samples					
Particle #2	(5.31 ± 0.05)E+6	(2.5 ± 0.2)E+4	--	--	(4.0 ± 0.4)E+4
Particle #3	(2.01 ± 0.04)E+5	--	--	--	(3.4 ± 0.1)E+2
Particle #4	(2.70 ± 0.02)E+4	--	(2.4 ± 0.2)E+2	(5.6 ± 0.4)E+2	(7.0 ± 0.3)E+2
Particle #5	(2.14 ± 0.03)E+5	--	(1.0 ± 0.07)E+3	(3.0 ± 0.2)E+3	(3.8 ± 0.2)E+3

a. Analysis performed by EXXON Nuclear Idaho, Inc., Environmental Analysis Group (EAG).

b. Grid survey stake located near sample location in ditch is used for identification of sample.

Figure AA-4. Test Area North TSF-1 soil sample results (gamma ray activity), as performed by Exxon Nuclear Idaho, including random surface samples, ditch samples, near stake samples, and random particle samples.

TABLE 1(b). TAN/TSF-1 SOIL SAMPLE RESULTS^a [Alpha and Beta Activity (pCi/g)]

Sample	Gross β	Gross α	^{90}Sr	^{238}Pu	^{240}Pu	^{238}U	$^{235}, ^{236}\text{U}$	$^{233}, ^{234}\text{U}$
Random Surface Samples								
Soil I-13	30	90	1.9 ± 0.2	$(6 \pm 2)\text{E-2}$	$(5 \pm 2)\text{E-2}$	$1.06 \pm .04$	$(5 \pm 2)\text{E-2}$	1.4 ± 0.1
Soil J-14	40 ± 20	20	5.4 ± 0.3	--	--	--	--	--
Soil K-13	20 ± 10	3	$(6 \pm 1)\text{E-1}$	$(3.0 \pm 0.8)\text{E-2}$	$(5.4 \pm 0.8)\text{E-2}$	--	--	--
Soil L-12	50 ± 10	20 ± 10	2.4 ± 0.2	$(1.6 \pm 0.2)\text{E-2}$	$(5.1 \pm 0.8)\text{E-2}$	$1.04 \pm .03$	$(3.9 \pm 0.7)\text{E-2}$	$(9.9 \pm 0.3)\text{E-1}$
Ditch Samples								
By Culvert								
Surface	20 ± 10	10	3.8 ± 0.3	--	--	--	--	--
5" below surface	80 ± 20	6	18 ± 1	--	--	--	--	--
10" below surface	40	8	2.3 ± 0.2	--	--	--	--	--
Near Stake N300 E650 ^b								
Surface	50 ± 10	1	5.1 ± 0.3	--	--	--	--	--
5" below surface	370 ± 30	20	43 ± 3	--	--	--	--	--
10" below surface	110 ± 20	10	15 ± 1	--	--	--	--	--
Random Particle Samples								
Particle #2	$(1.56 \pm 0.07)\text{E+7}$	9E+4	--	--	--	--	--	--
Particle #3	$(9.5 \pm 0.5)\text{E+5}$	6E+3	--	--	--	--	--	--
Particle #4	(6.9 ± 0.4)	4E+3	--	--	--	--	--	--
Particle #5	(3.6 ± 0.2)	2E+4	--	--	--	--	--	--

a. Analysis performed by EXXON Nuclear Idaho, Inc., Environmental Analysis Group (EAG).

b. Grid survey stake located near sample location in ditch is used for identification of sample.

Figure AA-5. Test Area North TSF-1 soil sample results (alpha and beta activity). Analysis performed by Exxon Nuclear Idaho.

Table AA-1. ProUCL results for Cs-137 at TSF-06, Area 1, for 41 soil samples. All samples were decayed to 2010.

General UCL Statistics for Full Data Sets			
User-Selected Options			
From file:	\\Fsicp02\Projects\ECORISK\5-year review\WAG1\		
Full precision	OFF		
Confidence coefficient	95%		
Number of bootstrap operations	2,000		
TSF-06 Area 1—all decayed			
General Statistics			
Number of valid observations	41	Number of distinct observations	39
Raw Statistics		Log-transformed Statistics	
Minimum	0.297	Minimum of log data	-1.214
Maximum	31.1	Maximum of log data	3.437
Mean	10.27	Mean of log data	2.041
Median	9.62	SD of log data	0.953
SD	6.646		
Coefficient of variation	0.647		
Skewness	1.117		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk test statistic	0.919	Shapiro Wilk test statistic	0.825
Shapiro Wilk critical value	0.941	Shapiro Wilk critical value	0.941
Data not normal at 5% significance level		Data not lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	12.02	95% H-UCL	17.15
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	20.88
95% Adjusted-CLT UCL	12.17	97.5% Chebyshev (MVUE) UCL	24.75
95% Modified-t UCL	12.05	99% Chebyshev (MVUE) UCL	32.35
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.76	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	5.836		
MLE of Mean	10.27		
MLE of Standard Deviation	7.742		
nu star	144.3		
Approximate Chi Square value (0.05)	117.6	Nonparametric Statistics	
Adjusted Level of significance	0.0441	95% CLT UCL	11.98
Adjusted Chi Square value	116.7	95% Jackknife UCL	12.02
		95% standard bootstrap UCL	11.95
Anderson-Darling test statistic	0.817	95% Bootstrap-t UCL	12.22
Anderson-Darling 5% critical value	0.761	95% Hall's bootstrap UCL	12.21
Kolmogorov-Smirnov test statistic	0.128	95% percentile bootstrap UCL	11.98
Kolmogorov-Smirnov 5% critical value	0.14	95% BCA bootstrap UCL	12.13

Table AA-1. (continued).

General UCL Statistics for Full Data Sets			
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	14.8
		97.5% Chebyshev(Mean, Sd) UCL	16.75
		99% Chebyshev(Mean, Sd) UCL	20.6
Assuming Gamma Distribution			
95% Approximate gamma UCL	12.61		
95% Adjusted gamma UCL	12.7		
Potential UCL to Use		Use 95% approximate gamma UCL	12.61

Table AA-2. ProUCL results for Cs-137 at TSF-06, Area 11.

General UCL Statistics for Full Data Sets				
User Selected Options				
From file:	\\Fsicp02\Projects\ECORISK\5-year review\TSF-29.wst			
Full precision	OFF			
Confidence coefficient	95%			
Number of bootstrap operations	2000			
Cs-137 TSF-06-11				
General Statistics				
Number of Valid Observations		12	Number of Distinct Observations	12
Raw Statistics		Log-transformed Statistics		
Minimum	0.88	Minimum of log data	-0.128	
Maximum	92	Maximum of log data	4.522	
Mean	20.94	Mean of log data	2.344	
Median	8.75	SD of log data	1.287	
SD	27.01			
Coefficient of variation	1.29			
Skewness	2.004			
Relevant UCL Statistics				
Normal Distribution Test		Lognormal Distribution Test		
Shapiro Wilk test statistic	0.72	Shapiro Wilk test statistic	0.975	
Shapiro Wilk critical value	0.859	Shapiro Wilk critical value	0.859	
Data not normal at 5% significance level		Data appear lognormal at 5% Significance level		
Assuming Normal Distribution		Assuming Lognormal Distribution		
95% Student's-t UCL	34.94	95% H-UCL	91.33	
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	59.13	
95% Adjusted-CLT UCL	38.59	97.5% Chebyshev (MVUE) UCL	75.46	
95% Modified-t UCL	35.7	99% Chebyshev (MVUE) UCL	107.5	
Gamma Distribution Test		Data Distribution		
k star (bias corrected)	0.689	Data appear gamma distributed at 5% significance level		
Theta Star	30.38			
MLE of mean	20.94			
MLE of standard deviation	25.22			
nu star	16.54			
Approximate Chi Square Value (.05)	8.348	Nonparametric Statistics		
Adjusted level of significance	0.029	95% CLT UCL	33.77	
Adjusted Chi Square value	7.475	95% Jackknife UCL	34.94	
		95% standard bootstrap UCL	33.31	

Table AA-2. (continued).

General UCL Statistics for Full Data Sets			
Anderson-Darling test statistic	0.449	95% Bootstrap-t UCL	49
Anderson-Darling 5% critical value	0.762	95% Hall's bootstrap UCL	41.64
Kolmogorov-Smirnov test statistic	0.192	95% percentile bootstrap UCL	33.79
Kolmogorov-Smirnov 5% critical value	0.254	95% BCA bootstrap UCL	38.52
Data appear gamma distributed at 5% significance level		95% Chebyshev(Mean, Sd) UCL	54.93
		97.5% Chebyshev(Mean, Sd) UCL	69.64
		99% Chebyshev(Mean, Sd) UCL	98.53
Assuming Gamma Distribution			
95% approximate gamma UCL	41.5		
95% adjusted gamma UCL	46.35		
Potential UCL to use		Use 95% approximate gamma UCL	41.5

Table AA-3. ProUCL results for Cs-137 at TSF-29 for counts-per-minute data collected in 1993.

General UCL Statistics for Full Data Sets			
User Selected Options			
From file:	\\Fsicp02\Projects\ECORISK\5-year review\TSF-29.wst		
Full precision	OFF		
Confidence coefficient	95%		
Number of bootstrap operations	2000		
TSF-29 Scan data			
General Statistics			
Number of valid observations		Number of distinct observations	
Raw Statistics		Log-transformed Statistics	
Minimum	120	Minimum of log data	4.787
Maximum	20,000	Maximum of log data	9.903
Mean	717.9	Mean of log data	5.534
Median	180	SD of log data	0.948
SD	2,291		
Coefficient of variation	3.191		
Skewness	6.054		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors test statistic	0.445	Lilliefors test statistic	0.306
Lilliefors critical value	0.0789	Lilliefors critical value	0.0789
Data not normal at 5% significance level		Data not lognormal at 5% significance level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	1,056	95% H-UCL	475.9
95% UCLs (adjusted for skewness)		95% Chebyshev (MVUE) UCL	567.1
95% Adjusted-CLT UCL	1,171	97.5% Chebyshev (MVUE) UCL	641.7
95% Modified-t UCL	1,074	99% Chebyshev (MVUE) UCL	788.2
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.585	Data do not follow a discernable distribution (0.05)	
Theta Star	1,228		
MLE of mean	717.9		
MLE of standard deviation	938.8		
nu star	147.4		

Table AA-3. (continued).

General UCL Statistics for Full Data Sets			
		Nonparametric Statistics	
Approximate Chi Square value (.05)	120.3	95% CLT UCL	1,054
Adjusted Level of significance	0.0481	95% Jackknife UCL	1,056
Adjusted Chi Square value	120	95% standard bootstrap UCL	1,066
Anderson-Darling test statistic	30.97	95% Bootstrap-t UCL	1,286
Anderson-Darling 5% critical value	0.81	95% Hall's bootstrap UCL	1,261
Kolmogorov-Smirnov test statistic	0.425	95% percentile bootstrap UCL	1,067
Kolmogorov-Smirnov 5% critical value	0.0869	95% BCA bootstrap UCL	1,251
Data not gamma distributed at 5% significance level		95% Chebyshev(Mean, Sd) UCL	1,607
		97.5% Chebyshev(Mean, Sd) UCL	1,992
		99% Chebyshev(Mean, Sd) UCL	2,748
Assuming Gamma Distribution			
95% approximate gamma UCL	879.4		
95% adjusted gamma UCL	881.4		
Potential UCL to use		Use 95% Chebyshev(Mean, Sd) UCL	1,607

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Appendix B

Waste Area Group 2—Advanced Test Reactor Complex Supporting Analysis

Appendix B

Waste Area Group 2—Advanced Test Reactor Complex Supporting Analysis

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ACRONYMS

ATR	Advanced Test Reactor
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
COPC	contaminant of potential concern
CWP	cold waste pond
DOE-ID	Department of Energy Idaho Operations Office
EPA	Environmental Protection Agency
FSP	field sampling plan
GPRS	global positioning radiometric scanner
INL	Idaho National Laboratory
OU	operable unit
PCB	polychlorinated biphenyl
PRG	preliminary remediation goal
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
SCA	soil contamination area
SLP	sewage leach pond
TRA	Test Reactor Area
UCL	upper confidence limit
UTL	upper tolerance limit
WAG	waste area group

Appendix B

Waste Area Group 2—Advanced Test Reactor Complex Supporting Analysis

B-1. INTRODUCTION

B-1.1 Scope

This appendix presents detailed information about the reevaluation of risk and associated risk calculations for individual Waste Area Group (WAG) 2 sites. Also included are two subappendixes:

- Appendix BA provides supporting risk information for the Advanced Test Reactor (ATR) Complex sites.
- Appendix BB provides supporting figures for the technical evaluation of WAG 2 sites.

B-1.2 Overview

Changes in the toxicity values that had occurred in the past were discussed in Appendix A of the first Site-wide 5-year review document (DOE-ID 2007). A high-level comparison was performed to ensure that the remedy and decisions at each site remained protective. However, no assessment was done at an individual site level to evaluate the impact of these changes to those sites that are currently under institutional control and/or to develop new dates for removal of institutional controls. At the ATR Complex,^a changes to toxicity and other risk values impact decisions made at TRA-06, TRA-08, TRA-13 (with TRA-M), TRA-34, TRA-X, polychlorinated biphenyl (PCB) spill at TRA-619 (TRA-B Site), PCB spill at TRA-626 (TRA-C Site), and PCB spill at TRA-653 (TRA-E Site).

Three sites (i.e., TRA-15, TRA-19, and the brass cap area) will be impacted by future Voluntary Consent Order activities, and the concentrations and characterization may not be applicable after this activity. However, as requested by the U.S. Department of Energy Idaho Operations Office (DOE-ID) to provide a date for removal of institutional controls under the Comprehensive Environmental, Response, Compensation, and Liability Act (CERCLA) (42 USC § 9601 et seq.), the concentrations presented in the Operable Unit (OU) 2-13 Remedial Investigation/Feasibility Study (RI/FS) (DOE-ID 1997a) will be decayed to the new U.S. Environmental Protection Agency (EPA) preliminary remediation goal (PRG) for Cs-137 (EPA 2010a).

At TRA-15, 26 radionuclides and metals were detected around the tank basin at the following ranges:

- Cs-137 0.07–2,000 pCi/g
- Sr-90 0.05–2,280 pCi/g
- Co-60 0.21–50.3 pCi/g.

The maximum concentration of Cs-137 will decay to below the EPA PRG in approximately 250 years, or by 2260. If metals remain an issue, this site may not be eligible for release.

a. The Advanced Test Reactor (ATR) Complex was previously called the Reactor Technology Complex; before that, it was the Test Reactor Area (TRA).

The estimated radionuclide concentrations at the TRA-19 and brass cap area sites are:

- Cs-137 19,500 pCi/g
- Cs-134 3,330 pCi/g
- Sr-90 833 pCi/g
- Co-60 8.33 pCi/g.

The estimated concentration of Cs-137 will decay to below the EPA PRG in approximately 350 years, or by 2360.

TRA-04, the warm waste retention area also has high contamination at depth (estimated at 6.1 m [20 ft] below ground surface [bgs]). Tables 4-20 and 4-21 from the *Environmental Characterization Report for the Test Reactor Area* (Doornbos et al. 1991) indicated that the following ranges:

- Cs-137 0.095–9,150 pCi/g
- Co-60 0.083–1,320 pCi/g
- Sr-90 3.58–416 pCi/g.

The maximum concentration of Cs-137 will decay to below the EPA PRG in approximately 300 years, or by 2310.

B-2. POLYCHLORINATED BIPHENYL SPILLS AT TRA-619, TRA-626, AND TRA-653

B-2.1 TRA-B—Polychlorinated Biphenyl Spill at TRA-619

The historical site of a PCB spill at TRA-619 is located in the northeastern part of the ATR Complex, adjacent to and on the east side of TRA-619 (the raw water pumphouse). The Preliminary Scoping Track 2 Summary Report (Sherwood et al. 1994) contains a map and photograph in Attachment 1 of Section 2.4. A transformer that used oil containing PCBs once rested on a 1.8- × 3.7- × 1.8-m) (6- × 12- × 2.5-ft) concrete pad and was in operation from approximately 1960 until it was replaced March 3, 1983, by a dry transformer that did not use oil. Waste was generated at the TRA-619 site when oil that contained PCBs leaked from the transformer to the concrete pad and the surrounding soil (Sherwood et al. 1994).

Two separate sampling events occurred at the TRA-619 site. The first event took place during a 1989 Idaho National Laboratory (INL)^b Site-wide assessment of possible PCB-contaminated areas performed by EG&G Idaho, Inc. (presented in Attachment 2 of Section 2.4 of Sherwood et al. [1994]).

Soil samples collected in 1989 indicated that PCBs were present in the soil around the concrete pad at concentrations up to 360.5 ppm. In November 1990, approximately 89.2 m³ (12 yd³) of soil was removed from around the transformer pad. The excavated area extended 0.3 m (1 ft) beyond the pad on all sides and approximately 0.9 m (3 ft) bgs (Sherwood et al. 1994).

In 1990, a second sampling event occurred, consisting of confirmation sampling by United States Pollution Control, Inc., after the excavation of contaminated soil from the site (Attachment 3 of

b. Previously named Idaho National Engineering Laboratory.

Section 2.4 [Sherwood et al. 1994]). The confirmation soil samples collected subsequent to the excavation indicated that the highest PCB concentration was 22 ppm in the soil surrounding the concrete pad. The PCB detected was Aroclor-1260. The excavation area was backfilled with a minimum of 0.6 m (2 ft) of clean soil.

B-2.2 TRA-C—Polychlorinated Biphenyl Spill at TRA-626

The historical site of a PCB spill at TRA-626 is located in the central part of the ATR Complex, adjacent to the northeast corner of Building TRA-626. The site is bordered on the north and east by paved roads and driveways; to the west is Building TRA-626. A General Electric pyranol unit substation transformer, which used 3,837 L (844 gal) of pyranol No. 1470 oil, once rested on a 3 × 3 m (10 × 10 ft) concrete pad and operated from approximately 1956 until it was removed August 3, 1988. Thickness of the original pad is not known. During operation, oil containing PCBs leaked from the transformer to the concrete pad and surrounding soil (Sherwood et al. 1994).

Three separate sampling events occurred at the TRA-626 site:

1. **1989**—The first event took place during the INL Site-wide assessment of areas possibly contaminated with PCBs. The assessment detected contamination above action levels (see Attachment 2 of Section 2.3 [Sherwood et al. 1994]).
2. **September 1990**—The second event consisted of confirmation sampling by United States Pollution Control, Inc., after excavation of the contaminated soil and the concrete pad (see Attachment 3a of Section 2.3 [Sherwood et al. 1994]).
3. **November 1990**—The third event, which consisted of verification sampling for two locations requiring additional excavation, occurred because the initial confirmation samples detected contamination above the 25-ppm cleanup level (Attachment 3b of Section 2.3 [Sherwood et al. 1994]).

No validation was performed for any of the empirical data.

Pyranol transformer oil contains equal parts of trichlorobenzene and PCBs. The transformer leaked oil onto the concrete pad and surrounding soil. Though trichlorobenzene concentrations in the soil were not analyzed, the Preliminary Scoping Track 2 Summary Report (Sherwood et al. 1994) stated that, because trichlorobenzene is a volatile organic compound, complete volatilization was expected in the INL Site's desert conditions. Analysis of soil samples collected in 1989 indicated that PCBs were present in concentrations greater than action levels. In 1990, the concrete pad and some contaminated soil, totaling 21.4 m³ (28 yd³) of material, were removed. Analysis of post-excavation soil samples indicated that nine samples had PCB concentrations greater than 25 ppm, and an additional 7 m³ (9 yd³) of soil was removed. The second set of post-excavation soil samples indicated that the highest soil PCB concentration was 24 mg/kg. The PCB detected was Aroclor-1260. The excavation was backfilled with 1.2 m (4 ft) of clean soil (Sherwood et al. 1994).

B-2.3 TRA-E—Polychlorinated Biphenyl Spill at TRA-653

This site is located in the south-central portion of the ATR Complex on the northern side of the TRA-653 building. A transformer that used oil containing PCBs operated from about 1960 until its replacement in 1980. The transformer leaked oil onto the concrete pad and surrounding soil. Both the transformer and the concrete pad were removed in 1980, and a replacement transformer was installed on a new pad. Soil samples collected in 1989 indicated that PCBs up to 107.2 ppm were present in the soil around the replacement pad (see Attachment 2 of Section 2.2 [Sherwood et al. 1994]). In September 1990,

approximately 6.1 m³ (8 yd³) of soil was removed from three sides of the existing pad. No soil was excavated from the 0.6-m (2-ft) -wide area between the building and the pad (south side), where PCBs (Aroclor 1260) had been detected at 2 mg/kg. Post-excavation soil sampling results ranged from 0.5 to 16 mg/kg for Aroclor-1260. These samples were obtained from the bottom of the excavation on three sides of the concrete pad. No additional samples were collected from the southern side of the pad, as noted previously. The excavation was backfilled with approximately 0.6 m (2 ft) of clean soil (Sherwood et al. 1994).

Data collected and information regarding the Track 2 assessment of this site are included in Section 2.2 of Sherwood et al. (1994). The assumption that the entire volume of soil between 0.6 and 1.8 m (2 and 6 ft) bgs is uniformly contaminated—laterally and vertically in the soil surrounding and beneath the concrete pad—is very conservative because 16 mg/kg was the highest concentration of Aroclor-1260 detected in the six post-excavation samples. This concentration was obtained from a depth of 0.6 m (2 ft) bgs. The other five samples ranged from 0.50–3.2 mg/kg; therefore, 16 mg/kg is not representative. In addition, previous sampling indicated that a maximum of only 2 mg/kg was detected on the southern side of the pad. PCBs have been shown to have limited migration potential in soil; therefore, the concentration is expected to decrease with depth and distance (Sherwood et al. 1994).

B-2.4 Risk Assessment History of the Polychlorinated Biphenyl Sites

The OU 2-13 Comprehensive RI/FS (DOE-ID 1997a) stated that sampling indicated that low levels of PCBs, identified as Aroclor-1260, remain in limited areas in soil surrounding the pads where transformers have been located. Oil leaks from the transformers were the source of the contamination at all three sites. As discussed in the previous subsections, a cleanup was performed at each site. Post-remediation confirmation sampling indicated that residual contamination of Aroclor-1260 remains present in shallow surface soil.

The OU 2-13 Comprehensive RI/FS assessed this residual contamination and found that the concentrations detected at these sites indicated a risk greater than 1E-04 to a potential resident living in the area (DOE-ID 1997a). This result was highly impacted by the fact that minimal samples were taken and that a 95% upper confidence limit (UCL) on the mean could not be calculated. As a result of the OU 2-13 assessment, these three sites were determined to be no action, with institutional controls placed on the site to permanently restrict these sites to industrial land use only, unless otherwise indicated in a 5-year review (DOE-ID 2000a, 1997a).

Since that time, the slope factors supported by EPA for use in risk assessment have been changed, allowing for a reevaluation in this 5-year review. Previously, the tumorigenic potency of PCBs (e.g., Aroclor-1260) was estimated by EPA to have a cancer slope factor of 7.7/mg/kg-day. This was the value used in the OU 2-13 Comprehensive RI/FS (DOE-ID 1997a). The newer upper-bound cancer slope factors calculated from a more complete data set (Mayes et al. 1998) resulted in a new EPA slope factor for PCBs, including Aroclor-1260, of 2/mg/kg-day.

The first 5-year review of this area, performed in 2003, did not address the changes in slope factors (DOE-ID 2003). The second 5-year review was the first Site-wide 5-year review (DOE-ID 2007). This review determined that the slope factor was less conservative (see Table A-3 of DOE-ID 2007) and stated that any decision made using the more conservative slope factor would be protective. However, the impact of this change on these sites was not evaluated further. Therefore, this 5-year review has included the reevaluation of the PCB spills at TRA-619, TRA-626, and TRA-653 using the less conservative slope factors.

B-2.5 Reevaluation of the Advanced Test Reactor Complex Polychlorinated Biphenyl Spill Sites

Potential carcinogenic risks are expressed as an estimated probability that an individual might develop cancer from lifetime exposure. This probability is based on projected intakes and chemical-specific dose-response data called cancer slope factors. Cancer slope factors and the estimated daily intake of a compound, averaged over a lifetime of exposure, are used to estimate the incremental risk by which individual exposed to that compound may develop cancer. This estimate is derived using Equation (B-1).

$$\text{Risk} = \text{Intake} \times \text{SF} \quad (\text{B-1})$$

Where

Risk = carcinogenic risk (unitless)
Intake = contaminant intake (mg/kg-day)
SF = slope factor (mg/kg-day)⁻¹.

The most conservative scenario used for assessment and decision-making at the INL Site is exposure to the future resident. The intakes and associated risks calculated in the OU 2-13 RI/FS are summarized in Table B-1. Risk was recalculated using the new slope factors provided by EPA in 1997 (EPA 2010a). As shown in Table B-1, using the new slope factors for Aroclor-1260, the risk at these sites is now below 1E-04. TRA-619 has the highest risk, at 9E-05 (8.88E-05 in Table B-1). This site also has a maximum detection that is slightly above the newer EPA cleanup level (i.e., 22 mg/kg at the 1E-04 risk level).

Table B-1. Summary of reevaluation of polychlorinated biphenyl spill sites TRA-619, TRA-626, and TRA-653 for the residential risk scenario.

Site	Intake (mg/kg-day) ^{a, b}			Risk				
	Soil Ingestion	Homegrown Produce Ingestion	Inhalation of Fugitive Dust ^b	Old or New	Soil Ingestion	Homegrown Produce Ingestion	Inhalation of Fugitive Dust	Sum of Risk
TRA-619	2.89E-05	8.52E-06	1.64E-11	Old ^a	2.23E-04	6.56E-05	1.26E-10	2.88E-04
				New	7.18E-05	1.70E-05	3.28E-11	8.88E-05
TRA-626	3.59E-05	1.06E-06	1.64E-11	Old ^a	2.76E-04	8.16E-06	1.26E-10	2.85E-04
				New	5.78E-06	2.12E-06	3.28E-11	5.99E-05
TRA-653	1.30E-05	3.84E-06	1.64E-11	Old ^a	1.00E-04	2.96E-05	1.26E-10	1.30E-04
				New	2.60E-06	7.68E-06	3.28E-11	3.37E-05
a. These intakes and risks are presented in the OU 2-13 RI/FS (DOE-ID 1997a).								
b. The other exposure pathways evaluated (groundwater and dermal) did not contribute to cumulative risk (see Table B-45 of the OU 2-13 RI/FS [DOE-ID 1997a]).								
OU operable unit RI/FS remedial investigation/feasibility study								

The CERCLA PCB sites were assessed for risk in the OU 2-13 Comprehensive RI/FS (DOE-ID 1997a). The Agencies (i.e., U.S. Department of Energy, EPA, and the Idaho Department of Environmental Quality) concluded that the PCB concentrations did not pose an unacceptable risk, and

selected no action in the Record of Decision (ROD) (DOE-ID 1997b). Therefore, the remedial action objectives established in the OU 2-13 ROD (DOE-ID 1997b) were based on the CERCLA risk evaluation rather than on proposed cleanup levels in the Toxic Substances Control Act (40 CFR 761.61[a][4]).

As noted previously, the concentrations at these sites were maximums detected due to the small sample size. However, recalculating the risk using the maximums at the site indicates that the risk is at acceptable levels (below 1E-04 for a resident at the site). Note that the amount of PCB remaining under the transformer pad at TRA-619 (Sherwood et al. 1994) is uncertain. It may be that this site should remain under institutional controls until sampling can be performed to confirm that the site is not a risk to human health. However, it is recommended that institutional controls at these sites be removed.

B-3. TRA-34—NORTH STORAGE AREA

The TRA-34 north storage area is located immediately north of the ATR Complex security fence, and it encompasses an area of approximately 0.9 ha (2.25 acres) (see Figure BB-1 in Appendix BB). This area was used for temporary storage of equipment and materials (e.g., reactor parts, pumps, and casks). It is divided into two sections: (1) the hot storage area and (2) the cold storage area. The hot storage area was used to store materials with low-level radionuclide contamination, and the Hot Storage Building (TRA-664) was located within the fence. This building (TRA-664) underwent deactivation and decommissioning in 2004. The cold storage area was used to store nonradiologically contaminated equipment and material and often contained lead bricks, cadmium sheets, chunks of concrete, and wood scraps (see Figure BB-1 in Appendix BB).

A gamma radiation survey, which was conducted in 1992, indicated 15 locations in the hot storage area with contact activities ranging from 0.134 to 200 mR/hour; the average reading was about 42 mR/hour. Three locations at the hot storage area had contact activity greater than 100 mR/hour, and five others had activities of 15 mR/hour. The sizes of the hot spots are unknown; however, pallet-size (i.e., 4 × 4 ft) could be expected based on typical storage (Haney 1994). The 1992 survey also detected contamination in the cold storage area, with contact readings ranging from 0.02–1.45 mR/hour, with an average reading of about 0.22 mR/hour. Only three of the 90 locations surveyed in the cold storage area had contact activities higher than 1 mR/hour, and only six were higher than 0.5 mR/hour. It did not appear that significant hot spots were present in the cold storage area (Haney 1994).

The site was assessed in the Track 2 Preliminary Scoping Package presented in Appendix C of the Track 2 Summary Report for OU 2-04 (Sherwood et al. 1994). At this time, the 1992 gamma scans and historical data were used to determine the presence of radionuclide contamination at levels of concern in area soil. The suspected source of contaminated soil in the hot storage area and the cold storage area was stored lead bricks, lead shot, and cadmium fuel grids, and lead and cadmium contamination might also be present in the soil. In May 1990, personnel from the EG&G Idaho Environmental Monitoring Unit collected four representative soil samples from the ATR Complex north storage area. These samples were collected within the cold storage area, directly beneath lead bricks and cadmium sheets stored in the area. Samples were submitted for extraction procedure toxicity tests for eight heavy metals to determine whether lead had leached from the lead bricks or cadmium sheets to the soil. Analytical results indicate that none of the eight metals were present above regulatory limits. The sampling procedures and analytical results from this investigation are contained in Attachment 3 of Appendix C OU 2-04 Track 2 Summary Report (Sherwood et al. 1994).

At this time, the site was not further evaluated as part of the OU 2-04 but was transferred to the windblown soils task developed under WAG 10 (OU 10-06). The OU 10-06 Phase II field investigation was conducted at the north storage area to determine the nature and extent of radionuclide contaminated soil and to fill existing data gaps (Haney 1995a). Between May and June 1994, samples were collected

from random and biased areas in the cold storage area and hot storage area in accordance with sampling discussed in Section 2.2 of the Sampling and Analysis Plan for Phase II of the OU 10-06 Radionuclide Investigation (Haney 1994). To bound the horizontal extent of radionuclide contamination, two additional biased samples were collected outside the perimeter of the north storage area. It was assumed that historical Radiological and Environmental Sciences Laboratory and OU 10-06 Phase II ATR Complex windblown data characterized the horizontal extent of contamination. Contamination in the north storage area was not expected to exceed 0.3 m (1 ft). Random samples were collected from 12 locations, as determined by a 7.6×7.5 m (25×25 ft) sample grid in the north storage area (see Figure 2-5 of Haney 1994). To characterize the vertical extent of contamination, additional samples were collected at depths deeper than originally specified in the Sampling and Analysis Plan. As described in Document Revision Request ER-1212 (EG&G 1994), additional samples were collected if Cs-137 was detected at 5 pCi/g or greater in the planned sample. Additional samples were collected until the deepest sample collected showed less than 5 pCi/g of Cs-137 or until samples could not be collected because 100% cobble or bedrock was encountered. The deepest sample collected at the north storage area was from the 1.1-m (3.5-ft) depth at sample location Biased #4-Rad 1, located in the hot storage area.

A non-time-critical removal action was conducted inside the fence during September 1995 as directed by DOE-ID Lead Agency Action Memorandum for the non-time-critical removal action at OU 10-06 Radionuclide Contaminated Soil Locations at the Idaho National Engineering Laboratory (Green 1995; DOE-ID 1995). This activity removed appropriately $1,453 \text{ m}^3$ ($1,900 \text{ yd}^3$) (Haney 1995a,b). Sodium-iodide detectors were used to guide the excavation activities. Cleanup criteria were set at 15 pCi/g for Cs-137, which is below the risk-based PRG of 16.7 pCi/g established at that time. It is assumed that the removal of the radionuclide-contaminated soil also removed any associated elevated metals in the soil. As directed by INEL (1995), the first set of confirmation samples was collected on September 26, 1995, to verify the attainment of cleanup criteria (Haney 1995a,b). Two additional samples were taken in November 1996 (Haney 1995b, p. 133).

The site was subsequently returned to WAG 2 and was assessed for residual risk in the OU 2-13 Comprehensive RI/FS (DOE-ID 1997a). Because most of the soil contamination at TRA-34 was excavated during the OU 10-06 removal action, only OU 10-06 post-removal sample data were evaluated in the Baseline Risk Assessment. These samples were collected from 0–4 in. (0–10.1 cm) bgs and were used to identify the following contaminants of potential concern (COPCs) at TRA-34: Ag-108m, Co-60, Cs-137, Eu-152, and Sr-90 (see Appendix B, Table B-3, OU 2-13 Comprehensive RI/FS [DOE-ID 1997a]). The OU 2-13 Comprehensive RI/FS identified Ag-108m, Cs-137, and Eu-152 as contaminants of concern (COCs) at this site.

In the risk assessment performed in the OU 2-13 Comprehensive RI/FS (DOE-ID 1997a), the concentrations were compared to slope factors provided by the Health Effects Assessment Summary Tables (EPA 1994) and used PRGs developed for use at the INL Site (Fromm 1996). Since that time, EPA has provided updated slope factors and PRGs for radionuclides presented on the EPA website (EPA 2009a). These were discussed in Appendix A of the last 5-year review (DOE-ID 2007), but, since they remained protective, the new values were not incorporated into any site-specific evaluation. To estimate the date for removal of institutional controls at this site, the concentrations detected at the site in 1995 were decayed and compared to the updated EPA PRG values in Table B-2.

The OU 2-13 Comprehensive RI/FS used the maximum concentration for the evaluation of the contaminants (DOE-ID 1997a). This reevaluation looks at the maximum; however, there were several samples, and a less conservative 95% UCL could be calculated using the EPA's ProUCL software (Singh, Maichle, and Nocerino 2007). Post-remediation guidance indicates that the 95% UCL would be the most appropriate value to use in determining whether a remediation has met the cleanup goals (presented in Table B-2). Therefore, the use of the maximum is very conservative. As shown in Tables B-2 and B-3, the

maximum detection of each radionuclide was decayed from the date analyzed in 1995 to January 1, 2010. Table B-3 presents the decayed values, which are below the newest EPA (2009a) residential cleanup level—at 1E-04, divided by five to account for multiple contaminants.

Table B-2. Summary of TRA-34 reexamination.

Contaminant	Maximum (pCi/g)	Concentration Decayed to 1/1/2010	Current Resident PRGs (pCi/g) 1E-06 Risk Level	Outdoor Worker PRGs (pCi/g) 1E-06 Risk Level
Ag-108m	0.34	0.332	1.68E-02	3.25E-02
Co-60	0.28	NA	3.61E-02	6.02E-02
Cs-137	1.05	0.37	5.97E-02	1.13E-01
Eu-152	1.43	0.44	4.16E-02	7.37E-02
Sr-90	1.1	NA	2.31E-01	1.08E+01
NA	not applicable			
PRG	preliminary remediation goal			

Table B-3. Comparison of decayed concentrations at TRA-34 to new radionuclide preliminary remediation goals.

Contaminant	Decayed to 1/1/2010	Resident 1E-04 Risk Level	Resident 1E-04 Risk Level Divided by Five	Decayed Concentration Below PRG?
Ag-108m	0.33	1.68	0.336	Yes
Co-60	0.04	3.61	0.722	Yes
Cs-137	0.37	5.97	1.194	Yes
Eu-152	0.44	4.16	0.832	Yes
Sr-90	0.71	23.1	4.62	Yes
PRG	preliminary remediation goal			

The OU 2-13 ROD listed the TRA-34 north storage area as a no action site (after the remediation) with institutional controls. Land use was to be restricted to industrial use until the residential risk was less than 1E-04, based on a 5-year review (DOE-ID 2000a). The concentrations and associated PRGs of radionuclides in this area are presented in Tables B-2 and B-3. As shown in Table B-3, the maximum concentrations detected in the soil have now decayed sufficiently to qualify for unrestricted land use, suggesting ICs can be removed.

B-4. TRA-X—HOT TREE SITE

When workers trimmed a spruce tree on the ATR Complex grounds, it was discovered that the branches of the tree were contaminated with gamma-emitting radionuclides. In May 1994, the tree was removed, boxed, and dispositioned. The suspected contamination source at the Hot Tree Site (see Figure BB-2 in Appendix BB) was a carbon steel warm waste line that originated in the gamma facilities building (TRA-641). However, results of the field investigation did not confirm the waste line as the source of the contamination in the removed spruce tree. The line is located approximately 3 m (10 ft) west and 1.8 m (6 ft) below the former location of the removed spruce tree. The warm waste transferred through this line was low-pressure, demineralized acidic water (pH 5.0 to 7.0). The acidic condition of the

waste could have contributed to the deterioration of the line, leading to potential releases due to a break in the line. The line was cut and capped in 1983 (DOE-ID 1997a).

After the removal of the tree in 1994, 10 soil samples (approximately 0.6 m [2 ft] deep) were collected from the area immediately surrounding the tree-removal site, and the tree's root system was surveyed. (Survey results are shown in Figure BB-2 in Appendix BB.) Though not definitive, surface screening of the adjacent trees showed no contamination (Burton and Lientz 1995). Surface radiation surveys of the Hot Tree Site performed around this time period indicated a radiation dose rate of 30–40 $\mu\text{rem}/\text{hour}$ at waist height (i.e., background levels) (Burton and Lientz 1995). At the same time, three soil samples—identified as A, B, and C—were collected and submitted to the Radiation Measurements Laboratory for analysis. As indicated in Figure BB-2, the highest contamination results were located on the west side of the Hot Tree Site, suggesting that the hot waste line was the contamination source. For those samples submitted to the Radiation Measurements Laboratory, Cs-137 was detected at the following concentrations: 6.2E-01 pCi/g, 3.2E+00 pCi/g, and not detected (unvalidated results) (Burton and Lientz 1995).

The Work Plan for WAG-2 OU 2-13 discussed the 1995 sampling for the Hot Tree Site (Attachment III of Lientz et al. 1995). Samples from the three borings were field-screened for radiological contamination over 0.3-m (1-ft) intervals. If the screened interval was greater than 100 cpm above background radiation levels, a sample was collected for analysis. The sample-collection depths were developed based on the waste line's elevation being approximately 1.8 m (6 ft) bgs. The bias for collecting samples at 2.1–2.4 m (7–8 ft) and 2.7–3 m (9–10 ft) at the location nearest to the hot tree excavation was to determine the depth of contamination. Samples collected at depth from sample locations further out from the “hot tree” were used to document the lateral extent of the contamination. The sampling was designed to ensure that no hot spots were missed.

During the field investigation, two additional samples were collected in addition to those discussed in the OU 2-13 Work Plan (DOE-ID 1997a). These shallow composite soil samples were collected from the bottom of a drainage ditch adjacent to the Hot Tree Site. The decision to collect additional samples was based on results from field screening of the soil boring samples, which were all less than 100 cpm above background, and the fact that the ditch, if contaminated, could provide an infiltration source for the “hot tree.”

Low levels of Sr-90 were detected in all the samples analyzed, with concentrations ranging from 0.7 to 2.0 pCi/g. The highest concentration was detected in the deepest (2.7–3-m [9–10-ft] bgs) sample in one of the soil borings. The ditch samples had the higher concentrations of Sr-90. Low levels (3.1 and 4.8 pCi/g) of Cs-137 were found in both ditch samples. The 4.8 pCi/g of Cs-137 was the maximum detection of this COC from all sampling. The deeper ditch sample (0.2–0.3 m [0.5–1 ft]), which was approximately 0.9 m (3 ft) bgs, relative to the borings, also contained Co-60 at 0.35 pCi/g (DOE-ID 1997a).

The horizontal and vertical extent of contamination was not defined. However, with such low levels of detected contamination, it was determined that no additional field investigation was required. As discussed previously, surface screening of adjacent trees showed no contamination, and surface radiation surveys of the Hot Tree Site suggested that the contamination was confined to the tree itself. The Hot Tree Site COPC concentrations evaluated in the OU 2-13 Baseline Risk Assessment (see Appendix B, Table B-22, of the OU 2-13 Comprehensive RI/FS [DOE-ID 1997a]) were calculated from results obtained during the 1995 sampling at the site. The contaminant concentrations shown in Appendix B, Table B-22, of DOE-ID (1997a), are the maximum concentrations from the 1995 sampling data set. The OU 2-13 ROD indentified Cs-137 as the COC.

In the risk assessment performed in the OU 2-13 Comprehensive RI/FS, the concentrations were compared to slope factors provided by the *Health Effects Assessment Summary Tables (HEAST)* (EPA 1994) and used PRGs developed for use at the INL Site (Fromm 1996). Since that time, EPA has provided updated slope factors and PRGs for radionuclides presented on the EPA website (EPA 2009a). These were discussed in Appendix A of the last 5-year review document (DOE-ID 2007), but because they remained protective, the new values were not incorporated into any site-specific evaluation. To estimate the date for removal of institutional controls at this site, the concentrations detected at the site in 1995 were decayed and compared to the updated values in Table B-4. As shown, the Cs-137 concentration at 1E-04, is now below the PRG for the residential scenario. The Hot Tree Site was listed as a no action site, and land use was to be restricted to industrial land use for approximately 30 years or until the residential risk is less than 1E-04, based on a 5-year review (DOE-ID 2000a). As shown in Table B-4, maximum concentrations detected in the soil have now decayed to levels that qualify for unrestricted land use, suggesting ICs can be removed.

Table B-4. Comparison of decayed concentration of Cs-137 at TRA-X to new radionuclide preliminary remediation goals.

Contaminant of Potential Concern	Maximum (pCi/g)	Decayed to 1/1/2010	Resident 1E-04 Preliminary Remediation Goal	Decayed Concentration Below Preliminary Remediation Goal?
Cs-137	4.8	3.43	5.97E+00	Yes

B-5. OU 2-09—COLD WASTE POND (TRA-08)

The cold waste pond (CWP) is located approximately 137 m (450 ft) southeast of the ATR Complex security fence (see Figure BB-3 in Appendix BB). The pond has been continually managed as a disposal site for nonradionuclide-contaminated wastewater since its construction in 1982 and remains in use today. The pond consists of two cells (southern and northern) that are used for cold wastewater disposal from cooling tower blowdown, air conditioning units, secondary system drains, floor drains, and other nonradioactive drains throughout the ATR Complex. Each cell measures approximately 134 × 55 × 3 m (440 × 180 × 10 ft). Historically, only one of the two cells is used at a time, and the flow of wastewater is alternated from one cell to another on an annual basis.

Each of the two CWP cells is surrounded by a berm, and both cells are enclosed by fencing around the perimeter of the pond. Inlet piping to the southern cell is located in the northwest corner, and the inlet piping to the northern cell is located in the southwest corner.

B-5.1 Sampling History

During summer 1988, the U.S. Department of Energy Headquarters Environmental Survey Sampling Team from Oak Ridge National Laboratory collected environmental samples from the northern CWP inlet and berms. Samples were analyzed for pH, volatile organic compounds, inductively coupled plasma metals, mercury, chromium (total), anions, gross alpha, gross beta, gamma scan, and tritium oxide. Results from this sampling effort were reported in the Idaho National Engineering Laboratory Sampling and Analysis Data Document (ORNL 1989).

In 1990, a few soil samples, collected from the cell bottoms by the environmental monitoring unit, were analyzed for the Resource Conservation and Recovery Act (42 USC § 6901 et seq., 1976) toxicity characteristic leaching procedure metals group, gamma-emitting radioisotopes, and volatile

organic compounds (EG&G 1990). Low levels of gamma-emitting radionuclides were found on the pond berms in two samples. The maximum activity detected (EG&G 1990) was:

- Co-60 0.97 pCi/g
- Cs-134 0.39 pCi/g
- Cs-137 23.7 pCi/g
- Eu-154 0.6 pCi/g.

The low levels of gamma-emitting radionuclides were assumed to be a result of windblown soil contamination from the warm waste pond. Low levels of volatile organic compounds and metals detected in the pond sediments were present as a result of disposal practices. The metals were assumed to exist in the pond sediments as a result of naturally occurring metals concentrating in the water during cooling tower operations. The CWP was not sampled again for the 1993 Track 2 assessment, based on an agreement resulting from March 1992 meetings and conference calls with the Agencies (Salomon 1992).

These data and the existing sampling data and process knowledge of the CWP were used in the Track 2 assessment of the ponds performed in 1993 (Salomon et al. 1993). Because the metals were analyzed using the toxicity characteristic leaching procedure, a total concentration was estimated by determining the mean effluent liquid concentration of each COPC, estimating the COPC sediment concentration that would result from equilibrium partitioning with these liquid concentrations, and summing the calculated sediment concentrations with background concentrations reported in the Idaho National Engineering Laboratory Track 1 guidance document (DOE-ID 1992a). These calculations assumed that all contaminants contained in the effluent were deposited in the top 15.2 cm (6 in.) of sediment. Using this approach, the Preliminary Scoping Track 2 Summary Report for OU 2-09 (Salomon et al. 1993) indicated that risk may occur to the future resident at levels that would be unacceptable, and the site was brought forward to the OU 2-13 Comprehensive Remedial Investigation/Baseline Risk Assessment.

The OU 2-13 Comprehensive Remedial Investigation/Baseline Risk Assessment used the same approach for assessment (DOE-ID 1997a). The COPC concentrations evaluated in the OU 2-13 Baseline Risk Assessment were taken from Table B-3 of Attachment B1 in Salomon et al. (1993) for the metals and from the maximums detected for the organics and radionuclides (EG&G 1990). Because the metals concentrations were not based on measurements, and in order to provide a conservative estimate of the risk, the estimated concentrations were assumed to be present at all three depth intervals evaluated in the Baseline Risk Assessment (see Section 5.3.3 and Appendix B, Table B-221 of DOE-ID [1997a]). Arsenic and Cs-137 were identified as the COCs in the OU 2-13 ROD.

Not included in the OU 2-13 comprehensive assessment was the sediment sampling performed in May 1996. Sediment samples were collected from the CWP. The analyses required for this sampling event include gamma spectroscopy, gross alpha/beta, and Resource Conservation and Recovery Act sampling for underlying hazardous constituents. The radionuclide results are presented in the Closure Report for Sampling of the TRA CWP (Rice 1996). The OU 2-13 ROD indicates that these radionuclides, including Co-60, Cs-137, and Am-241, were detected at background or slightly above background concentrations. The Co-60 maximum was 1.09 mg/kg, the Cs-137 maximum was 9.2 pCi/g, and the Am-241 maximum was 0.14 pCi/g (Rice 1996). These results are comparable to those seen in the 1990 sampling effort. However, the risk presented by arsenic in the CWP in the assessment was based on assumptions about accumulation of arsenic in the pond sediments from historical pond discharge data rather than actual soil data. Based on these assumptions, arsenic was identified as a COC. However, toxicity characteristic leaching procedure data from sediment samples and metals data from effluent samples collected in May 1996 suggest levels of arsenic to be far below what was assumed for

risk-assessment purposes. Arsenic was not detected above instrument detection limits in the effluent samples, and toxicity characteristic leaching procedure concentrations of arsenic from the soil samples ranged from 0.042 to 0.076 mg/L.

Sampling was then performed as directed by the Field Sampling Plan (FSP) for Post-ROD Sampling and Field Screening of Selected Sites at WAG 2 OU 2-13 (DOE-ID 1998a) (see Figure BB-3 in Appendix BB]). This sampling was to determine the extent and character of the arsenic and Cs-137 contamination. The sampling was designed to determine whether arsenic was present in the pond sediments at levels exceeding the 18.3 mg/kg remediation goal or above the toxicity characteristic leaching procedure regulatory limit. This post-ROD sampling was also used to determine if arsenic hot spots were present. The samples collected for the arsenic study locations could not be located; however, the FSP (DOE-ID 1998a) presents tentative sampling locations. The OU 2-13 FSP states that two of the samples were to be biased toward the pond inlet because these areas hold the greatest chance for deposition of arsenic contamination, and three samples were to be collected down the center line of each pond (Section 4.2.1, DOE-ID 1998a). These data are presented in Appendix G of the Comprehensive Remedial Design/Remedial Action Work Plan for TRA OU 2-13 (DOE-ID 1998b). Based on the results of this sampling, arsenic was eliminated as a COC. This is verified in Table B-5. Table B-5 indicates that the maximum concentration detected at the pond is under the arsenic PRG for both human and ecological soil screening levels. The remediation goal set in the OU 2-13 ROD was 18.3 mg/kg.

Table B-5. Comparison of maximum detection of arsenic from 1998 sampling to preliminary remediation goals.^a

Contaminant	Maximum Source Concentration (mg/kg)	Background Concentration (mg/kg)	Preliminary Remediation Goal (mg/kg) (HQ = 1.0)	Ecological Screening Value (mg/kg)	Maximum Concentration Greater Than Screening Values?
Arsenic	12.7	5.80E+00	2.2E+01	1.80E+01	No

a. The PRG for arsenic is taken from *Human Health Medium-Specific Screening Levels* (EPA 2010b). Note that arsenic is both a carcinogenic and noncarcinogenic concern. The PRG for the carcinogenic risk is 38 mg/kg at the 1E-04 level. Therefore, the noncarcinogenic risk for a HQ of 1.0 is the limiting value at 22 mg/kg. The ecological screening levels are taken from *Ecological Soil Screening Levels for Arsenic* (EPA 2005).

HQ hazard quotient

PRG preliminary screening level

During this period, the remediation goal for Cs-137 was increased to 23.3 pCi/g (as discussed in the final OU 2-13 ROD [DOE-ID 1997b, 2000b]). Soil samples collected for arsenic analysis in 1998 were also sent to the TRA Radiation Measurements Laboratory for radionuclide analysis. Of these 10 samples, the five northern CWP results could not be found in the Administrative Record. Results of the five southern CWP samples were found reported in an interdepartmental communication (Daley 1998)—the concentration of Cs-137 ranges from 1.8 to 2.9 pCi/g.

For additional characterization, the Post-ROD FSP (DOE-ID 1998a) directed that the global positioning radiometric scanner (GPRS) be used at the northern CWP and the southern CWP. The field screening was used to determine locations for soil sampling for characterization. Six locations with elevated Cs-137 concentrations were sampled at the surface (i.e., 2.5–15 and 15–30.1 cm (1–6 and 6–12 in.) bgs. In addition, two points along the berm with lower Cs-137 values were sampled using this same approach. These grab samples were sent to the Radiation Measurements Laboratory for analysis. These post-ROD sampling data are presented in Appendix G of the Comprehensive Remedial

Design/Remedial Action Work Plan for OU 2-13 (DOE-ID 1998b). Results of the radionuclide surveys were used to determine locations for remediation.

In 1999, remedial actions were conducted at the CWP. This activity included the removal of approximately 61 m³ (80 yd³) of Cs-137-contaminated soil from the northern CWP. This soil was transported to warm waste pond Cell 1957 for disposal. Post-remediation samples were collected to verify that all contamination was removed from the northern CWP. These samples were collected in accordance with the project FSP (DOE-ID 1998c). Samples were delivered to the TRA Radiation Measurements Laboratory, and analysis was performed on the samples. These samples were below the Cs-137 remediation goal (DOE-ID 2000b). These data were presented in Appendix H of the Remedial Action Report for OU 2-13 (DOE-ID 2000b).

At the time of the remediation, no assessment of the final remaining concentration was conducted. The Explanation of Significant Differences (DOE-ID 2000a) for this site discussed that institutional controls were established, thereby restricting the site to industrial land use for less than 100 years, until residential risk is less than 1E-04, based on the results of a 5-year review.

Cs-137 concentrations were evaluated as compared to PRGs developed for use at the INL Site (Fromm 1996). Since that time, EPA has provided updated PRGs for radionuclides presented on the EPA website (EPA 2009a). These were discussed in Appendix A of the last 5-year review document (DOE-ID 2007); however, because they remained protective, the new values were not incorporated into any site-specific evaluation. To estimate the date for removal of institutional controls at this site, Cs-137 concentrations were decayed and compared to the updated PRG.

B-5.2 Evaluation of the Southern Cold Waste Pond

As discussed above, the 1998 post-ROD sampling of the southern CWP was performed to further characterize concentrations and locations of the COCs (Cs-137 and arsenic) (see Figure BB-4 in Appendix BB). These COCs were identified in past sampling activities at the CWP (Section 4.1.6, DOE-ID 1997a). As shown in Table B-5, the maximum arsenic concentration detected is below PRGs for both ecological and human health. Because the southern CWP was not remediated, the Cs-137 data collected at this time remain usable to determine the concentration in the pond.

In September 1999, as part of the post-remediation activity, 10 samples were taken from the southern CWP from the 0- to 15-cm (0- to 0.5-ft) -bgs depth to further characterize the concentration of contaminants. The locations of these samples are not documented. The FSP for Confirmation Sampling and Field Screening of Selected Sites at OU 2-13 (DOE-ID 1998) indicates that sampling was designed to be biased in the areas of highest suspected contamination. These samples were delivered to the TRA Radiation Measurements Laboratory for analysis. Of the 10 samples collected, one sample was above the 23.3-pCi/g Cs-137 remediation goal. An additional sample was collected from the same area, and four more samples were collected around the location. These five samples were elevated but were not above the remediation goal. These data are presented in Appendix H of the Remedial Action Report for OU 2-13 (DOE-ID 2000b).

As part of the post-ROD sampling activities, the southern CWP was scanned using the GPRS, mounted on the front of a four-wheel drive vehicle. The system was used to locate and document areas of high gamma activity. The detection system consisted of two large plastic scintillator detectors, which measure gross counts per second. The scan results are presented in Appendix G of DOE-ID (1998b). Because the range in the southern CWP was from less than 1 pCi/g to a value of 6.85 pCi/g in the pond bottom, no sodium iodide measurement or other sampling was performed at this time. The GPRS data

were assessed using ProUCL and decayed to January 1, 2010, and found to be at 2.6 pCi/g (the ProUCL analysis done for this assessment is presented in Table BA-1 in Appendix BA).

Table B-6 presents a summary of these different soil sampling efforts. Table B-7 presents the calculated UCLs on the mean and the results decayed to January 1, 2010. The data collected in 1998 and 1999 were decayed to January 1, 2010, and assessed using the ProUCL software and found to have a 95% UCL on the mean of 7.61 pCi/g (the ProUCL analysis done for this assessment is presented in Table BA-2 in Appendix BA). This will decay to an acceptable concentration (5.91 pCi/g) and institutional controls could be removed from this site in 2021.

Table B-6. Data available from various sampling events at the southern cold waste pond.

Sampling	Northern Pond	Status	Southern Pond	Status
1988 ORNL	pH, VOCs, inductively coupled plasma metals, Hg, Cr (total), anions, gross alpha, gross beta, gamma scan	Not used	NS	NA
1990 general monitoring	Limited sampling (see Figure BB-3 in Appendix BB)	Not used	Limited sampling (see Figure BB-3 in Appendix BB)	Not used
1996	TCLP metals	Not used	TCLP metals	Used for support
1998 soil samples	5-arsenic (RAD could not be found)	Used arsenic	5-arsenic and RAD	Used
1998 scans	RAD	Used for support	RAD	Used for support
1998 Post-ROD grab samples	RAD	Not used	NS	Not used
1999	RAD	Used	RAD	Used
NA	not applicable			
NS	not sampled			
ORNL	Oak Ridge National Laboratory			
RAD	radionuclides			
ROD	record of decision			
TCLP	toxicity characteristic leaching procedure			
VOC	volatile organic compound			

Table B-7. Comparison of decayed concentration of Cs-137 at the southern and northern cold waste ponds to the new cesium-137 preliminary remediation goals.

Cold Waste Pond Area	Contaminant of Potential Concern	95% UCL Decayed to 01/01/2010 ^a	Resident 1E-04 PRG	Decayed Concentration Below PRG?	Estimated Date Decayed to Below PRG
Northern	Cs-137	4.59	6 pCi/g	Yes	NA
	Cs-137 scans	4.40		Yes	NA
Southern	Cs-137	7.61	6 pCi/g	No	2021
	Cs-137 scans	2.62		Yes	NA

a. All concentrations were decayed to January 1, 2010, before calculating a 95% UCL on the mean. The ProUCL results are presented in Appendix BA.

CWP cold waste pond
NA not applicable
PRG preliminary remediation goal
UCL upper confidence limit

B-5.3 Evaluation of the Northern Cold Waste Pond

As part of the 1998 post-ROD sampling activities, the northern CWP was scanned using the GPRS, mounted on the front of a four-wheel drive vehicle. The system was used to locate and document areas of high gamma activity. Results of this scan are presented in Appendix G of DOE-ID (1998b). Measurements at some points indicated elevated Cs-137 concentrations. The areas showing elevated concentrations were rescanned. The southwestern corner of the northern CWP had several locations with elevated Cs-137 concentrations. These points were also surveyed with the Bendix NaI detector to establish locations for sampling. At six locations with elevated Cs-137, concentrations were sampled from the surface–2.5–15 and 15–30.1 cm (1–6 and 6–12 in.) bgs. In addition, two points along the berm with lower Cs-137 values were sampled using this same approach. These grab samples were sent to the Radiation Measurements Laboratory for analysis. These data are presented in Table G3-1 in Appendix G of DOE-ID (1998b). The data collected indicate that the Cs-137 in the southwestern and northwestern corners of the pond is elevated at depth while the berm is not. In 1999, these elevated areas in the northern CWP were remediated. The area remediated is shown in Figures BB-3 and BB-4 in Appendix BB.

The scan data are not recommended for final decision-making because of limitations in the method; however, these data provide verification of the overall site average. To supply supporting information, all the GPRS data (included pre-remediation) were assessed using EPA's ProUCL and found to have a 95% UCL on the mean of 5.73 pCi/g (the results from the assessment are presented in Table BA-3 in Appendix BA). This decayed to a value of 4.40 pCi/g by January 1, 2010.

After the remediation in September 1999, 15 samples and duplicates were collected from the northern CWP. The locations of these samples were not documented, but the FSP for Confirmation Sampling and Field Screening of Selected Sites at OU 2-13 (DOE-ID 1998c) indicates that the samples will confirm remedial actions by being biased in the areas of highest remaining contamination. These data are presented in Appendix H of the Remedial Action Report for OU 2-13 (DOE-ID 2000b). These data were assessed using the ProUCL software and found to have a 95% UCL on the mean of 5.87 pCi/g (results of this assessment are presented in Table BA-4 in Appendix BA). This decayed to 4.59 pCi/g by January 1, 2010.

The calculated UCLs on the means and the results decayed to the current timeframe are presented in Table B-7. Both the 95% UCL on the means calculated from the post-remediation data and the scans from the northern CWP are already decayed below acceptable levels, suggesting institutional controls could be removed at this site.

B-5.4 Summary of the Cold Waste Pond

The CWP was remediated in 1999 (DOE-ID 2000b). Both pre-remediation scans and pre- and post-remediation soil sampling results were evaluated to determine an average concentration. The post-remediation sampling is biased in that it was used to confirm remedial actions in the areas of highest remaining contamination. As discussed in Section B-5.2, the concentrations of Cs-137 and arsenic in the northern CWP are below levels of concern based on current EPA PRGs. As discussed in Section B-5.1, the concentration of arsenic at the southern CWP is within acceptable levels; however, the residual Cs-137 remains at levels that preclude unrestricted land use. The highest 95% UCL (calculated from the post-remediation sampling) on the mean at the southern CWP will decay to acceptable levels by January 1, 2021, suggesting, institutional controls at this site could be removed at that time.

B-6. OU 2-09—CHEMICAL WASTE POND (TRA-06)

The chemical waste pond is located east of the northern part of ATR Complex, as shown in Figures BB-6 through BB-8 in Appendix BB. The chemical waste pond was excavated and put into operation in 1962. It was an unlined surface impoundment 4.6 m (15 ft) deep and 51.8 m (170 ft) square and was surrounded by a 0.6–0.9-m (2–3-ft) -high berm. The chemical waste pond was designed as an infiltration pond to receive effluent containing mineral salts from the TRA demineralization plant. Average discharge to the chemical waste pond was approximately 57 L/m (15 gpm). In addition, until 1982, solid and liquid waste types were disposed of directly into the pond from a support structure constructed for waste disposal. This disposal included corrosives and other types of waste. It is estimated that three or four 55-gal drums were dumped into the chemical waste pond from the support structure. It is also noted in records that a 1,900-L (502-gal) tank containing battery acid from the Vehicle Storage Facility at the Central Facilities Area was drained into the chemical waste pond in August 1982. In May and June of 1995, approximately 1,068,788 L (287,100 gal) of liquid used to neutralize and flush out-of-service acid and caustic tanks (TRA-731B, C, D, and E) was disposed of to the pond. It is also known that Tanks TRA-731E and TRA-731D leaked during the flushing operations. Tank TRA-731E leaked approximately 3,785 L (1,000 gal) of liquid that had a measured chromium concentration of 3.93 ppm, and Tank-731D leaked approximately 1,893 L (500 gal) of liquid that had a measured mercury concentration of 1.81 ppm. The leaked liquid was collected in a nearby trench that had dimensions of approximately 0.3 × 30.5 m (1 × 100 ft). Accurate records were not kept, and details of the disposals to this waste pond are not known. Possible disposal of pesticides, solvents, PCBs, and biocides is suspected (Burns et al. 1990; ORNL 1989), but not documented.

B-6.1 Sampling History

The first sampling effort found was in 1987 to determine the presence and type of hazardous constituents in the TRA-06 CWP (see Figure BB-5 in Appendix BB). These data are presented and discussed in the Closure Plan for TRA Chemical Waste Pond (COCA Unit TRA-06) (Burns et al. 1990). The 1987 sampling methodology for TRA-06 CWP involved collecting grab samples of surface and subsurface soil at three different locations within the pond. Soil samples were collected at depths of 0–10 and 60–65 cm (0–4 and 24–26 in.) bgs. Samples collected for the COCA Survey (Burns et al. 1990) were submitted to Envirodyne Engineers for analyses between July 1 and July 24, 1987.

The second sampling event occurred when the U.S. Department of Energy Headquarters Environmental Survey Sampling Team from Oak Ridge National Laboratory collected environmental samples from the TRA-06 chemical waste pond during summer 1988. Results from this sampling effort were reported in the Idaho National Engineering Laboratory Sampling and Analysis Data Document (ORNL 1989). Water, sediment, and soil samples were collected within the pond and underlying region to determine the presence, type, and extent of contamination. Samples collected included:

- Vertical composite water samples from the pond's inlet and at a point in the pond where velocity decreased (reduced flow area)
- Four grab sediment samples collected at the same locations in the pond as water samples were collected (two samples at each location)
- Three grab soil samples collected from three locations along the perimeter of the pond and at depths ranging from 12–16 m (40–53.5 ft) bgs.

Samples were analyzed for pH, volatile organic compounds, pesticides, PCBs, inductively coupled plasma metals, atomic absorption mercury, atomic absorption chromium (total), anions, gross alpha, gross beta, gamma scan, and tritium oxide. Locations of samples are presented in Figure BB-5 in Appendix BB.

Environmental samples collected in 1990 verified the presence of potentially hazardous contaminants at the TRA-06 chemical waste pond and estimated the areal extent of contamination (Burns et al. 1990). Locations of samples collected from the chemical waste pond in 1990 are presented in Figure BB-6 in Appendix BB. Sampling was directed at the gravel section (approximately 60%) and a precipitate section (approximately 40%). The precipitate section covers a strip along the northern side of the pond and an area in the southwestern area of the pond. Limited sampling was performed at the inflow to the chemical waste pond and discharges into the southwestern area of the pond. A 15-m (50-ft) deep borehole was also drilled and sampled. The location of this borehole is approximately 5.8 m (19 ft) south of the fence surrounding the pond (see Figure BB-6 in Appendix BB). Six samples were collected from the borehole due to the depth of the bedrock (i.e., basalt). Based on the 1990 results, the preliminary COPCs in the chemical waste pond were considered to be barium, mercury, and PCBs (DOE-ID 1997a). The maximum concentrations of mercury (133 mg/kg) and barium (3,830 mg/kg) were from samples collected in the area where standing water occurs. This is consistent with the wastewater discharge and flow in the pond. Both mercury and barium are detected in the surface sediments at much higher concentrations than background. The average concentration of mercury exhibited a rapid decrease in measured concentration with depth. The barium also showed a decrease, and the average concentration at the 3–5-m (10–16-ft) -bgs interval was less than background level.

Table 7-1 of the ROD (DOE-ID 1997b) lists barium, manganese, mercury, and zinc as the COCs. The OU 2-13 Comprehensive Remedial Investigation/Baseline Risk Assessment assessed the site using the 1990 sampling data (DOE-ID 1997a). The concentrations calculated (see Appendix B, Table B-22, of DOE-ID [1997a]) were the 95% UCLs on the mean or maximum, whichever was less. The ROD implemented post-ROD sampling for further characterization to support remediation decisions.

Sampling was then performed, as directed by the FSP for Post-ROD Sampling and Field Screening of Selected Sites at OU 2-13 (DOE-ID 1998a). The sampling locations in the chemical waste pond are shown on in Figures BB-7 and BB-8 in Appendix BB. Sampling was biased toward the inflow area because this was potentially the most contaminated with the heavy metals of concern. Samples were collected from each location at depth intervals of 0–0.3 m (0–1 ft), 0.3–0.9 m (1–3 ft), and 0.9–1.5 m (3–5 ft) bgs, with the exception of Grids F-16, F-17, F-18, G-16, G-17, and G-18, in which samples were collected at the 0–0.3-m (0–1-ft) -bgs interval only. This sampling was designed to meet the following objectives:

- Determine the volume of mercury-contaminated soil for possible removal
- Determine whether the soil exhibits the toxicity characteristic for barium and mercury and what type of treatment would be required, if excavated
- Obtain data to use as the basis for determining the cost-effectiveness of excavation, disposal, and possible treatment of the soil versus construction of a native soil cover and long-term monitoring.

These post-ROD sampling data are presented in Appendix G of the Comprehensive Remedial Design/Remedial Action Work Plan for OU 2-13 (DOE-ID 1998b).

Based on the sampling results, it was determined that no soil removal would occur, and that the remediation at the chemical waste pond was the installation of a native soil cover to grade. Institutional controls were established, restricting the site to industrial land use for less than 100 years, until residential risk is less than $1\text{E-}04$, based on the results of a 5-year review (DOE-ID 2003).

Barium, manganese, mercury, and zinc were identified as COCs to the resident in the original assessment in the OU 2-13 ROD. All four COCs were reevaluated for this site in this 5-year review because of changes in toxicity and/or input values for risk assessment. EPA reviewed barium and zinc

toxicity in 2005, and though EPA did not change the toxicity for zinc, the uptake factors currently used by EPA for the calculation of PRGs for irrigated sites are less conservative. The toxicity value for barium was changed in 2005 and is less conservative. Since the initial analysis of this site, EPA has also reviewed and modified the toxicity data for mercury (EPA 2010a), and the Mercury Report to Congress (EPA 1997) also presents a less conservative value for uptake. Manganese values have not changed; but, during review of the data, it became apparent that all the data were not included in the OU 2-13 Comprehensive RI/FS (DOE-ID 1997a), and some of the data presented was misinterpreted.

B-6.2 Reevaluation of TRA-06

The first step was to compile the data because new data that were collected in 1998 (as well as other years) had not been included in the original risk assessment presented in the OU 2-13 Comprehensive RI/FS (DOE-ID 1997a). TSF-06, the CWP, was sampled in 1987, 1988, 1990, and 1998. These data are summarized in Tables B-8 through B-11. The 1987 and 1988 data are surface samples. The 1990 data were collected at various depths, as indicated. The latest data were collected in 1998 at a number of gridded locations within the pond, from 0–0.3-, 0.3–0.6-, and 0.9–1.5-m (0–1-, 1–2-, and 3–5-ft) depths (see Table B-11 and Figures BB-7 and BB-8 in Appendix BB). A more complete evaluation of the site can be performed when all the data are evaluated.

B-6.2.1 Manganese and Zinc

Soil samples collected in 1987 were not analyzed for either manganese or zinc. Evaluation of the 1988 data indicates that all concentrations of both zinc and manganese are below the INL Site background. In fact, both of these metals are at very low concentrations. As shown in Table B-9, the manganese 95/95% upper tolerance limit (UTL) at the INL Site for composite samples is 490 mg/kg (Rood, Harris, and White 1996). For those locations sampled in 1988, the manganese concentrations in the pond ranged from 6.9–9.1 mg/kg, which is well below the background concentration. As shown in Table B-9, the 95/95% UTL for zinc at the INL Site (Rood, Harris, and White 1996) for composite samples is 150 mg/kg. For those locations sampled in 1988, the zinc concentrations in the pond ranged from 3.2–5.5 mg/kg, which is well below the background concentrations.

Table B-8. Concentrations of contaminants of concern from samples collected at the chemical waste pond in 1987.

Inorganic	Sample ID	Concentration (ppm) (mg/kg)
Barium	TR0687003	24,500
Barium	TR0687004	2,150
Mercury	TR0687001	22
Mercury	TR0687002	11
Mercury	TR0687003	45
Mercury	TR0687004	28
Mercury	TR0687005	5.8
ID identifier		

Table B-9. Concentrations of contaminants of concern from samples collected at the chemical waste pond in 1988.

Description	Mercury (mg/kg)	Barium (mg/kg)	Manganese (mg/kg)	Zinc (mg/kg)
Sample #1	91	8,520	6.9	3.2
Sample #2	34	1,990	9.1	5.5
Sample #3	43	2,860	7	4.9
Sample #4	31	1,460	8.6	3.9
INL Site background (95/95% UTL) composite	0.05	300	490	150
INL Site background (95/95% UTL) grab	0.074	440	700	220

INL Idaho National Laboratory
UTL upper tolerance limit

Table B-10. Concentrations of contaminants of concern from samples collected at the chemical waste pond in 1990.

Contaminant of Concern	Data	Sample Location						
		Undisturbed Area	Borehole	Drain Pipe Outlet	Gravel Area of Main Pond	Gravel Fan	Precipitate Area of Main Pond	Truck Ramp
Barium	Minimum (mg/kg)	177	134	1,370	113	997	75.6	156
	Maximum (mg/kg)	284	519	3,830	1,920	2,340	3,570	156
	Number of samples	10	8	4	18	2	27	1
Manganese	Minimum (mg/kg)	285	51.6	12	11.7	21.4	8.9	226
	Maximum (mg/kg)	483	915	17.2	46	22.3	40.8	226
	Number of samples	10	8	4	18	2	27	1
Mercury	Minimum (mg/kg)	0.02	0.06	25.6	0.09	105	0.16	0.21
	Maximum (mg/kg)	0.03	0.17	86.7	30	115	133	0.21
	Number of samples	10	8	4	18	2	27	1
Zinc	Minimum (mg/kg)	91.3	30.3	2.3	2.8	8.8	2.3	55.6
	Maximum (mg/kg)	144	210	7.8	33.4	9	20.8	55.6
	Number of samples	10	8	4	18	2	27	1

Table B-11. Concentrations of contaminants of concern from samples collected at the chemical waste pond in 1998, by depth.

Standard Constituent	Data (mg/kg)	Concentrations for Sample Depth		
		0–1 (ft)	1–2 or 3 (ft)	3–5 (ft)
Barium	Minimum	546	166	137
	Maximum	3,170	1,010	562
Manganese	Minimum	2.7	1.2	0.9
	Maximum	18.8	12.3	12.4
Mercury	Minimum	1.7	2.9	0.3
	Maximum	161	22.6	10.5
Zinc	Minimum	1.3	1	0.92
	Maximum	11.2	6.3	6.4
	Data (µg/L)			
Barium	Minimum)	549	Not sampled	Not sampled
	Maximum	3,220	Not sampled	Not sampled
Mercury	Minimum	0.2	0.2	0.54
	Maximum	9.9	47	49

Sampling in 1990 was more extensive in looking at concentrations at depth and included an undisturbed background area (see Table B-10). As shown in Table B-10, for those samples collected at the area considered undisturbed, the manganese concentration of these 10 samples ranged from 285–483 mg/kg, which is within the range of background found by Rood, Harris, and White (1996). Similarly the barium, mercury, and zinc samples at the undisturbed location are also within the range of background found by Rood, Harris, and White (1996).

In 1990, one sample was taken from the truck ramp. The truck ramp sample 0–15 cm (0–0.5 ft) bgs is also below background for barium, manganese, and zinc, with the exception of mercury, which was 0.21 mg/kg. As shown in Table B-10, the concentrations of manganese and zinc are both below what would normally be expected in soils in this area in the drain pipe outlet (0–15 cm [0–0.5 ft]), gravel fan (0–15 cm [0–0.5 ft]), gravel area (0–4.9 m [0–16 ft]) bgs, and precipitate area (0–4.9 m [0–16 ft]) bgs of the main pond locations. The manganese concentrations in these areas range from 8.9–46 mg/kg. The zinc concentrations range from 2.3–33.4 mg/kg. Sampling from the pond in 1990 indicates that, in the pond area, only one location has elevated levels of either zinc or manganese. These sampling data collected from 14 and 15 m (45 and 50 ft) bgs from the borehole sample were elevated. In the borehole at depth, manganese concentrations were 803 and 915 mg/kg, and zinc concentrations were 177 and 210 mg/kg.

Evaluation of the additional data collected by depths and performed in 1998 indicates that all concentrations of both zinc and manganese are under the INL Site background. In fact, both of these metals are at very low concentrations as compared to expected background at this location. For those locations sampled in 1998, the manganese concentrations in the pond ranged from 0.9–18.8 mg/kg, which is well below the background concentrations and could be considered limiting for plant growth. For those locations sampled in 1998, the zinc concentrations in the pond ranged from 0.92–11.2 mg/kg, which is

well below the background concentrations and could be considered limiting for plant growth because zinc plays an essential metabolic role in plant growth.

Two detections out of 59 samples taken in 1990 and 89 samples taken in 1998 for manganese exceeded background values used at the INL Site (Rood, Harris, and White, 1996). These were both from deeper than 3 m (10 ft) bgs and would not be available for uptake in a homegrown-produce scenario. In addition, these concentrations should be considered to be within the range of what would be expected for background. Both are biased grab samples (803 and 915 mg/kg) from deeper than 14 m (45 ft) within the borehole sampling taken at TRA-06. Given the number of samples, it is possible to evaluate against background at the 99/99% UTL. Rood, Harris, and White (1996) states that:

...when less than 5% of the site concentrations is greater than the 95/95% UTL, background concentrations of an analyte may still be indicated. In these instances, comparison of the site concentrations to the 95/99% UTL is warranted. If none of the 5% of the site concentrations of a given analyte exceeds the 95/99% UTL and the remaining 95% is below the 95/99% UTL, then the analyte can be removed for further evaluation.

The 95/99% UTL for manganese is 860 mg/kg for bias samples. Manganese was not identified as a groundwater issue (see Table B-29 of the OU 2-13 Comprehensive RI/FS [DOE-ID 1997a]); therefore, manganese can be eliminated as a COC.

As shown in Tables B-10 and B-11, concentrations of zinc in the environment at this pond are related to the manganese. Two detections out of 59 samples taken in 1990 and 89 samples in 1998 for zinc exceeded background values used at the INL Site (Rood, Harris, and White 1996). These were both deeper than 14 m (45 ft) bgs and would not be available for uptake in a homegrown-produce scenario. Again, these should be considered within the range of what would be expected for background as well. Both are biased grab samples (177 and 210 mg/kg) taken from deeper than 14 m (45 ft) bgs from the borehole at TRA-06. Again, comparing the number of samples, it is possible to evaluate against background at the 95/99% UTL. Rood, Harris, and White (1996) states that, in some instances, when less than 5% of the site concentrations is greater than the 95/95% UTL, background concentrations of an analyte may still be indicated. In these instances, comparison of site concentrations to the 95/99% UTL is warranted. If none of the 5% of the site concentrations of a given analyte exceeds the 95/99% UTL and the remaining 95% is below the 95/99% UTL, then the analyte can be removed from further evaluation (Rood, Harris, and White 1996). The 95/99% UTL for zinc is 270 mg/kg for bias samples, and both detections are below this value. Note that detections are also below the 95/95% UTL for zinc (220 mg/kg). Zinc was not identified as a groundwater issue (see Table B-29 of the OU 2-13 Comprehensive RI/FS [DOE-ID 1997a]); therefore, zinc can be eliminated as a COC.

This pattern of concentrations is repeated for many of the natural metals at this location. It is difficult to believe that the metals could be leached from the pond bottom in such a consistent pattern. Therefore, it is believed that the subsurface soil at this location is low in these metals until at 14 m (45 ft) bgs, a strata of subsurface soil has levels more similar to background due to changes in subsurface conditions. However, the concentrations are not elevated, and manganese and zinc should be removed as COCs.

B-6.2.2 Barium and Mercury

Soil samples collected in 1987 were analyzed for both barium and mercury. Both COCs were elevated in this sampling activity. Evaluation of the 1988 data indicates that all concentrations of both barium and mercury are above the INL Site background. As shown in Table B-9, the barium 95/95% UTL

at the INL Site for composite samples is 300 mg/kg (Rood, Harris, and White 1996). Concentrations detected in surface soil in 1988 are at a maximum of 8,520 mg/kg, which is greatly elevated from background. As shown in Table B-9, the 95/95% UTL for mercury at the INL Site (Rood, Harris, and White 1996) for composite samples is 0.05 mg/kg. For those locations sampled in 1988, the mercury concentrations in the pond ranged from 31–91 mg/kg, which is well above the background concentrations.

In 1990, one sample was taken from the truck ramp. The truck ramp sample, taken from 0–15 cm (0–0.5 ft) bgs, is also below background for barium, but not mercury (0.21 mg/kg). As shown in Table B-10, the concentrations of barium are above background in the drain pipe outlet data (0–15 cm [0–0.5 ft] bgs) gravel fan (0–15 cm [0–0.5 ft] bgs), gravel area (0–0.3 m [0–10 ft] bgs), and precipitate area (0–0.3 m [0–10 ft] bgs) of the main pond locations. Barium concentrations in these areas range from 620–3,830 mg/kg. The concentrations of barium return to within background in the deeper samples in this area.

As shown in Table B-10, the concentrations of mercury are above background in the drain pipe outlet data (0–15 cm [0–0.5 ft] bgs), gravel fan (0–15 cm [0–0.5 ft] bgs), gravel area (0–4.3 m [0–14 ft] bgs), and precipitate area (0–4.3 m [0–14 ft] bgs) of the main pond locations. The mercury concentrations in these areas range from 0.09–133 mg/kg. The concentration of mercury also returns to within background at depth (although at greater depth than the barium).

The concentrations found by soil sampling for barium and mercury indicate levels of concern in the surface and a number of subsurface locations at the pond. As shown in Tables B-10 and B-11, the highest concentrations are in the surface and decline with depth, still being above the level for release.

Analysis in the OU 2-13 Comprehensive RI/FS (DOE-ID 1997a) used a maximum detection from the 1990 sampling for evaluated mercury at the site and the 95% UCL on the mean for barium (i.e., 1,750 mg/kg). Combining all the data collected at the site, the maximum is 24,500 mg/kg from the earlier sampling. Using all the data, the EPA ProUCL calculates a 95% UCL on the mean of 32.6 mg/kg for mercury and 1,195 mg/kg for barium (this new analysis is presented in Tables BA-5, BA-6, and BA-7 in Appendix BA). If the risk analysis was performed with the new 95% UCL on the mean in conjunction with using the new uptake factors, this would reduce the hazard quotients at the site over a factor of 10. From analysis of the characterization of the site, it appears that the contamination could be removed in the top 3 m (10 ft) or less. The latest cleanup goals for mercury at the Central Facilities Area and Test Area North were considerably higher than initially developed for TRA-06. If this mercury cleanup goal was found to be applicable to this site, it may be reasonable to consider this site for remediation. However, any future remediation would require verification sampling at depth. The cleanup goals for this site would have to be recalculated if it appears that this site may be a candidate for remediation in the future. In the meantime, both barium and mercury will continue to remain as COCs into the indefinite future.

B-6.3 TRA-06—Summary

It appears that both zinc and manganese are at low concentrations in the surface soil of CWP to a depth of approximately 14 m (45 ft), while both barium and mercury were retained in the top soil depths of the pond. Based on new information available from EPA and new data collected as part of the post-remediation activities, all four COCs at this site (i.e., barium, manganese, mercury, and zinc) and their data were reevaluated. As discussed in detail above, reevaluation of both the manganese and zinc data indicates that these COC concentrations were not elevated, and both should be eliminated as a concern in this 5-year review. Reevaluation of the barium and mercury indicates that these COCs are at levels of concern. However, if the risk for these COCs was recalculated using the 95% UCL on the mean and updated values, the hazard quotient would be much less than calculated in the OU 2-13

Comprehensive RI/FS (DOE-ID 1997a). Tables BA-6 and BA-7 in Appendix BA provide 95% UCL calculations for all mercury and barium data collected at TRA-06.

From analysis of the characterization of the site, it appears that the contamination could be removed in the top 3 m (10 ft) or less. The latest cleanup goals for mercury (8.4 mg/kg) used at the Central Facilities Area and Test Area North were considerably higher than initially developed for TRA-06. If this mercury cleanup goal were found to be applicable to this site, it may be reasonable to consider this site for remediation. However, any future remediation would require verification sampling at depth. In the meantime, both barium and mercury will continue to remain as COCs into the indefinite future.

B-7. TRA-13—SEWAGE LEACH POND AND TRA-M—SEWAGE LEACH POND BERM AND SOIL CONTAMINATION AREA

The sewage leach ponds (SLPs) were part of the sewage treatment area at the ATR Complex (see Figures BB-9 through BB-12 in Appendix BB). This area was composed of an Imhoff tank, trickling filter, chlorination basin, sludge pit, and the leach ponds. The remediated SLPs (TRA-13) are located 45 m (150 ft) outside the ATR Complex security fence, directly east of the central part of ATR Complex (see Figure BB-9 in Appendix BB) and consisted of two cells (Cell 1950 and Cell 1965). The southern cell (Cell 1950) was constructed in 1950, and the northern cell (Cell 1965) was constructed in 1965. The dimensions of Cell 1965 were approximately $76 \times 15 \times 4$ m ($250 \times 50 \times 14$ ft), and Cell 1950 was approximately $76 \times 24 \times 5.4$ m ($250 \times 80 \times 18$ ft). Since 1952, the system was used continuously, receiving effluent from sanitary sewer drains throughout the ATR Complex. Based on effluent volumes available in the Industrial Waste Management Information System for March 1971 to December 1990, the average flow to the ponds was 7.9×10^5 gal/year (15 gal/minute). It was estimated that the total discharge to the sewage ponds through December 1990 was 2.03×10^{10} L (5.35×10^9 gal) (Doornbos et al. 1991).

During construction, the material excavated from the leach ponds was piled along the long axis of the cells, resulting in an uneven berm around the ponds. The berm was highest adjacent to the southern boundary of Cell 1950, where it was approximately 7.3 m (24 ft) from the pond bottom to the top of the adjacent berm. The SLP berms were assessed separately from the SLP bottoms and were included with the soil contamination area (SCA). The SCA is an area surrounding the SLP where elevated levels of radionuclides were detected (see Figure BB-11 in Appendix BB). The SLP berm and SCA were designated as TRA-M, and the SLP bottoms were designated as TRA-13.

B-7.1 Sampling History

Since 1986, the environmental monitoring unit routinely monitored the effluent to the SLPs. The nonradiological monitoring program analyzed the effluent for various metals, anions, and total organic carbon. A description of the sanitary sewage system, including results of effluent monitoring, is located in the Environmental Characterization Report for TRA (Doornbos et al. 1991). No monitoring of the radionuclide content in the effluent was performed at the site.

As part of the characterization program supporting CERCLA, extensive sampling was conducted in the ATR Complex area during 1990. To investigate potential contamination from the SLP, a borehole (SB-09) was drilled near the SLP (see Figure BB-9 in Appendix BB). Results from soil and sediment sampling from this borehole are located in Tables 4-20 and 4-21 of the Environmental Characterization Report for TRA (Doornbos et al. 1991). Table 4-20 indicated that no alpha- or beta-emitting radionuclides were present before reaching the 7.6–14.3-m (25–47-ft) -bgs level (Doornbos et al. 1991). The highest concentrations were found at 12–12.5 m (39–41 ft) bgs. The boring results indicate the presence of Sr-90

(beta-emitter) at 660 ± 63.6 pCi/g and Pu-238 at 18.9 ± 2.68 pCi/g, as well as other alpha-emitters (Doornbos et al. 1991). Table 4-21 of Doornbos et al. (1991) indicates that there were no detectable levels of man-made, gamma-emitting radioisotopes. Metals at SB-09 showed a presence at slightly above background levels, which is common for SLPs (Salomon 1992).

These positive radionuclide results in the borehole were detected in the shallow perched groundwater that occurs in the immediate vicinity of the SLP and retention basin and forms on the interface between the surficial alluvium and the underlying basalts at about 15 m (50 ft) bgs. These elevated levels of radionuclides in the shallow perched water are addressed in the OU 2-12 ROD (DOE-ID 1992b).

In 1991, the bottom of Cell 1965 of the SLP was sampled for gamma-emitting radioisotopes and surveyed for general radiation fields (Salomon 1992). Results indicated the presence of gamma-emitting radionuclides in the soil as high as 935 pCi/g and radiation fields as high as 2 mR/hour (Salomon 1992). In addition, low levels of gamma-emitting isotopes were found in vegetation within the pond (Salomon 1992). No other sampling within the pond is known to have been completed at this time (Salomon 1992).

The soil in the SLP bottoms was sampled in 1992 as part of the OU 2-09 Track 2 sampling. The FSP for the Track 2 investigation states that "...DOE, EPA Region 10, and the Idaho Department of Health and Welfare decided to collect soil samples from the SLP bottoms only" (Salomon 1992). At this time, the SCA and SLP berm sampling discussed in the draft scope of work was not conducted and the scope of work was superseded by the FSP (Salomon et al. 1993). As a result, the risk assessment performed in the Track 2 for OU 2-09 focused on the SLP bottoms, essentially using this to perform the risk assessment for the entire area (Salomon et al. 1993). The sampling locations are identified in Figures BB-10 and BB-11 in Appendix BB.

As part of the 1992 Track 2 investigation, radiation detection equipment was used to relocate the highest concentration of gamma-emitting radionuclides (935 pCi/g) found during the 1991 scan. This resulted in a grab sample being taken at sample location SLP-12 at the highest radiation field. This strategically located sample resulted in the highest total gamma concentration (198.3 pCi/g) found during the Track 2 investigation but was below the 935 pCi/g found previously. It is assumed that the radioactive particles creating the hot spots were removed as part of the samples during the previous sampling investigation. Therefore, the scan data were used to provide general information but were not used in the Track 2 assessment (Salomon et al. 1993).

The 1992 sampling was summarized and assessed in Appendix A of the OU 2-09 Track 2 Summary Report (Salomon et al. 1993). The maximum concentrations detected are listed in Table A-1 of Salomon et al. (1993). The contaminants considered (following screening) for Cell 1950 included Ag-108m, Co-60, Cs-134, Cs-137, Eu-152, and Eu-154. The contaminants considered (following screening) for Cell 1960 included Ag-108m, Co-60, and Cs-137 (Appendix A of Salomon et al. 1993).

During the 1993 interim action at the warm waste pond, Cs-137 hot spots were excavated at the SLP berm (see Figure BB-9 in Appendix BB). Because the SLP berms were known to have elevated radiation levels and because earthmoving equipment was readily available, DOE-ID considered it best management practice to remove as much contaminated soil from the SLP berms as practical during the Warm Waste Pond Interim Action. In accordance with the DOE-ID request, contractor personnel collected 10 soil samples from locations along the south-facing dike of the sewage lagoon. Samples were collected approximately 3m (10 ft) above the toe of the berm and spaced approximately 4.6 m (15 ft) apart. Results of the sample survey indicated that four of the 10 samples exhibited radioactivity above 100 cpm. A front-end loader was used to excavate approximately 3 m^3 (4 yd^3) of soil from each location

on the dike where the four samples were obtained. The excavated soil was placed on the bottom of warm waste pond Cell 1957 (INEL 1994). These survey results were not used in any evaluation since the contamination was removed.

The area was sampled in 1995 to support the OU 2-13 Comprehensive RI/FS (DOE-ID 1997a). As part of the OU 2-13 field sampling for the comprehensive RI/FS, samples were collected from 36 locations to characterize the SLP berm and SCA. Samples were collected from the upper 10 cm (4 in.) of soil. Analysis of 18 bias samples collected on Cell 1950 berm indicated Cs-137 was present, ranging from 3.8–29 pCi/g. Other gamma-emitting isotopes detected were Co-60, ranging from 1.29–11.6 pCi/g, and Ag-108m, ranging from 0.061–0.61 pCi/g. Am-241 was detected in only one berm sample at 0.14 pCi/g. Samples collected at random from locations in the remainder of the SCA, in general, had lower concentrations of radionuclide contamination. Gamma-emitting isotopes were detected in all samples, in the following ranges:

- Cs-137 15–39 pCi/g
- Co-60 0.31–10.2 pCi/g
- Ag-108m 0.0095–0.72 pCi/g
- Am-241 was found in only three samples and ranged from 0.15 to 0.9 pCi/g.

Only estimated values, below the detection limit, of Sr-90 were reported for SCA samples.

The SLP bottoms (TRA-13), the SLP berms, and SCA (TRA-M) were assessed in the OU 2-13 Comprehensive RI/FS (DOE-ID 1997a). The SLP bottoms were assessed using the 1992 data, and the SLP berms and SCA were assessed using the 1995 data. The OU 2-13 ROD found the SLP bottoms (TRA-13) to have Ag-108m, Cs-137, mercury, and zinc at levels of concern and the SLP berms and SCA (TRA-M) to have Cs-137 at levels of concern.

As part of the FSP for Post-ROD Sampling and Field Screening of Selected OU 2-13 Sites (DOE-ID 1998a), the SLP area was scanned for further characterization to identify areas of soil exhibiting Cs-137 concentrations greater than 23.3 pCi/g in order to reduce the radiation control zone footprint. The remediation goal for Cs-137 was increased to 23.3 pCi/g in the final OU 2-13 ROD (DOE-ID 1997b).

Field screening was used at the SLP berm to locate and define areas of Cs-137 contamination above the remediation goal of 23.3 pCi/g. The SLP berm was inaccessible to the GPRS system and was surveyed only with the high-purity germanium and the NaI scintillometer. Results of this sampling, including scans, are presented in Appendix G of the Post-ROD Sample Data (DOE-ID 1998b). Note that Appendix G states that the field measurements should not be viewed as an absolute contaminant measurement because the technique is not fully quantitative. However, the data were used to provide an areal trend of contaminant location. It indicated that the SLP berm has several areas with Cs-137 above 23.3 pCi/g. Locations where the Cs-137 values were near or above the remediation goal were staked and noted as sampling points. Soil samples were collected at the source of contamination at depth intervals of 0–15 cm (0–6 in.) and 15–30 cm (6–12 in.) for laboratory gamma-screening analysis. These grab samples were assessed at the Radiation Measurements Laboratory, and the results are presented in Table G3-2 of Appendix G of the Post-ROD Sample Data report (DOE-ID 1998b).

B-7.2 Remediation Activities

Major components of the remedial action for SLP (TRA-13) and the associated SLP berms and SCA (TRA-M) were:

- Containment by capping with a native soil cover constructed primarily of native materials
- Consolidation of soil from the berms surrounding the SLP and from an appropriate borrow source located at the INL Site
- Contouring and grading of surrounding terrain to direct surface water runoff away from the cover
- Final cover layer material vegetated with crested wheatgrass
- Periodic inspection and maintenance following completion of the cover to ensure integrity and surface drainage away from the cover
- Access restrictions consisting of posted signs and permanent markers
- Restrictions limiting land use for at least 100 years following completion of the cover
- Review of the remedy no less than every 5 years until determined to be unnecessary by the regulatory agencies.

The native soil cover installed on SLP consists of three layers:

1. General backfill layer of approximately 4,664 m³ (6,100 yd³) of Type “C1” soil, 1,094 m³ (1,431 yd³) of Type “C2,” and 3,135 m³ (4,100 yd³) of Type “B” was used at the SLP (DOE-ID 2000b). These soils were used to bring the pond up to the design slope (rough grade). The Type “C2” soil, which was radiologically contaminated, came from the SLP berms. This soil was placed in the bottom of the SLP before any other soils.
2. 1,989 m³ (2,600 yd³) of a compacted low-permeability soil layer (Type “A”) was used to bring the SLP up to final grade (see final grade drawing in Appendix C in DOE-ID [2000b]).
3. Topsoil layer or Type “A” that created the final grade and allows for growth of the vegetative cover.

During the remedial action at SLP, it was determined to place 15 cm (6 in.) of clean Type A fill material over the entire SCA. Before placement of the 15 cm (6 in.) of material, the Agencies were informed of the proposed placement during a WAG 2 weekly conference call and agreed to this action. The project team felt this action was required for three main reasons:

1. To allow easy access around the SLP for the subcontractor
2. To prevent additional spread of contamination
3. To support the Radiological Control organization in controlling air emissions of radiological fugitive dust (Section 4, Parsons [1999]).

The final sampling at this location was directed by the FSP for Confirmation Sampling and Field Screening of Selected Sites at OU 2-13 (DOE-ID 1998c). The results of this sampling effort can be found in the Appendix G of the Remedial Design/Remedial Action Work Plan (DOE-ID 1998b).

B-7.3 Reevaluation of the Soil Contamination Area (TRA-M) and Sewage Leach Pond (TRA-13)

The OU 2-13 ROD found that the SLP bottoms (TRA-13) had Ag-108m, Cs-137, mercury, and zinc at levels of concern. The OU 2-13 ROD also identified that the SLP berms and SCA (TRA-M) had Cs-137 at levels of concern. Because the berms were remediated, TRA-M is now only the SCA. Zinc and mercury were identified in the OU 2-13 ROD as a risk to the resident in the original assessment; both now have new toxicity and/or other risk input information available. This is based on the EPA review of zinc

toxicity in 2005. Although EPA did not change the toxicity for zinc, the uptake factor currently used by EPA for the calculation of the zinc PRGs for irrigated sites is less conservative. Mercury was also reevaluated. Since the initial analysis of this site, EPA has also reviewed and modified the toxicity data for mercury. The Mercury Report to Congress (EPA 1997) also presents a less conservative value for the solubility limit, the soil-water partition coefficient, and plant uptake. Therefore, the mercury evaluation was reviewed at this site. Tables BA-8 and BA-9 provide 95% UCL on the mean for Ag-108m and Cs-137 at TRA-13.

Finally, the risk assessment performed in the OU 2-13 Comprehensive RI/FS (DOE-ID 1997a) compared the concentrations of radionuclides to slope factors provided by the *Health Effects Assessment Summary Tables (HEAST)* (EPA 1994) and used PRGs developed for use at the INL Site (Fromm 1996). Since that time, EPA has provided updated slope factors and PRGs for radionuclides, which are presented on the EPA website (EPA 2009a). These were discussed in Appendix A of the last 5-year review document (DOE-ID 2007); however, because they remained protective, the new values were not incorporated into any evaluation. To estimate the date for removal of institutional controls from this site, the data on radionuclide concentrations detected at the site were compiled and decayed for comparison to the updated, more appropriate PRGs.

As a result of these changes, all the COCs identified at TRA-13 are reevaluated in this 5-year review. As discussed in the sampling section, sampling and remediation of this area are complicated. A summary of the information used in the reassessment, is presented in Table B-12. This table also indicates the sampling data that were used to determine a 95% UCL on the mean for this reevaluation. The approach for this 5-year assessment assumes that the SLP berms no longer exist because they were pushed into the SLP bottoms. The concentration of the soil from the berm is now included with the concentration of the contamination present in the pond bottom.

B-7.3.1 Reassessment of Nonradionuclides

B-7.3.1.1 Zinc. In reviewing the zinc data, it was noted that a 95% UCL on the mean for the concentration for zinc was calculated as 343 mg/kg. This was calculated using one-half the detection-limit approach. Reexamination of the data indicated that the zinc ‘U’ flag data qualifications in SDG 2SL10201C1 were a result of rinsate blank contamination that identified the data as nondetectable at the reported values. That data assessment was based on established data validation procedures. This does not mean that the results are nondetect down to the detection limit but that they can be considered nondetect at the reported value. The values can be conservatively used as detections to calculate a 95% UCL on the mean across the area of 424 mg/kg (see Table B-12 and Table BA-10 in Appendix BA).

Table B-12. Exposure point concentrations for nonradionuclides used in the assessment at the TRA-13.

Nonradionuclide	Maximum Concentration Detected	No. Detects/No. Samples	Residential Exposure Point Concentration (mg/kg) ^a	Update 95% UCL on the Mean (mg/kg) ^b
Zinc	795	2/17	343	433.8
Mercury	4.7	16/17	4.7	2.54

a. Used in OU 2-13 Comprehensive RI/FS (DOE-ID 1997a).

b. Used for reevaluation. Calculated using the EPA ProUCL software (EPA 2009b) and as discussed in Section B-7.3.1.

EPA U.S. Environmental Protection Agency
OU operable unit
RI/FS remedial investigation/feasibility study
UCL upper confidence limit

The hazard quotient is a comparison of an estimated chemical intake (dose) with a reference dose level below which adverse health effects are unlikely. The hazard quotient is expressed as the ratio of the estimated intake to the reference dose. The value is used to evaluate the potential for noncancer health effects (e.g., organ damage) from chemical exposures. This estimate is derived using Equation (B-2).

$$HQ = RfD/Intake \quad (B-2)$$

Where

- HQ = hazard quotient (unitless)
- Intake = contaminant intake (mg/kg-day)
- RfD = reference dose (mg/kg-day)⁻¹.

The most conservative scenario used for assessment and decision-making at the INL Site is exposure to the future resident. As part of the residential scenario, a hazard quotient for homegrown produce is calculated. The conclusion to include zinc and the associated cleanup goal developed for the OU 2-13 ROD was developed from the back-calculation of the homegrown-produce scenario. This calculation was made using a very conservative uptake factor. This conservative uptake factor was presented in an International Atomic Energy Agency report (IAEA 1994) and was the most conservative factor recommended for use (35 mg COC/kg plant/mg COC/kg soil dry weight). Another value from the same report is currently recommended on the EPA-sponsored website (ORNL 2009) and is a more representative value (0.9 mg COC/kg plant/mg COC/kg soil dry weight). This more-appropriate uptake factor should be used in the development of a homegrown produce hazard quotient. The intakes and associated hazard quotients calculated for the homegrown-produce pathway from the OU 2-13 Comprehensive RI/FS (DOE-ID 1997a) are summarized in Table B-13. As shown, the hazard quotient for the homegrown-produce route is the highest. The hazard quotients were recalculated using the approach in the OU 2-13 RI/FS, but with the updated concentration and uptake factors. As shown in Table B-14, by using the new values, the hazard quotient contribution from zinc at this site is now below 1.

It is also important to note that the EPA PRG provided for zinc was 2,400 mg/kg, which is much more than the maximum detection of this metal (795 mg/kg) at this site. This value is also below one-half the EPA PRG provided for zinc (1,200 mg/kg). The value would be divided by one-half to account for the presence of multiple noncarcinogenic COCs.

B-7.3.1.2 Mercury. Similar to the approach used for zinc, the mercury data were reevaluated. It was determined that enough information was available to calculate a 95% UCL on the mean for this COC. This new value is presented in Table B-13, and the ProUCL calculation is presented in Table BA-11 in Appendix BA. The most conservative scenario used for assessment and decision-making at the INL Site is exposure to the future resident. As part of the residential scenario, a hazard quotient for homegrown produce is calculated. The conclusion to include mercury and the associated cleanup goal developed for the OU 2-13 ROD was developed from the back-calculation of the homegrown produce scenario. This calculation was made using a conservative uptake factor. This conservative uptake factor was presented in an International Atomic Energy Agency report (IAEA 1994) and represents the highest value seen across several studies.

The Mercury Report to Congress (EPA 1997) presents a less conservative value for the solubility limit, the soil-water partition coefficient, and plant uptake, as is shown in Table B-15. The toxicity values used are also presented.

Table B-13. Summary of hazard quotients at TRA-13 calculated in the OU 2-13 Comprehensive RI/FS (DOE-ID 1997a).

Nonradionuclide	Soil Ingestion	Homegrown Produce Ingestion	Inhalation of Dust	Ingestion of Groundwater ^a
Mercury	0.05	2	0.0002	0.00
Zinc	0.004	2	No toxicity data	0.02

a. A hazard quotient was calculated for zinc associated with ingesting the COC maximum modeled groundwater concentrations at the ATR Complex. This was 0.02 from Table B-57 (DOE-ID 1997a). All other hazard quotients are taken from Table B-54 (DOE-ID 1997a).

ATR Advanced Text Reactor
COC contaminant of concern

Table B-14. Summary of hazard quotients at TRA-13 recalculated with updated concentrations and uptake value using the OU 2-13 Comprehensive RI/FS (DOE-ID 1997a) approach.

Nonradionuclide	Soil Ingestion	Homegrown Produce Ingestion	Inhalation of Dust	Ingestion of Groundwater ^b
Mercury	0.034	0.24	0.0002	0.00
Methyl mercury	0.0051	0.075	No toxicity data	0.00
Zinc	0.002 ^a	0.069	No toxicity data	0.02

a. The zinc soil ingestion appears to have declined from those reported in the OU 2-13 RI/FS. This issue was examined, and the considered opinion is that a typographical error occurred in the presentation of OU 2-13 results where the hazard quotient for the zinc ingestion was reported as 2E-03 instead of 4E-03. The mercury values did not have this issue.

b. A hazard quotient was calculated for zinc associated with ingesting the COC maximum modeled groundwater concentrations at the ATR Complex. This was 0.02 from Table B-57 (DOE-ID 1997a). All other hazard quotients are taken from Table B-54 (DOE-ID 1997a).

ATR Advanced Text Reactor
COC contaminant of concern
OU operable unit
RI/FS remedial investigation/feasibility study

Table B-15. Comparison of mercury values for modeling of human health risk.

	Previous Mercury Values	Updated Mercury Values	Updated Methyl Mercury Values
Fate and Transport			
Soil-water partition coefficient K_d (mL/g)	1.00E+02 ^a	1.00E+03 ^{b,c}	7.00E+03 ^{b,c}
Solubility limit (mg/L)	1.00E+06 ^a	5.6E-02 ^{b,c}	1.00E+06 ^a
Plant uptake factor	9.0E-01 ^d	1.0E-01 ^e	2.0E-01 ^e
Toxicity (mg/kg-day)			
Oral reference dose	3.00E-04 ^f	3.0E-04 ^g	1.0E-04 ^h
Inhalation reference dose	8.57E-05 ^f	3.0E-05 ^g	Not available

a. Conservative default values from the Track 2 Guidance (DOE-ID 1994).

b. Conservatively used the K_d and solubility limit for elemental mercury (EPA 1997).

c. EPA (1998).

d. Bums (1996).

e. EPA (1997).

f. DOE-ID (1997a).

g. Assuming mercury chloride (EPA 2009a).

h. EPA (2009a).

It is important in any former pond environment to evaluate the amount of methyl mercury that may be present. Limited information is available on the methylation of inorganic mercury (Hg) to methyl mercury in the terrestrial soil environment, and this was evaluated for the CFA-674 pond site (Van Horn and Stacey 2002). Lacking analytical data for methyl mercury at CFA-674, the Bailey and Gray study (Bailey and Gray 1995) was used as the basis to assume a percentage of methyl mercury to total mercury, which is used to calculate an acceptable remediation goal for cleanup of the CFA-674 pond. This range was 0.5–0.005%. Subsequent sampling at the CFA-674 pond to determine the percent of methyl to nonmethyl mercury at this site. The results of this study are presented in Appendix C of Remedial Action Report for OU 4-13 (DOE-ID 2004). Methyl mercury was only detected in one of the samples, and this sample was 0.008% of the total mercury detected. The maximum percentage of methyl mercury to mercury that could be calculated with the detection limit for the nondetects was 0.2%. Therefore, assuming that the mercury in the TRA-13 pond is 5% of the total concentration of mercury detected is conservative.

The associated hazard quotients calculated by ingestion route from the OU 2-13 RI/FS are summarized in Table B-14. As shown, the hazard quotient for the homegrown-produce route is the highest. The hazard quotients were recalculated using the approach used in the OU 2-13 RI/FS using the updated concentration and uptake factors. As shown in Table B-15, using the new values, the hazard quotient contribution from mercury at this site is now below 1.

B-7.3.1.3 Nonradionuclide Summary. In summary, it is apparent that there are hot spots of zinc and mercury in the subsurface soil in the bottom of the old pond. This would be consistent with the deposition of sewage in the past. The past decision on these two contaminants was driven by the homegrown-produce pathway, which used extremely conservative uptake factors or other values. Also, in the case of mercury, very conservative concentrations for assessment were used. A summary of the difference from the reevaluation of the data using the less conservative uptake factors and concentrations is presented in Table B-15. The next highest hazard quotients presented in the OU 2-13 Comprehensive RI/FS are from concentrations of cadmium (hazard quotient equals 0.02) and copper (hazard quotient equals 0.9). The total hazard index for the residential scenario is now less than 0.5. Therefore, zinc and mercury can be eliminated as a concern at this site in this 5-year review.

B-7.3.2 Reassessment of Radionuclides

B-7.3.2.1 TRA-M Soil Contamination Area. The TRA-M site was identified as the SLP berms and the SCA. Post-remediation, the SLP berms no longer exist as part of the TRA-M. The berm soil has been pushed into the bottom of the SLP for fill. Therefore, only the SCA is remaining in TRA-M and, as shown in Table B-16, the only data available for assessment were collected in 1995.

The radionuclide concentrations at TRA-M were compiled from the SCA sampling (1995). A 95% UCL on the mean was calculated and decayed to January 1, 2010, (11.35 pCi/g) and compared to the updated EPA residential PRG for Cs-137 at 1E-04 risk (5.97 pCi/g). As shown in Table B-17, the concentration of Cs-137 at TRA-M will not decay to acceptable levels for release for residential use until 2038. Therefore, institutional controls must remain in place at TRA-M until 2038.

Table B-16. Data available from various sampling events at the sewage leach pond area.

Sampling	Pond Bottoms	Berms	Soil Contamination Area	Associated	Used in Assessment?
1990 initial characterization	NS	NS	NS	SB-09 boring	No
1991 general monitoring	Scans	NS	NS	NS	No
1992 OU 2-09 Track 2	Metals/RADs/VOCs	NS	NS	NS	Yes
1993 warm waste pond remediation scans	NS	RAD	NS	NS	No
1995 OU 2-13 Comprehensive RI/FS	NS	RAD	RAD	NS	Yes
1998 post-ROD grab samples	RAD ^a	RAD ^a	NS	NS	Yes
1998 scans	RAD ^a	RAD ^a	NS	NS	Yes; used for support

a. It appears that both areas were sampled for radionuclides.

NS	not sampled	RI/FS	remedial investigation/feasibility study
OU	operable unit	ROD	record of decision
RAD	radionuclide	VOC	volatile organic compound

Table B-17. Comparison of decayed concentration of Cs-137 at TRA-M and TRA-13 to new radionuclide preliminary remediation goals.

Area	Contaminant of Potential Concern	95% UCL on the Mean (pCi/g)	Decayed to 01/01/2010 (pCi/g)	Resident 1E-04 PRG (pCi/g)	Decayed Concentration Below PRG?	Date Decayed to Below PRG	Decayed Concentration at that Date (pCi/g)
TRA-M	Cs-137	15.88	11.35	5.97	No	2038	5.96
TRA-13 ^a	Cs-137	19.95	19.95	5.94	No	2063	5.91
TRA-13 ^a	Ag-108m	0.453	0.453	1.68	Yes	NA	NA

a. For TRA-13, assumed all concentrations were decayed to January 1, 2010, before calculating a 95% UCL on the mean.

NA	not applicable
PRG	preliminary remediation goal
UCL	upper confidence limit

B-7.3.2.2 TRA-13. After the 1999 remediation, the SLP berms no longer exist because the contaminated soil has been pushed into the SLP bottoms for fill. Therefore, the characterization data collected for this location are now considered part of the SLP bottoms. The radionuclide concentrations at TRA-13 were compiled for the SLP bottoms (1992 and 1998 grab samples) and the SLP berms (1995 and 1998 grab samples). Including all appropriate data, the data were decayed to January 1, 2010, and a 95% UCL on the mean was calculated (19.95 pCi/g) and compared to the updated EPA residential PRGs for Ag-108m (1.68 pCi/g) and Cs-137 (5.97 pCi/g). The concentration of Ag-108m is now below levels of concern. However, the concentration of Cs-137 at TRA-13 will not decay to acceptable levels for release for residential use until 2063.

The 1998 scan was summarized. From the discussion in Appendix G (DOE-ID 1998b), it was difficult to determine whether both the SLP bottoms and/or the SLP berms were scanned. However, because the SLP berm was pushed into the SLP bottoms, it is not an issue. The 95% UCL on the mean

calculated merging the SLP bottoms soil sample data, and the SLP berm soil sample datum was 22.49 pCi/g (see Tables BA-12 and BA-13 in Appendix BA). This decayed to 17.3 pCi/g by January 1, 2010. This scan was across the SLP bottoms and the SLP berm area and reflects the concentration detected in the soil grab samples. Therefore, institutional controls must remain in effect for TRA-13 until 2063.

B-7.4 Summary of Reevaluation of TRA-13 and TRA-M

The SLP bottoms (TRA-13), the SLP berms and the SCA (TRA-M) were assessed in the OU 2-13 Comprehensive RI/FS (1997a). In the OU 2-13 Comprehensive RI/FS, the SLP bottoms were assessed using the 1992 data collected, and the SLP berms and SCA were assessed using the 1995 data. The OU 2-13 ROD found the SLP bottoms (TRA-13) to have Ag-108m, Cs-137, mercury, and zinc at levels of concern and the SLP berms and SCA (TRA-M) to have Cs-137 at levels of concern. During remediation, the SLP berms were pushed into the SLP bottoms and are now part of TRA-13. The SCA is the only area remaining to be evaluated as TRA-M.

The nonradionuclides data from TRA-13 were compiled and reevaluated to include the new EPA information now available. The past decision on these two nonradionuclides was influenced by the homegrown-produce pathway, which used extremely conservative uptake factors or other values. In the case of mercury, very conservative concentrations for assessment were used, and the 1992 data were used. A summary of the difference from the reevaluation of the data using the less conservative uptake factors and concentrations is presented in Table B-15. The next highest hazard quotients presented in the OU 2-13 Comprehensive RI/FS are from concentrations of cadmium (hazard quotient equals 0.02) and copper (hazard quotient equals 0.9). The total hazard index for the residential scenario is now less than 0.5. Therefore, zinc and mercury can be eliminated as a concern at this site in this 5-year review.

The radionuclide concentrations at TRA-13 were compiled for the SLP bottoms (1992 and 1998 grab samples) and the SLP berms (1995 and 1998 grab samples). Including these new data, a 95% UCL on the mean was calculated and decayed to January 1, 2010, and compared to the updated EPA residential PRGs (1E-04) for Ag-108m (1.68 pCi/g) and Cs-137 (5.97 pCi/g). The concentration of Ag-108m is now below levels of concern. However, the concentration of Cs-137 at TRA-13 will not decay to acceptable levels for release for residential use until 2063.

The radionuclide concentrations at TRA-M were compiled from the SCA sampling (1995). A 95% UCL on the mean was calculated and decayed to January 1, 2010, and compared to the residential PRG for Cs-137. The concentration of Cs-137 at TRA-M will not decay to acceptable levels for release for residential use until 2038.

B-8. REFERENCES

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Appendix BA

Supporting Risk Information for the Advanced Test Reactor Complex

Appendix BA

Supporting Risk Information for the Advanced Test Reactor Complex

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Table BA-1. 95% upper confidence level calculations for the 1998 global positioning radiometric scanner from the southern cold waste pond scans.

Southern Cold Waste Pond—Cs-137—Scan			
General Statistics			
Number of valid observations		63	
		Number of distinct observations	
		61	
Raw Statistics		Log-Transformed Statistics	
Minimum	0.282	Minimum of log data	-1.266
Maximum	6.85	Maximum of log data	1.924
Mean	2.332	Mean of log data	0.672
Median	2.03	SD of log data	0.629
SD	1.362		
Coefficient of variation	0.584		
Skewness	1.101		
Relevant Upper Confidence Level Statistics			
Normal Distribution Test		Log-normal Distribution Test	
Lilliefors test statistic	0.178	Lilliefors test statistic	0.124
Lilliefors critical value	0.112	Lilliefors critical value	0.112
Data not normal at 5% significance level		Data not Log-normal at 5% significance level	
Assuming Normal Distribution		Assuming Log-normal Distribution	
95% Student's-t UCL	2.619	95% H-UCL	2.791
95% UCLs (adjusted for skewness)		95% Chebyshev (MVUE) UCL	3.267
95% adjusted-CLT UCL	2.64	97.5% Chebyshev (MVUE) UCL	3.651
95% modified-t UCL	2.623	99% Chebyshev (MVUE) UCL	4.406
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.888	Data appear gamma distributed at 5% significance level	
Theta Star	0.807		
MLE of mean	2.332		
MLE of standard deviation	1.372	Nonparametric Statistics	
nu star	363.9	95% CLT UCL	2.615
Approximate Chi square value (.05)	320.7	95% jackknife UCL	2.619
Adjusted level of significance	0.0462	95% standard bootstrap UCL	2.613
Adjusted Chi square value	319.8	95% bootstrap-t UCL	2.637

Table BA-1. (continued).

Southern Cold Waste Pond—Cs-137—Scan			
Anderson-Darling test statistic	0.601	95% Hall's bootstrap UCL	2.654
Anderson-Darling 5% critical value	0.758	95% percentile bootstrap UCL	2.63
Kolmogorov-Smirnov test statistic	0.104	95% BCA Bootstrap UCL	2.646
Kolmogorov-Smirnov 5% critical value	0.113	95% Chebyshev(Mean, Sd) UCL	3.081
Data appear gamma distributed at 5% significance level		97.5% Chebyshev(Mean, Sd) UCL	3.404
		99% Chebyshev(Mean, Sd) UCL	4.04
Assuming Gamma Distribution			
95% approximate gamma UCL	2.647		
95% adjusted gamma UCL	2.654		
Potential UCL to use		Use 95% approximate gamma UCL	2.647

Table BA-2. ProUCL calculation of the 95% upper confidence limit on the mean for the southern cold waste pond 1998 and 1999 soil sampling data.

General Upper Confidence Level Statistics for Full Data Sets – Southern Cold Waste Pond Decayed Cs-137—All			
User selected options			
From file	\\Fsicp02\Projects\ECORISK\5-year review\prouclforTRA-08version2.wst		
Full precision	OFF		
Confidence coefficient	95%		
Number of bootstrap operations	2000		
General Statistics			
Number of valid observations	20	Number of distinct observations	19
Raw Statistics		Log-transformed Statistics	
Minimum	1.38	Minimum of log data	0.322
Maximum	20.75	Maximum of log data	3.033
Mean	5.543	Mean of log data	1.418
Median	3.5	SD of log data	0.752
SD	5.014		
Coefficient of variation	0.905		
Skewness	2.001		
Relevant Upper Confidence Level Statistics			
Normal distribution test		Log-normal distribution test	
Shapiro Wilk test statistic	0.755	Shapiro Wilk test statistic	0.951
Shapiro Wilk critical value	0.905	Shapiro Wilk critical value	0.905
Data not normal at 5% significance level		Data appear Log-normal at 5% significance level	
Distribution			
Assuming Normal Distribution		Assuming Log-normal Distribution	
95% Student's-t UCL	7.482	95% H-UCL	8.143
95% UCLs (adjusted for skewness)		95% Chebyshev (MVUE) UCL	9.626
95% adjusted-CLT UCL	7.923	97.5% Chebyshev (MVUE) UCL	11.46
95% modified-t UCL	7.565	99% Chebyshev (MVUE) UCL	15.07

Table BA-2. (continued).

General Upper Confidence Level Statistics for Full Data Sets – Southern Cold Waste Pond Decayed Cs-137—All			
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.604	Data appear gamma distributed at 5% significance level	
Theta Star	3.455		
MLE of mean	5.543		
MLE of standard deviation	4.376		
nu star	64.17		
Approximate Chi square value (.05)	46.74	Nonparametric Statistics	
Adjusted level of significance	0.038	95% CLT UCL	7.387
Adjusted Chi square value	45.57	95% jackknife UCL	7.482
Anderson-Darling test statistic	0.681	95% standard bootstrap UCL	7.337
Anderson-Darling 5% critical value	0.754	95% bootstrap-t UCL	9.145
Kolmogorov-Smirnov test statistic	0.17	95% Hall's bootstrap UCL	15.13
Kolmogorov-Smirnov 5% critical value	0.197	95% percentile bootstrap UCL	7.487
		95% BCA Bootstrap UCL	7.891
Data appear gamma distributed at 5% significance level		95% Chebyshev(Mean, Sd) UCL	10.43
		97.5% Chebyshev(Mean, Sd) UCL	12.54
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	16.7
95% approximate gamma UCL	7.61		
95% adjusted gamma UCL	7.806		
Potential UCL to Use		Use 95% approximate gamma UCL	7.61

Table BA-3. 95%UCL calculations for the 1998 global positioning radiometric scanner from the north cold waste pond scans (data not decayed).

Cs-137 Northern Cold Waste Pond Scan			
General Statistics			
Number of valid observations	88	Number of distinct observations	79
Raw Statistics		Log-transformed Statistics	
Minimum	0.112	Minimum of log data	-2.189
Maximum	19.3	Maximum of log data	2.96
Mean	3.901	Mean of log data	0.967
Median	2.49	SD of log data	0.938
SD	3.926		
Coefficient of variation	1.007		
Skewness	2.256		
Relevant Upper Confidence Level Statistics			
Normal Distribution Test		Log-normal Distribution Test	
Lilliefors test statistic	0.231	Lilliefors test statistic	0.126
Lilliefors critical value	0.0944	Lilliefors critical value	0.0944
Data not normal at 5% significance level		Data not lognormal at 5% significance level	
Assuming Normal Distribution		Assuming Log-normal Distribution	
95% Student's-t UCL	4.597	95% H-UCL	5.09
95% UCLs (adjusted for skewness)		95% Chebyshev (MVUE) UCL	6.136
95% adjusted-CLT UCL	4.697	97.5% Chebyshev (MVUE) UCL	7.036
95% modified-t UCL	4.613	99% Chebyshev (MVUE) UCL	8.803
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.372	Data do not follow a discernable distribution (0.05)	
Theta Star	2.843		
MLE of mean	3.901		
MLE of standard deviation	3.33		
nu star	241.5		
Approximate Chi square value (.05)	206.5	Nonparametric Statistics	
Adjusted level of significance	0.0473	95% CLT UCL	4.589
Adjusted Chi square value	206	95% jackknife UCL	4.597

Table BA-3. (continued).

Cs-137 Northern Cold Waste Pond Scan			
		95% standard bootstrap UCL	4.59
Anderson-Darling test statistic	2.522	95% bootstrap-t UCL	4.764
Anderson-Darling 5% critical value	0.773	95% Hall's bootstrap UCL	4.697
Kolmogorov-Smirnov test statistic	0.135	95% percentile bootstrap UCL	4.606
Kolmogorov-Smirnov 5% critical value	0.0973	95% BCA Bootstrap UCL	4.718
Data not gamma distributed at 5% significance level		95% Chebyshev(Mean, Sd) UCL	5.725
Assuming Gamma Distribution		97.5% Chebyshev(Mean, Sd) UCL	6.515
95% approximate gamma UCL	4.561	99% Chebyshev(Mean, Sd) UCL	8.065
95% adjusted gamma UCL	4.573		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	5.725

Table BA-4. ProUCL 95% UCL on the mean for north cold waste pond post-remediation soil sampling taken in 1999 (data not decayed).

Northern Cold Waste Pond Cs-137 1999			
General Statistics			
Number of valid observations	17	Number of distinct observations	17
Raw Statistics		Log-transformed Statistics	
Minimum	1.42	Minimum of log data	0.351
Maximum	10.3	Maximum of log data	2.332
Mean	4.727	Mean of log data	1.393
Median	4	SD of log data	0.602
SD	2.698		
Coefficient of variation	0.571		
Skewness	0.838		
Relevant Upper Confidence Level Statistics			
Normal Distribution Test		Log-normal Distribution Test	
Shapiro Wilk test statistic	0.905	Shapiro Wilk test statistic	0.949
Shapiro Wilk critical value	0.892	Shapiro Wilk critical value	0.892
Data appear Normal at 5% significance level		Data appear Log-normal at 5% significance level	

Table BA-4. (continued).

Northern Cold Waste Pond Cs-137 1999			
Assuming Normal Distribution		Assuming Log-normal Distribution	
95% Student's-t UCL	5.87	95% H-UCL	6.66
95% UCLs (adjusted for skewness)		95% Chebyshev (MVUE) UCL	7.938
95% adjusted-CLT UCL	5.946	97.5% Chebyshev (MVUE) UCL	9.31
95% modified-t UCL	5.892	99% Chebyshev (MVUE) UCL	12.01
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.735	Data appear normal at 5% significance level	
Theta Star	1.728		
MLE of mean	4.727	Nonparametric Statistics	
MLE of standard deviation	2.858	95% CLT UCL	5.803
nu star	93	95% jackknife UCL	5.87
Approximate Chi square value (.05)	71.76	95% standard bootstrap UCL	5.768
Adjusted level of significance	0.0346	95% bootstrap-t UCL	6.113
Adjusted Chi square value	69.8	95% Hall's bootstrap UCL	5.914
		95% percentile bootstrap UCL	5.753
Anderson-Darling test statistic	0.331	95% BCA Bootstrap UCL	5.902
Anderson-Darling 5% critical value	0.745	95% Chebyshev(Mean, Sd) UCL	7.58
Kolmogorov-Smirnov test statistic	0.118	97.5% Chebyshev(Mean, Sd) UCL	8.814
Kolmogorov-Smirnov 5% critical value	0.21	99% Chebyshev(Mean, Sd) UCL	11.24
Data appear gamma distributed at 5% significance level			
Assuming Gamma Distribution			
95% approximate gamma UCL	6.126		
95% adjusted gamma UCL	6.298		
Potential UCL to use		Use 95% Student's-t UCL	5.87

Table BA-5. TRA-06 summary of 1990 data.

Standard Constituent	Sample Level Top	Data	Borehole	Drain Pipe Outlet	Gravel Area of Main Pond	Gravel Fan	Precipitate Area of Main Pond	Truck Ramp
Barium	0	Minimum		1,370	710	997	620	156
		Maximum		3,830	1,920	2,340	3,570	156
		# samples		4	10	2	17	1
		# detects		4	10	2	17	1
	10	Minimum			199		95.1	
		Maximum			1090		108	
		# samples			3		2	
		# detects			3		2	
	11	Minimum			141		75.6	
		Maximum			141		332	
		# samples			1		7	
		# detects			1		7	
	14	Minimum			126		130	
		Maximum			168		130	
		# samples			3		1	
		# detects			3		1	
	15	Minimum	186		113			
		Maximum	186		113			
		# samples	1		1			
		# detects	1		1			
	20	Minimum	190					
		Maximum	190					
		# samples	1					
		# detects	1					
	30	Minimum	182					
		Maximum	182					
		# samples	1					
		# detects	1					

Table BA-5. (continued).

Standard Constituent	Sample Level Top	Data	Borehole	Drain Pipe Outlet	Gravel Area of Main Pond	Gravel Fan	Precipitate Area of Main Pond	Truck Ramp
	35	Minimum	156					
		Maximum	156					
		# samples	1					
		# detects	1					
	37	Minimum	134					
		Maximum	134					
		# samples	1					
		# detects	1					
	40	Minimum	168					
		Maximum	168					
		# samples	1					
		# detects	1					
	45	Minimum	372					
		Maximum	372					
		# samples	1					
		# detects	1					
	50	Minimum	519					
		Maximum	519					
		# samples	1					
		# detects	1					
Manganese	0	Minimum		12	11.7	21.4	8.9	226
		Maximum		17.2	19.9	22.3	21.6	226
		# samples		4	10	2	17	1
		# detects		4	10	2	17	1
	10	Minimum			14.2		17.5	
		Maximum			46		29.6	
		# samples			3		2	
		# detects			3		2	

Table BA-5. (continued).

Standard Constituent	Sample Level Top	Data	Borehole	Drain Pipe Outlet	Gravel Area of Main Pond	Gravel Fan	Precipitate Area of Main Pond	Truck Ramp
	11	Minimum			24.7		10.7	
		Maximum			24.7		40.8	
		# samples			1		7	
		# detects			1		7	
	14	Minimum			25.6		18.5	
		Maximum			29.6		18.5	
		# samples			3		1	
		# detects			3		1	
	15	Minimum	219		24.1			
		Maximum	219		24.1			
		# samples	1		1			
		# detects	1		1			
	20	Minimum	280					
		Maximum	280					
		# samples	1					
		# detects	1					
	30	Minimum	213					
		Maximum	213					
		# samples	1					
		# detects	1					
	35	Minimum	51.6					
		Maximum	51.6					
		# samples	1					
		# detects	1					
	37	Minimum	52.8					
		Maximum	52.8					
		# samples	1					
		# detects	1					

Table BA-5. (continued).

Standard Constituent	Sample Level Top	Data	Borehole	Drain Pipe Outlet	Gravel Area of Main Pond	Gravel Fan	Precipitate Area of Main Pond	Truck Ramp
	40	Minimum	104					
		Maximum	104					
		# samples	1					
		# detects	1					
	45	Minimum	915					
		Maximum	915					
		# samples	1					
		# detects	1					
	50	Minimum	803					
		Maximum	803					
		# samples	1					
		# detects	1					
Mercury	0	Minimum		25.6	7.4	105	6.5	0.21
		Maximum		86.7	30	115	133	0.21
		# samples		4	10	2	17	1
		# detects		4	10	2	17	1
	10	Minimum			0.39		0.47	
		Maximum			17.2		1	
		# samples			3		2	
		# detects			3		2	
	11	Minimum			1.2		0.16	
		Maximum			1.2		3.5	
		# samples			1		7	
		# detects			1		7	
	14	Minimum			0.37		2.6	
		Maximum			0.6		2.6	
		# samples			3		1	
		# detects			2		1	

Table BA-5. (continued).

Standard Constituent	Sample Level Top	Data	Borehole	Drain Pipe Outlet	Gravel Area of Main Pond	Gravel Fan	Precipitate Area of Main Pond	Truck Ramp
	15	Minimum	0.08		0.09			
		Maximum	0.08		0.09			
		# samples	1		1			
		# detects	1		1			
	20	Minimum	0.06					
		Maximum	0.06					
		# samples	1					
		# detects	1					
	30	Minimum	0.06					
		Maximum	0.06					
		# samples	1					
		# detects	1					
	35	Minimum	0.17					
		Maximum	0.17					
		# samples	1					
		# detects	1					
	37	Minimum	0.1					
		Maximum	0.1					
		# samples	1					
		# detects	0					
	40	Minimum	0.07					
		Maximum	0.07					
		# samples	1					
		# detects	1					
	45	Minimum	0.11					
		Maximum	0.11					
		# samples	1					
		# detects	1					

Table BA-5. (continued).

Standard Constituent	Sample Level Top	Data	Borehole	Drain Pipe Outlet	Gravel Area of Main Pond	Gravel Fan	Precipitate Area of Main Pond	Truck Ramp
	50	Minimum Maximum # samples # detects	0.11 0.11 1 0					
Zinc	0	Minimum		2.3	2.8	8.8	2.3	55.6
		Maximum		7.8	5.9	9	8.4	55.6
		# samples		4	10	2	17	1
		# detects		4	10	2	17	1
	10	Minimum			3.7		9	
		Maximum			33.4		14.3	
		# samples			3		2	
		# detects			3		2	
	11	Minimum			14.6		9.7	
		Maximum			14.6		20.8	
		# samples			1		7	
		# detects			1		7	
	14	Minimum			17.1		20.7	
		Maximum			19.6		20.7	
		# samples			3		1	
		# detects			3		1	
	15	Minimum	54.9		16.3			
		Maximum	54.9		16.3			
		# samples	1		1			
		# detects	1		1			
	20	Minimum	61.5					
		Maximum	61.5					
		# samples	1					
		# detects	1					

Table BA-5. (continued).

Standard Constituent	Sample Level Top	Data	Borehole	Drain Pipe Outlet	Gravel Area of Main Pond	Gravel Fan	Precipitate Area of Main Pond	Truck Ramp
	30	Minimum	61.2					
		Maximum	61.2					
		# samples	1					
		# detects	1					
	35	Minimum	30.3					
		Maximum	30.3					
		# samples	1					
		# detects	1					
	37	Minimum	32.4					
		Maximum	32.4					
		# samples	1					
		# detects	1					
	40	Minimum	56.8					
		Maximum	56.8					
		# samples	1					
		# detects	1					
	45	Minimum	177					
		Maximum	177					
		# samples	1					
		# detects	1					
	50	Minimum	210					
		Maximum	210					
		# samples	1					
		# detects	1					

Table BA-6. Calculation of the 95% upper confidence level on the mean for all the mercury data collected at TRA-06.

Mercury—TRA-06—All			
General Statistics			
Number of valid observations		150	
Number of distinct observations			127
Raw Statistics		Log-transformed Statistics	
Minimum	0.09	Minimum of log data	-2.408
Maximum	161	Maximum of log data	5.081
Mean	19.28	Mean of log data	2.253
Median	10.1	SD of log data	1.36
SD	26.15		
Coefficient of variation	1.356		
Skewness	3.06		
Relevant Upper Confidence Level Statistics			
Normal Distribution Test		Log-normal Distribution Test	
Lilliefors test statistic	0.231	Lilliefors test statistic	0.138
Lilliefors critical value	0.0723	Lilliefors critical value	0.0723
Data not normal at 5% significance level		Data not Log-normal at 5% significance level	
Assuming Normal Distribution		Assuming Log-normal Distribution	
95% Student's-t UCL	22.81	95% H-UCL	31.9
95% UCLs (adjusted for skewness)		95% Chebyshev (MVUE) UCL	39.19
95% adjusted-CLT UCL	23.36	97.5% Chebyshev (MVUE) UCL	45.89
95% modified-t UCL	22.9	99% Chebyshev (MVUE) UCL	59.04
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.824	Data do not follow a discernable distribution (0.05)	
Theta Star	23.41		
MLE of mean	19.28	Nonparametric Statistics	
MLE of standard deviation	21.24	95% CLT UCL	22.79
nu star	247.1	95% jackknife UCL	22.81
Approximate Chi square value (.05)	211.7	95% standard bootstrap UCL	22.73
Adjusted level of significance	0.0484	95% bootstrap-t UCL	23.59
Adjusted Chi square value	211.4	95% Hall's bootstrap UCL	23.54

Table BA-6. (continued).

Mercury—TRA-06—All			
Anderson-Darling test statistic	1.981	95% percentile bootstrap UCL	22.69
Anderson-Darling 5% critical value	0.791	95% BCA Bootstrap UCL	23.53
Kolmogorov-Smirnov test statistic	0.0844	95% Chebyshev(Mean, Sd) UCL	28.58
Kolmogorov-Smirnov 5% critical value	0.0793	97.5% Chebyshev(Mean, Sd) UCL	32.61
Data not gamma distributed at 5% significance level		99% Chebyshev(Mean, Sd) UCL	40.52
Assuming Gamma Distribution			
95% approximate gamma UCL	22.5		
95% adjusted gamma UCL	22.54		
Potential UCL to use		Use 97.5% Chebyshev (Mean, Sd) UCL	22.49

Table BA-7. Calculation of the 95% upper confidence limit on the mean for all the barium data collected at TRA-06.

Barium—TRA-06—All			
General Statistics			
Number of valid observations	147	Number of distinct observations	136
Raw Statistics		Log-transformed Statistics	
Minimum	75.6	Minimum of log data	4.325
Maximum	24,500	Maximum of log data	10.11
Mean	1,081	Mean of log data	6.426
Median	630	SD of log data	0.982
SD	2,182		
Coefficient of variation	2.019		
Skewness	8.881		
Relevant Upper Confidence Level Statistics			
Normal Distribution Test		Log-normal Distribution Test	
Lilliefors test statistic	0.323	Lilliefors test statistic	0.0442
Lilliefors critical value	0.0731	Lilliefors critical value	0.0731
Data not normal at 5% significance level		Data appear Log-normal at 5% significance level	

Table BA-7. (continued).

Barium—TRA-06—All			
Assuming Normal Distribution		Assuming Log-normal Distribution	
95% Student's-t UCL	1,379	95% H-UCL	1,195
95% UCLs (adjusted for skewness)		95% Chebyshev (MVUE) UCL	1,418
95% adjusted-CLT UCL	1,518	97.5% Chebyshev (MVUE) UCL	1,600
95% modified-t UCL	1,401	99% Chebyshev (MVUE) UCL	1,959
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.012	Data appear Log-normal at 5% significance level	
Theta Star	1,068	Nonparametric Statistics	
MLE of mean	1,081	95% CLT UCL	1,377
MLE of standard deviation	1,075	95% jackknife UCL	1,379
nu star	297.5	95% standard bootstrap UCL	1,369
Approximate Chi square value (.05)	258.6	95% bootstrap-t UCL	1,750
Adjusted level of significance	0.0484	95% Hall's bootstrap UCL	2,655
Adjusted Chi square value	258.2	95% percentile bootstrap UCL	1,413
Anderson-Darling test statistic	2.996	95% BCA Bootstrap UCL	1,614
Anderson-Darling 5% critical value	0.783	95% Chebyshev(Mean, Sd) UCL	1,866
Kolmogorov-Smirnov test statistic	0.103	97.5% Chebyshev(Mean, Sd) UCL	2,205
Kolmogorov-Smirnov 5% critical value	0.0796	99% Chebyshev(Mean, Sd) UCL	2,872
Data not gamma distributed at 5% significance level			
Assuming Gamma Distribution			
95% approximate gamma UCL	1,244		
95% adjusted gamma UCL	1,246		
Potential UCL to use		Use 95% H-UCL	1,195

Table BA-8. Calculation of the 95% upper confidence level on the mean calculation for Ag-108m using all applicable data from TRA-13 (all data is decayed to January 1, 2010).

All Ag-108m—TRA-13—Decayed to January 1, 2010			
General Statistics			
Number of valid observations	24	Number of distinct observations	23
Raw Statistics		Log-transformed Statistics	
Minimum	0.06	Minimum of log data	-2.813
Maximum	1.47	Maximum of log data	0.385
Mean	0.355	Mean of log data	-1.251
Median	0.29	SD of log data	0.677
SD	0.279		
Coefficient of variation	0.784		
Skewness	2.933		
Relevant Upper Confidence Level Statistics			
Normal Distribution Test		Log-normal Distribution Test	
Shapiro Wilk test statistic	0.714	Shapiro Wilk test statistic	0.956
Shapiro Wilk critical value	0.916	Shapiro Wilk critical value	0.916
Data not normal at 5% significance level		Data appear Log-normal at 5% significance level	
Assuming Normal Distribution		Assuming Log-normal Distribution	
95% Student's-t UCL	0.453	95% H-UCL	0.488
95% UCLs (adjusted for skewness)		95% Chebyshev (MVUE) UCL	0.585
95% adjusted-CLT UCL	0.485	97.5% Chebyshev (MVUE) UCL	0.685
95% modified-t UCL	0.459	99% Chebyshev (MVUE) UCL	0.88
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.184	Data appear gamma distributed at 5% significance level	
Theta Star	0.163	Nonparametric Statistics	
MLE of mean	0.355	95% CLT UCL	0.449
MLE of standard deviation	0.241	95% jackknife UCL	0.453
nu star	104.8	95% standard bootstrap UCL	0.446
Approximate Chi square value (.05)	82.19	95% bootstrap-t UCL	0.521
Adjusted level of significance	0.0392	95% Hall's bootstrap UCL	0.891

Table BA-8. (continued).

All Ag-108m—TRA-13—Decayed to January 1, 2010			
Adjusted Chi square value	80.78	95% percentile bootstrap UCL	0.449
Anderson-Darling test statistic	0.454	95% BCA Bootstrap UCL	0.491
Anderson-Darling 5% critical value	0.753	95% Chebyshev(Mean, Sd) UCL	0.603
Kolmogorov-Smirnov test statistic	0.109	97.5% Chebyshev(Mean, Sd) UCL	0.71
Kolmogorov-Smirnov 5% critical value	0.18	99% Chebyshev(Mean, Sd) UCL	0.921
Data appear gamma distributed at 5% significance level			
Assuming Gamma Distribution			
95% approximate gamma UCL	0.453		
95% adjusted gamma UCL	0.461		
Potential UCL to Use		Use 95% approximate gamma UCL	0.453

Table BA-9. Calculation of the 95% upper confidence limit mean of the Cs-137 scans performed in 1998 at the sewage leach ponds (data are not decayed).

Sewage Leach Pond Scans—Cs-137—1998			
General Statistics			
Number of valid observations	50	Number of distinct observations	49
Raw Statistics		Log-Transformed Statistics	
Minimum	0.373	Minimum of log data	-0.986
Maximum	70.9	Maximum of log data	4.261
Mean	18.23	Mean of log data	2.523
Median	15.2	SD of log data	1.039
SD	14.59		
Coefficient of variation	0.8		
Skewness	1.468		
Relevant Upper Confidence Level Statistics			
Normal Distribution Test		Log-normal Distribution Test	
Shapiro Wilk test statistic	0.875	Shapiro Wilk test statistic	0.905
Shapiro Wilk critical value	0.947	Shapiro Wilk critical value	0.947
Data not normal at 5% significance level		Data not Log-normal at 5% significance level	

Table BA-9. (continued).

Sewage Leach Pond Scans—Cs-137–1998			
Assuming Normal Distribution		Assuming Log-normal Distribution	
95% Student's-t UCL	21.69	95% H-UCL	30.48
95% UCLs (adjusted for skewness)		95% Chebyshev (MVUE) UCL	37.06
95% adjusted-CLT UCL	22.09	97.5% Chebyshev (MVUE) UCL	43.99
95% modified-t UCL	21.77	99% Chebyshev (MVUE) UCL	57.6
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.385	Data appear gamma distributed at 5% significance level	
Theta Star	13.16	Nonparametric Statistics	
MLE of mean	18.23	95% CLT UCL	21.63
MLE of standard deviation	15.49	95% jackknife UCL	21.69
nu star	138.5	95% standard bootstrap UCL	21.61
Approximate Chi square value (.05)	112.3	95% bootstrap-t UCL	22.31
Adjusted level of significance	0.0452	95% Hall's bootstrap UCL	22.26
Adjusted Chi square value	111.6	95% percentile bootstrap UCL	21.73
Anderson-Darling test statistic	0.334	95% BCA Bootstrap UCL	22.17
Anderson-Darling 5% critical value	0.768	95% Chebyshev(Mean, Sd) UCL	27.23
Kolmogorov-Smirnov test statistic	0.0975	97.5% Chebyshev(Mean, Sd) UCL	31.12
Kolmogorov-Smirnov 5% critical value	0.128	99% Chebyshev(Mean, Sd) UCL	38.76
Data appear gamma distributed at 5% significance level			
Assuming Gamma Distribution			
95% approximate gamma UCL	22.49		
95% adjusted gamma UCL	22.63		
Potential UCL to Use		Use 95% approximate gamma UCL	22.49
General Upper Confidence Level Statistics for Full Data Sets			
User-Selected Options			
From file	\\Fsicp02\Projects\ECORISK\5-year review\TRA-06CP.wst		
Full precision	OFF		
Confidence coefficient	95%		
Number of bootstrap operations	2000		

Table BA-10. Calculation of 95% upper confidence limit on the mean for zinc at the sewage leach ponds, 1992 data.

Sewage Leach Ponds—Zinc—1992			
General Statistics			
Number of valid observations		17	
		Number of distinct observations	17
Raw Statistics		Log-transformed Statistics	
Minimum	71.1	Minimum of log data	4.264
Maximum	795	Maximum of log data	6.678
Mean	320.1	Mean of log data	5.548
Median	256	SD of log data	0.702
SD	221.4		
Coefficient of variation	0.692		
Skewness	1.218		
Relevant Upper Confidence Level Statistics			
Normal Distribution Test		Log-normal Distribution Test	
Shapiro Wilk test statistic	0.85	Shapiro Wilk test statistic	0.956
Shapiro Wilk critical value	0.892	Shapiro Wilk critical value	0.892
Data not normal at 5% significance level		Data appear Log-normal at 5% significance level	
Assuming Normal Distribution		Assuming Log-normal Distribution	
95% Student's-t UCL	413.8	95% H-UCL	488.7
95% UCLs (adjusted for skewness)		95% Chebyshev (MVUE) UCL	577.2
95% adjusted-CLT UCL	425.3	97.5% Chebyshev (MVUE) UCL	687.2
95% modified-t UCL	416.4	99% Chebyshev (MVUE) UCL	903.3
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.036	Data appear gamma distributed at 5% significance level	
Theta Star	157.2		
MLE of mean	320.1		
MLE of standard deviation	224.3		
nu star	69.21		
Approximate Chi square value (.05)	51.06	Nonparametric Statistics	
Adjusted level of significance	0.0346	95% CLT UCL	408.4
Adjusted Chi square value	49.43	95% jackknife UCL	413.8

Table BA-10. (continued).

Sewage Leach Ponds—Zinc—1992			
Anderson-Darling test statistic	0.335	95% standard bootstrap UCL	406.1
Anderson-Darling 5% critical value	0.748	95% bootstrap-t UCL	445.1
Kolmogorov-Smirnov test statistic	0.113	95% Hall's bootstrap UCL	426.3
Kolmogorov-Smirnov 5% critical value	0.211	95% percentile bootstrap UCL	410.9
Data appear gamma distributed at 5% significance level		95% BCA bootstrap UCL	418.5
Assuming Gamma Distribution		95% Chebyshev(Mean, Sd) UCL	554.1
95% approximate gamma UCL	433.8	97.5% Chebyshev(Mean, Sd) UCL	655.4
95% adjusted gamma UCL	448.2	99% Chebyshev(Mean, Sd) UCL	854.3
Potential UCL to Use		Use 95% approximate gamma UCL	
General Upper Confidence Level Statistics for Full Data Sets			
User selected options			
From file	\\Fsicp02\Projects\ECORISK\5-year review\TSF-08scans.wst		
Full precision	OFF		
Confidence coefficient	95%		
Number of bootstrap operations	2000		

Table BA-11. Calculation of 95% upper confidence level on the mean for the sewage leach pond bottoms for mercury from 1992 sampling.

Sewage Leach Pond Bottoms—Mercury—All—1992			
General Statistics			
Number of valid observations	17	Number of distinct observations	16
Raw Statistics		Log-transformed Statistics	
Minimum	0.06	Minimum of log data	-2.813
Maximum	4.7	Maximum of log data	1.548
Mean	1.516	Mean of log data	-0.223
Median	0.66	SD of log data	1.284
SD	1.554		
Coefficient of variation	1.025		
Skewness	1.008		

Table BA-11. (continued).

Sewage Leach Pond Bottoms—Mercury—All—1992			
Relevant Upper Confidence Level Statistics			
Normal Distribution Test		Log-normal Distribution Test	
Shapiro Wilk test statistic	0.831	Shapiro Wilk test statistic	0.955
Shapiro Wilk critical value	0.892	Shapiro Wilk critical value	0.892
Data not normal at 5% significance level		Data appear Log-normal at 5% significance level	
Assuming Normal Distribution		Assuming Log-normal Distribution	
95% Student's-t UCL	2.174	95% H-UCL	4.966
95% UCLs (adjusted for skewness)		95% Chebyshev (MVUE) UCL	4.303
95% adjusted-CLT UCL	2.235	97.5% Chebyshev (MVUE) UCL	5.436
95% modified-t UCL	2.189	99% Chebyshev (MVUE) UCL	7.66
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.791	Data appear gamma distributed at 5% significance level	
Theta Star	1.916		
MLE of mean	1.516	Nonparametric Statistics	
MLE of standard deviation	1.704	95% CLT UCL	2.136
nu star	26.9	95% jackknife UCL	2.174
Approximate Chi square value (.05)	16.07	95% standard bootstrap UCL	2.12
Adjusted level of significance	0.0346	95% bootstrap-t UCL	2.281
Adjusted Chi square value	15.2	95% Hall's bootstrap UCL	2.171
Anderson-Darling test statistic	0.404	95% percentile bootstrap UCL	2.101
Anderson-Darling 5% critical value	0.77	95% BCA Bootstrap UCL	2.178
Kolmogorov-Smirnov test statistic	0.158	95% Chebyshev(Mean, Sd) UCL	3.159
Kolmogorov-Smirnov 5% critical value	0.216	97.5% Chebyshev(Mean, Sd) UCL	3.87
Data appear gamma distributed at 5% significance level		99% Chebyshev(Mean, Sd) UCL	5.267
Assuming Gamma Distribution			
95% approximate gamma UCL	2.537		
95% adjusted gamma UCL	2.683		
Potential UCL to use		Use 95% approximate gamma UCL	2.537

Table BA-12. Calculation of the 95% UCL on the mean for Cs-137 for the sewage leach pond soil contamination area (TRA-M) from 1995 sampling (not decayed).

Sewage Leach Pond Soil Contamination Area—Cs-137—1995			
General Statistics			
Number of valid observations		19	
		Number of distinct observations	
		18	
Raw Statistics		Log-transformed Statistics	
Minimum	1.5	Minimum of log data	0.405
Maximum	39	Maximum of log data	3.664
Mean	11.11	Mean of log data	2.055
Median	6.9	SD of log data	0.883
SD	9.735		
Coefficient of variation	0.877		
Skewness	1.53		
Relevant Upper Confidence Level Statistics			
Normal Distribution Test		Log-normal Distribution Test	
Shapiro Wilk test statistic	0.837	Shapiro Wilk test statistic	0.974
Shapiro Wilk critical value	0.901	Shapiro Wilk critical value	0.901
Data not normal at 5% significance level		Data appear Log-normal at 5% significance level	
Assuming Normal Distribution		Assuming Log-normal Distribution	
95% Student's-t UCL	14.98	95% H-UCL	19.19
95% UCLs (adjusted for skewness)		95% Chebyshev (MVUE) UCL	22.07
95% adjusted-CLT UCL	15.62	97.5% Chebyshev (MVUE) UCL	26.76
95% modified-t UCL	15.11	99% Chebyshev (MVUE) UCL	35.98
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.354	Data appear gamma distributed at 5% significance level	
Theta Star	8.201	Nonparametric Statistics	
MLE of mean	11.11	95% CLT UCL	14.78
MLE of standard deviation	9.543	95% jackknife UCL	14.98
nu star	51.46	95% standard bootstrap UCL	14.69
Approximate Chi square value (.05)	35.98	95% bootstrap-t UCL	16.45
Adjusted level of significance	0.0369	95% Hall's bootstrap UCL	16.53
Adjusted Chi square value	34.85	95% percentile bootstrap UCL	14.54

Table BA-12. (continued).

Sewage Leach Pond Soil Contamination Area—Cs-137—1995			
Anderson-Darling test statistic	0.358	95% BCA Bootstrap UCL	15.49
Anderson-Darling 5% critical value	0.756	95% Chebyshev(Mean, Sd) UCL	20.84
Kolmogorov-Smirnov test statistic	0.134	97.5% Chebyshev(Mean, Sd) UCL	25.05
Kolmogorov-Smirnov 5% critical value	0.202	99% Chebyshev(Mean, Sd) UCL	33.33
Data appear gamma distributed at 5% significance level			
Assuming Gamma Distribution			
95% approximate gamma UCL	15.88		
95% adjusted gamma UCL	16.4		
Potential UCL to Use		Use 95% approximate gamma UCL	15.88

Table BA-13. Calculation of 95% upper confidence level on the mean for all Cs-137 data applicable for characterization of the sewage leach pond bottoms (all data decayed to January 1, 2010).

Decayed Sewage Leach Pond Data—Cs-137—All			
General Statistics			
Number of valid observations	71	Number of distinct observations	70
Raw Statistics		Log-transformed Statistics	
Minimum	0.16	Minimum of log data	-1.833
Maximum	91.18	Maximum of log data	4.513
Mean	16.47	Mean of log data	2.327
Median	12.04	SD of log data	1.188
SD	15.22		
Coefficient of variation	0.924		
Skewness	2.224		
Relevant Upper Confidence Level Statistics			
Normal Distribution Test		Log-normal Distribution Test	
Lilliefors test statistic	0.151	Lilliefors test statistic	0.127
Lilliefors critical value	0.105	Lilliefors critical value	0.105
Data not normal at 5% significance level		Data not Log-normal at 5% significance level	

Table BA-13. (continued).

Decayed Sewage Leach Pond Data—Cs-137—All			
Assuming Normal Distribution		Assuming Log-normal Distribution	
95% Student's-t UCL	19.48	95% H-UCL	29.32
95% UCLs (adjusted for skewness)		95% Chebyshev (MVUE) UCL	36.09
95% adjusted-CLT UCL	19.95	97.5% Chebyshev (MVUE) UCL	42.88
95% modified-t UCL	19.56	99% Chebyshev (MVUE) UCL	56.22
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.151	Data appear gamma distributed at 5% significance level	
Theta Star	14.3	Nonparametric Statistics	
MLE of mean	16.47	95% CLT UCL	19.44
MLE of standard deviation	15.35	95% jackknife UCL	19.48
nu star	163.5	95% standard bootstrap UCL	19.41
Approximate Chi square value (.05)	134.9	95% bootstrap-t UCL	20.17
Adjusted level of significance	0.0466	95% Hall's bootstrap UCL	20.52
Adjusted Chi square value	134.4	95% percentile bootstrap UCL	19.55
Anderson-Darling test statistic	0.334	95% BCA Bootstrap UCL	19.89
Anderson-Darling 5% critical value	0.776	95% Chebyshev(Mean, Sd) UCL	24.34
Kolmogorov-Smirnov test statistic	0.0723	97.5% Chebyshev(Mean, Sd) UCL	27.75
Kolmogorov-Smirnov 5% critical value	0.108	99% Chebyshev(Mean, Sd) UCL	34.44
Data appear gamma distributed at 5% significance level			
Assuming Gamma Distribution			
95% approximate gamma UCL	19.95		
95% adjusted gamma UCL	20.03		
Potential UCL to use		Use 95% approximate gamma UCL	19.95

Appendix BB

Supporting Figures for Waste Area Group 2 Sites Technical Reevaluation

Appendix BB

Supporting Figures for WAG 2 Sites Technical Evaluation

FIGURES

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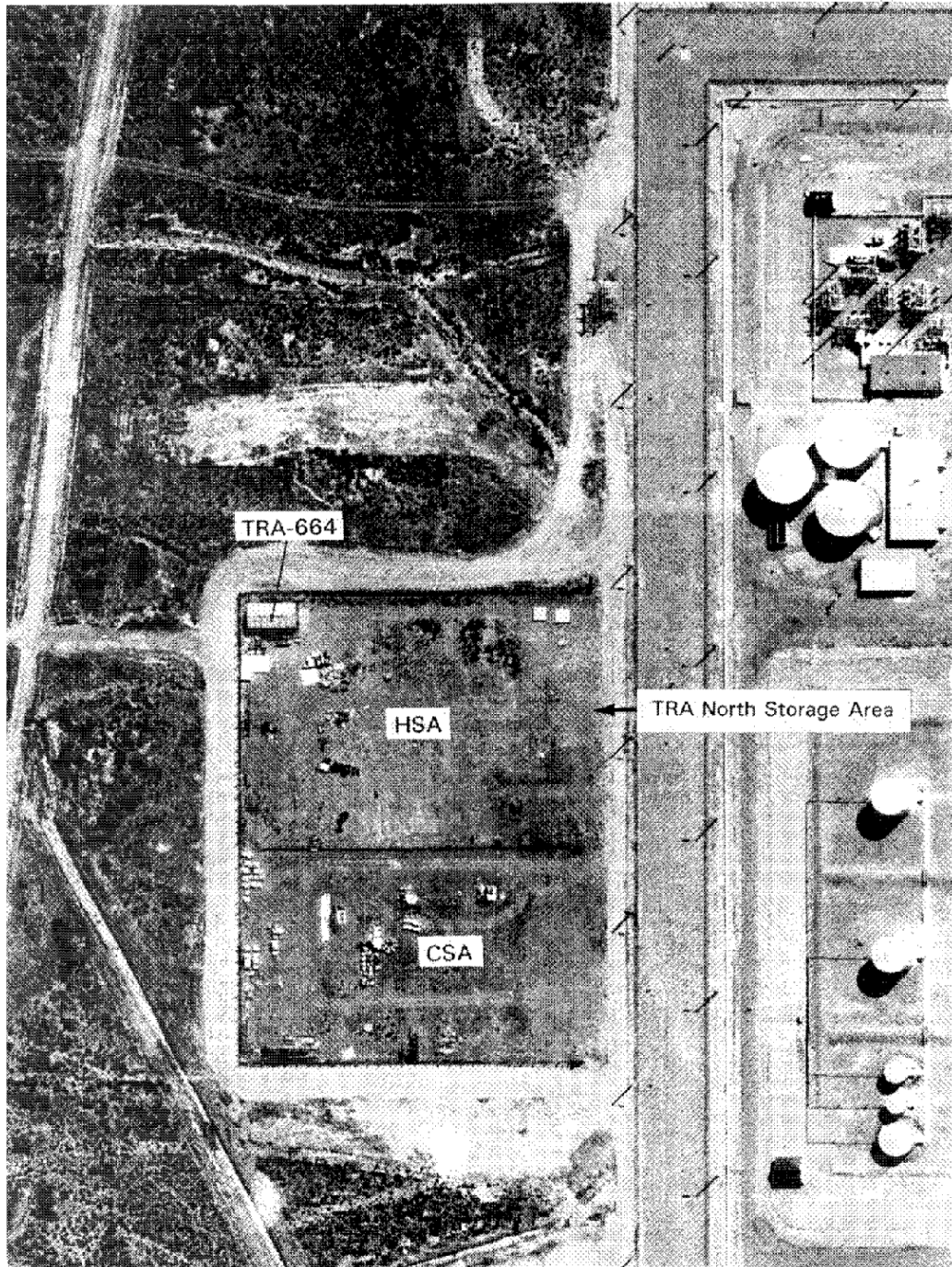
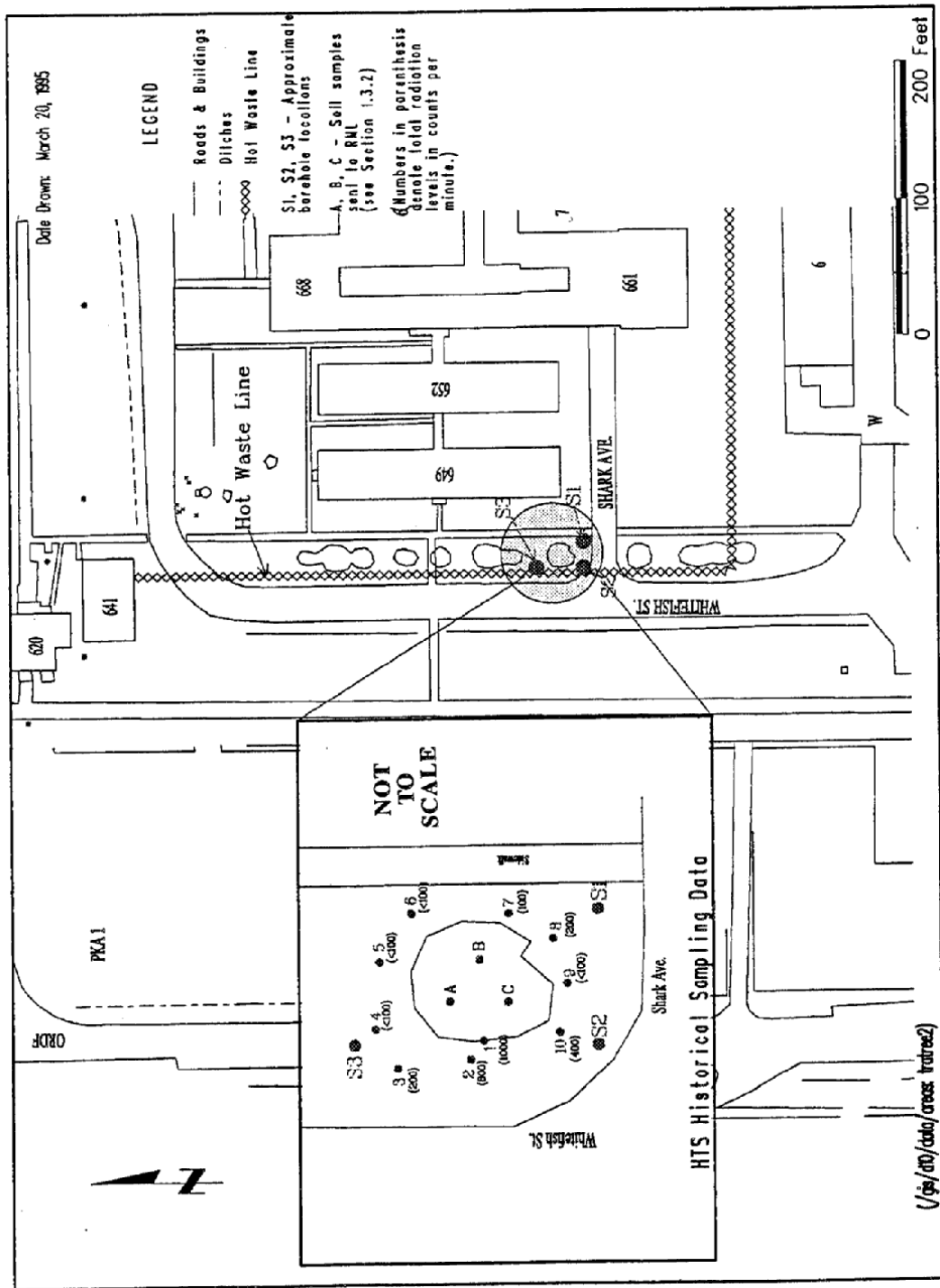


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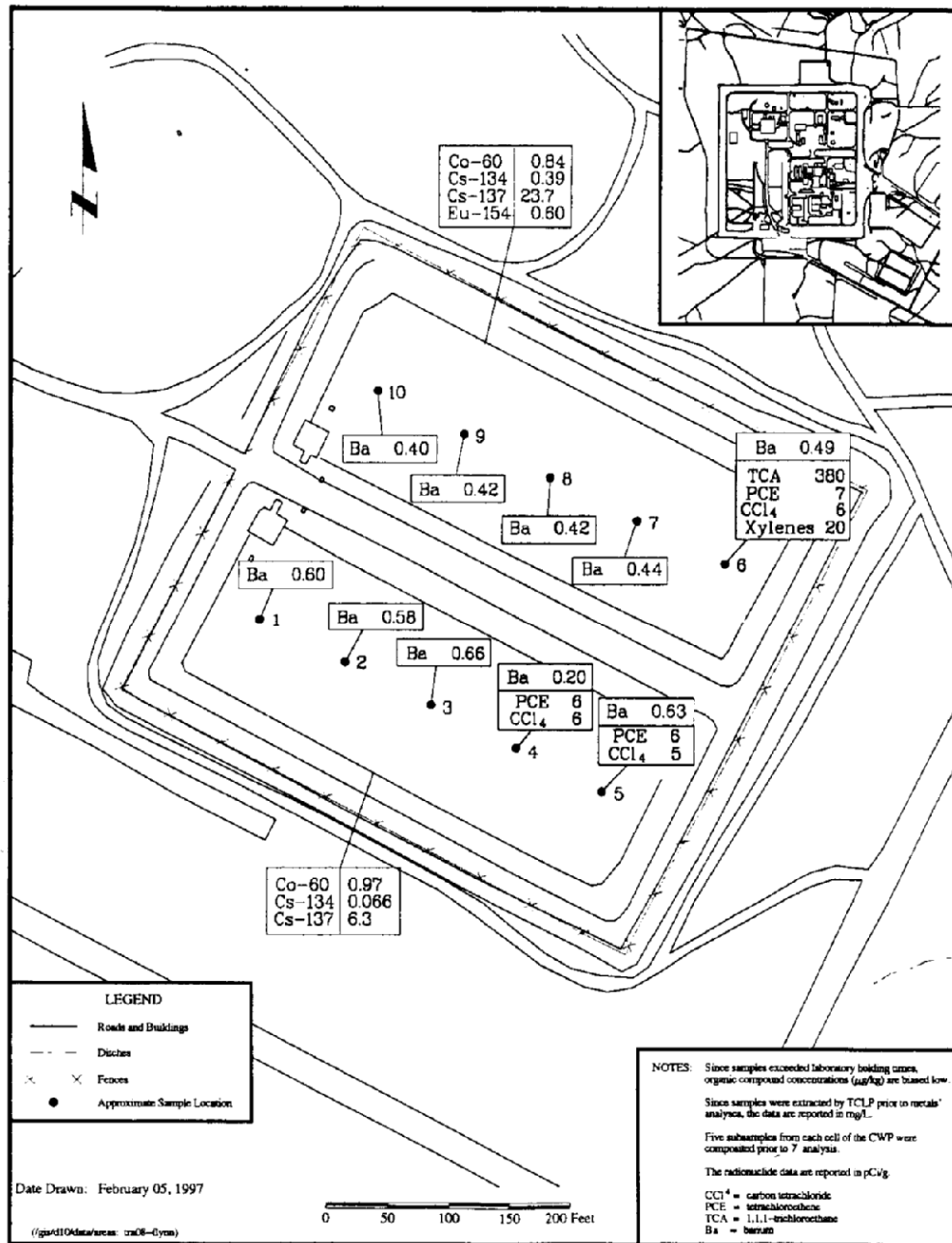


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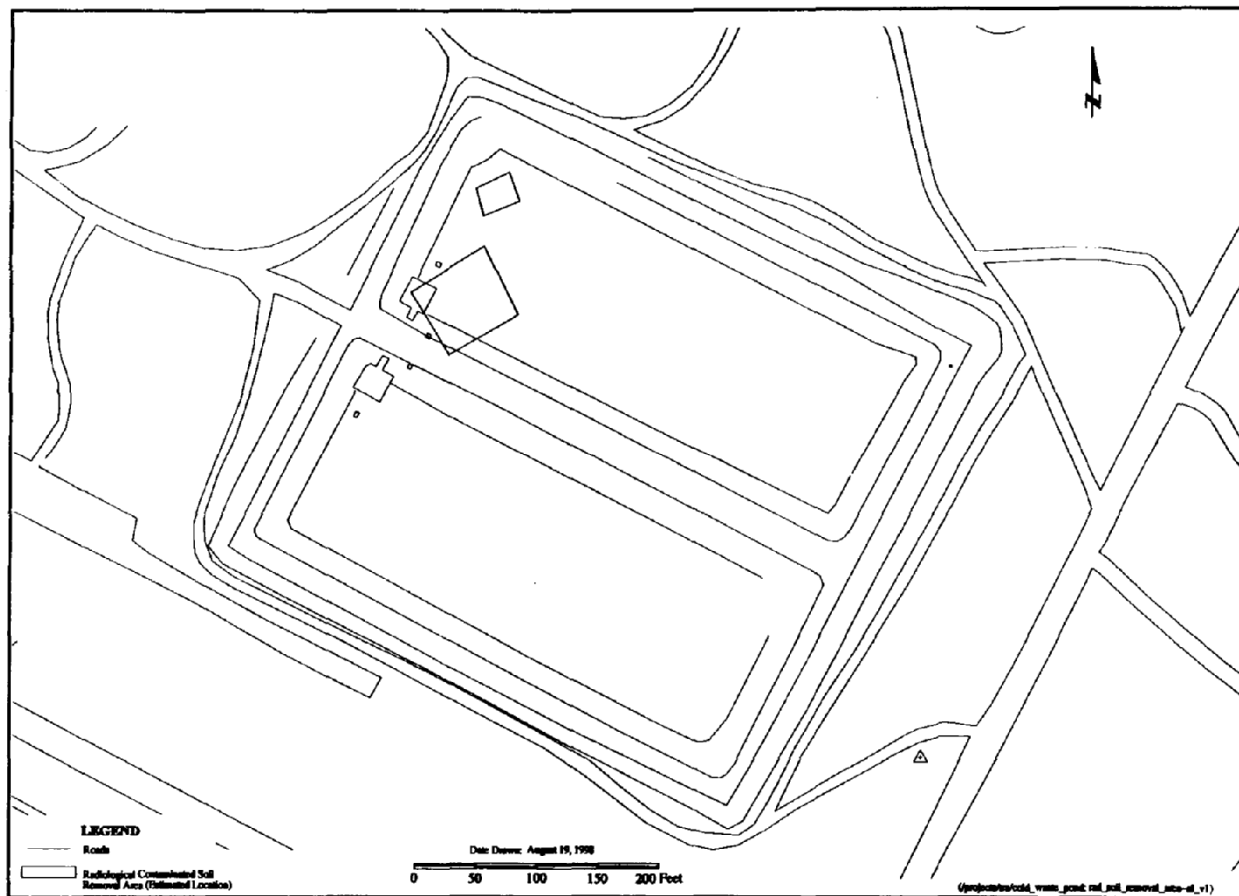


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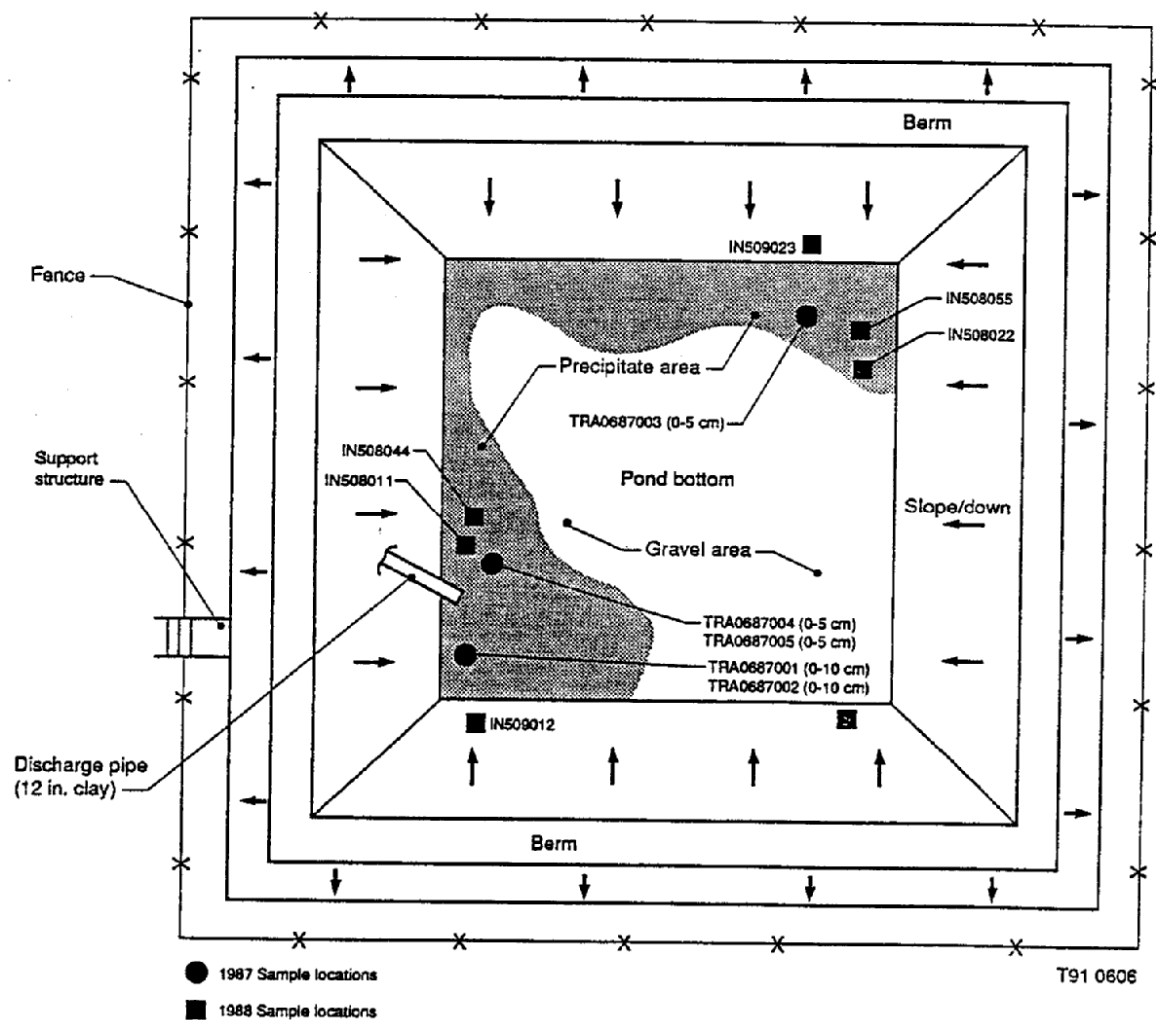


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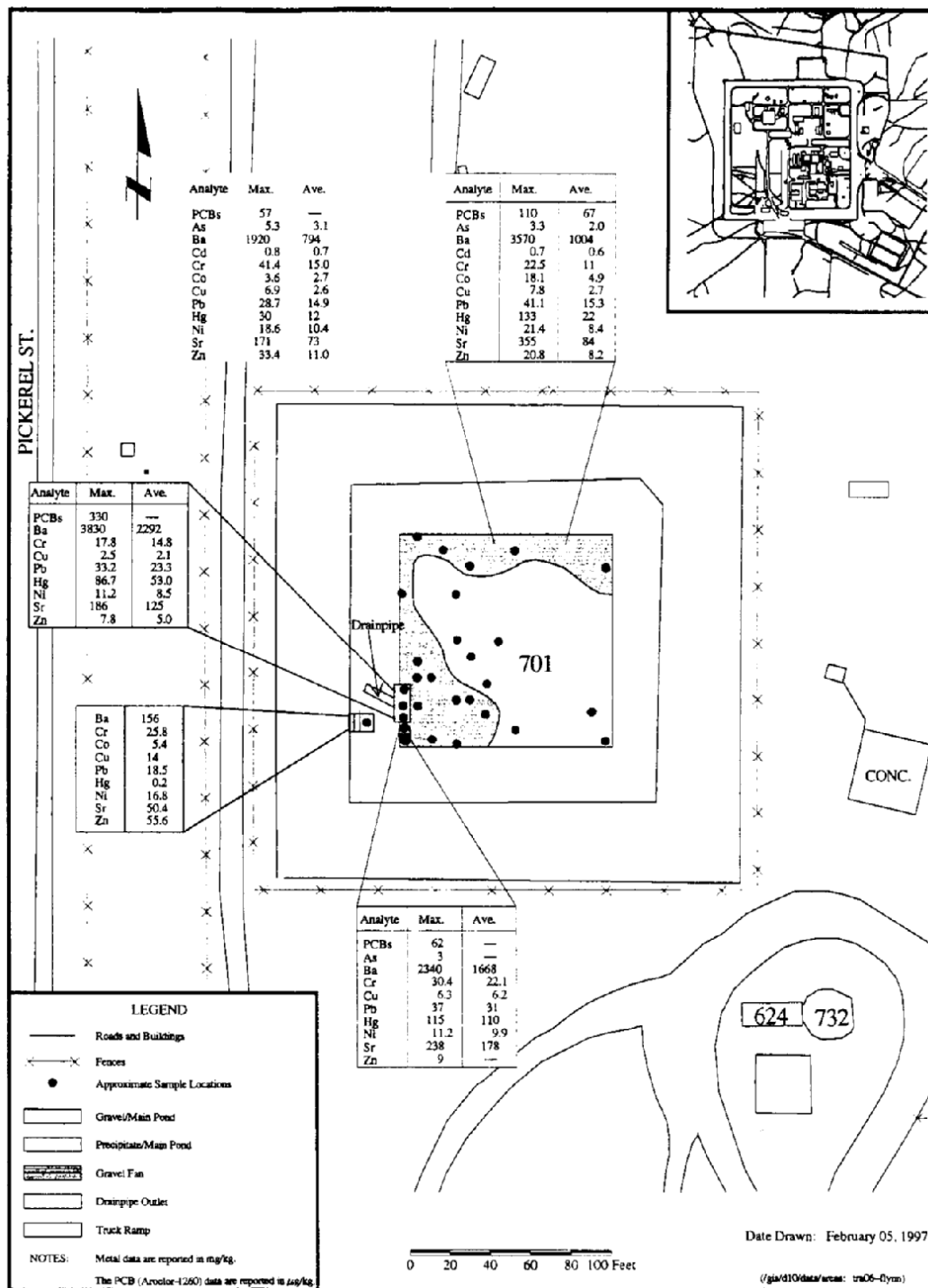


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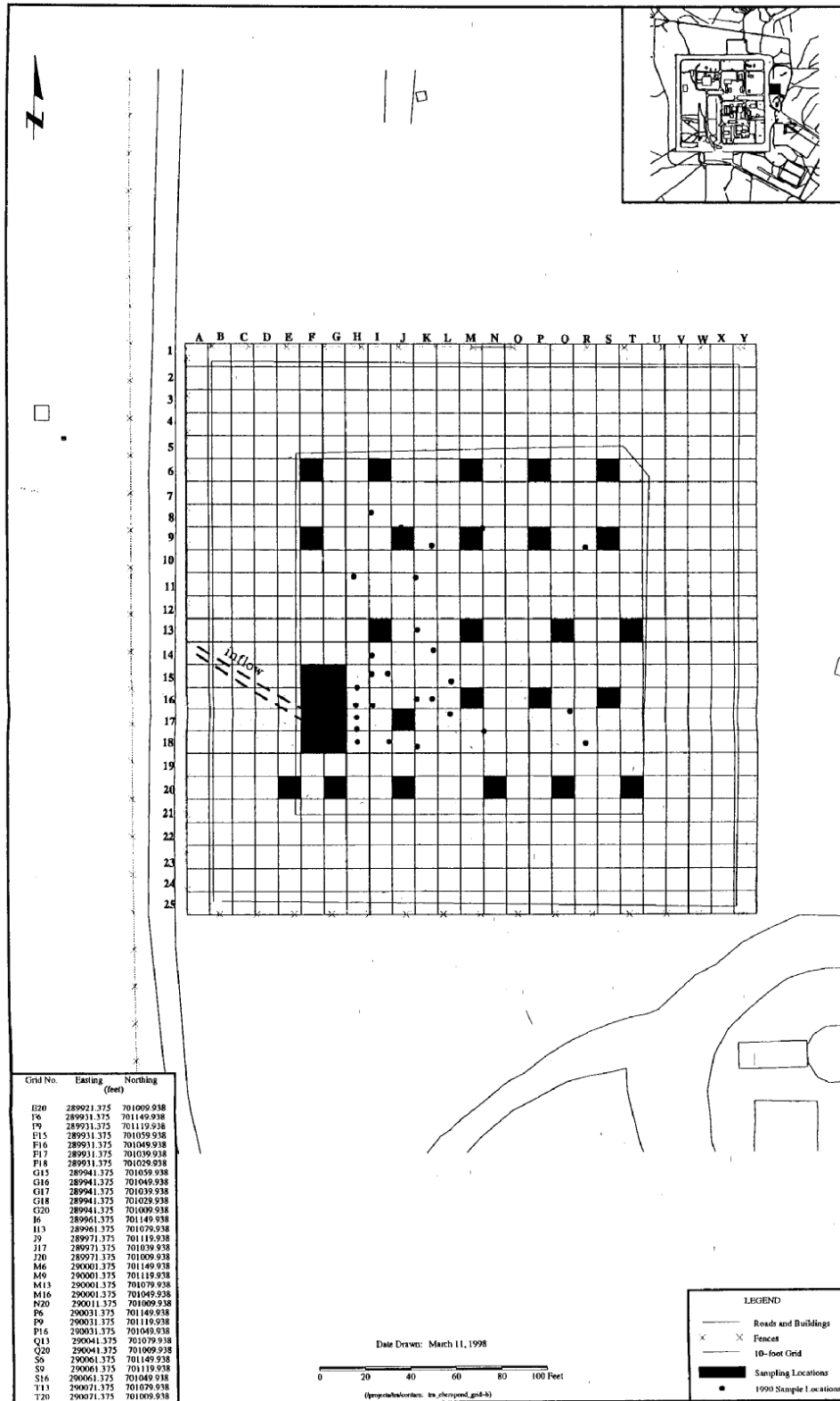


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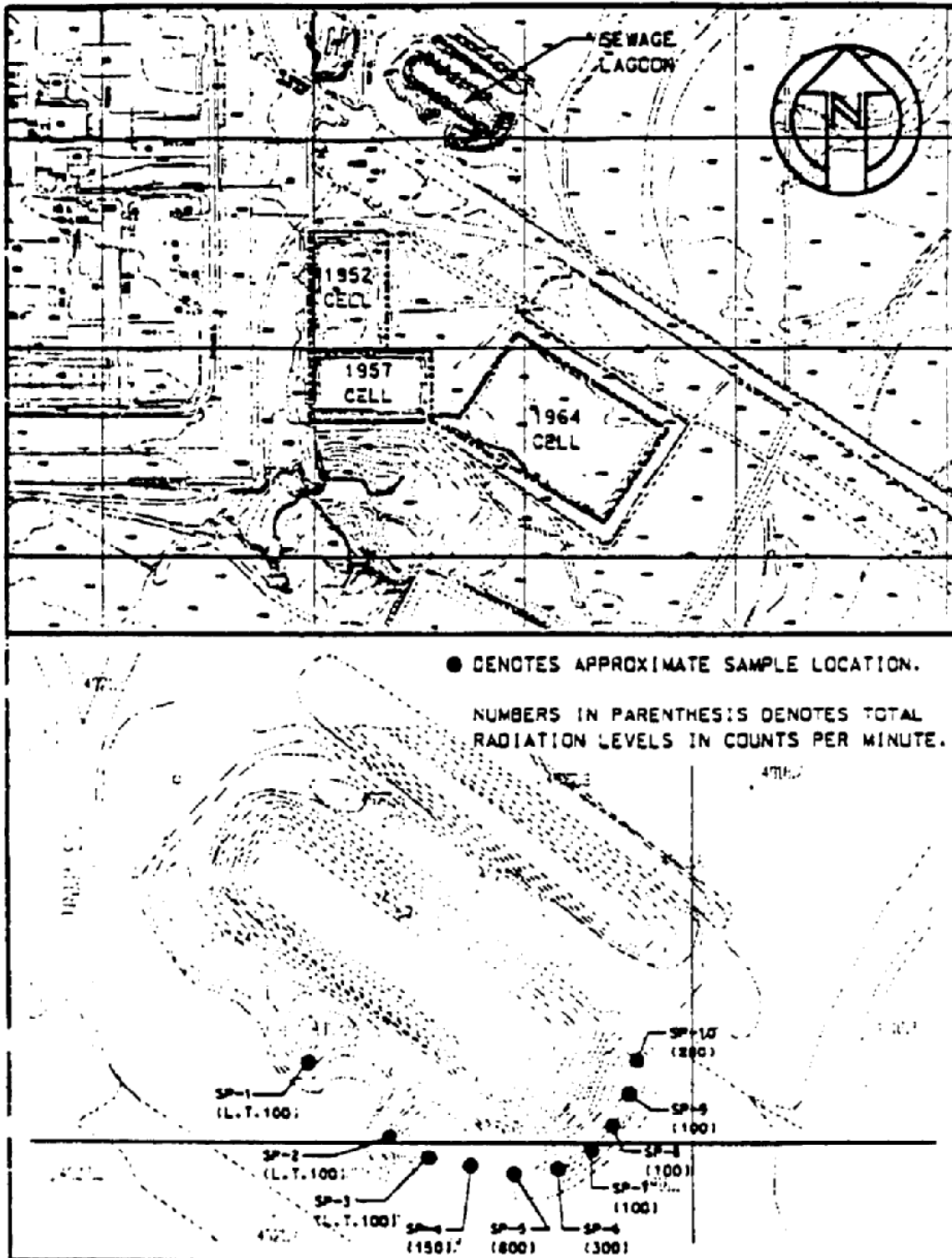


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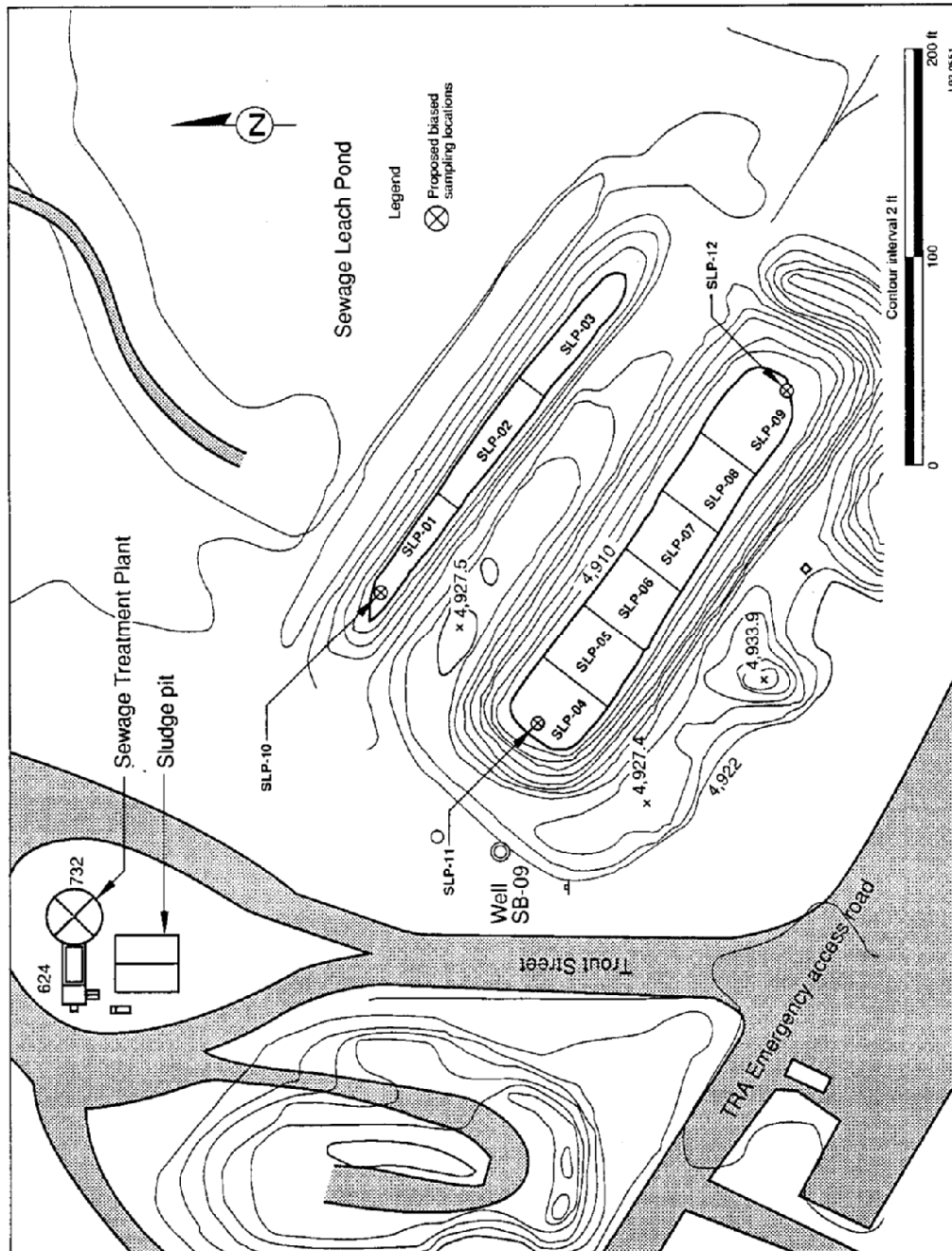


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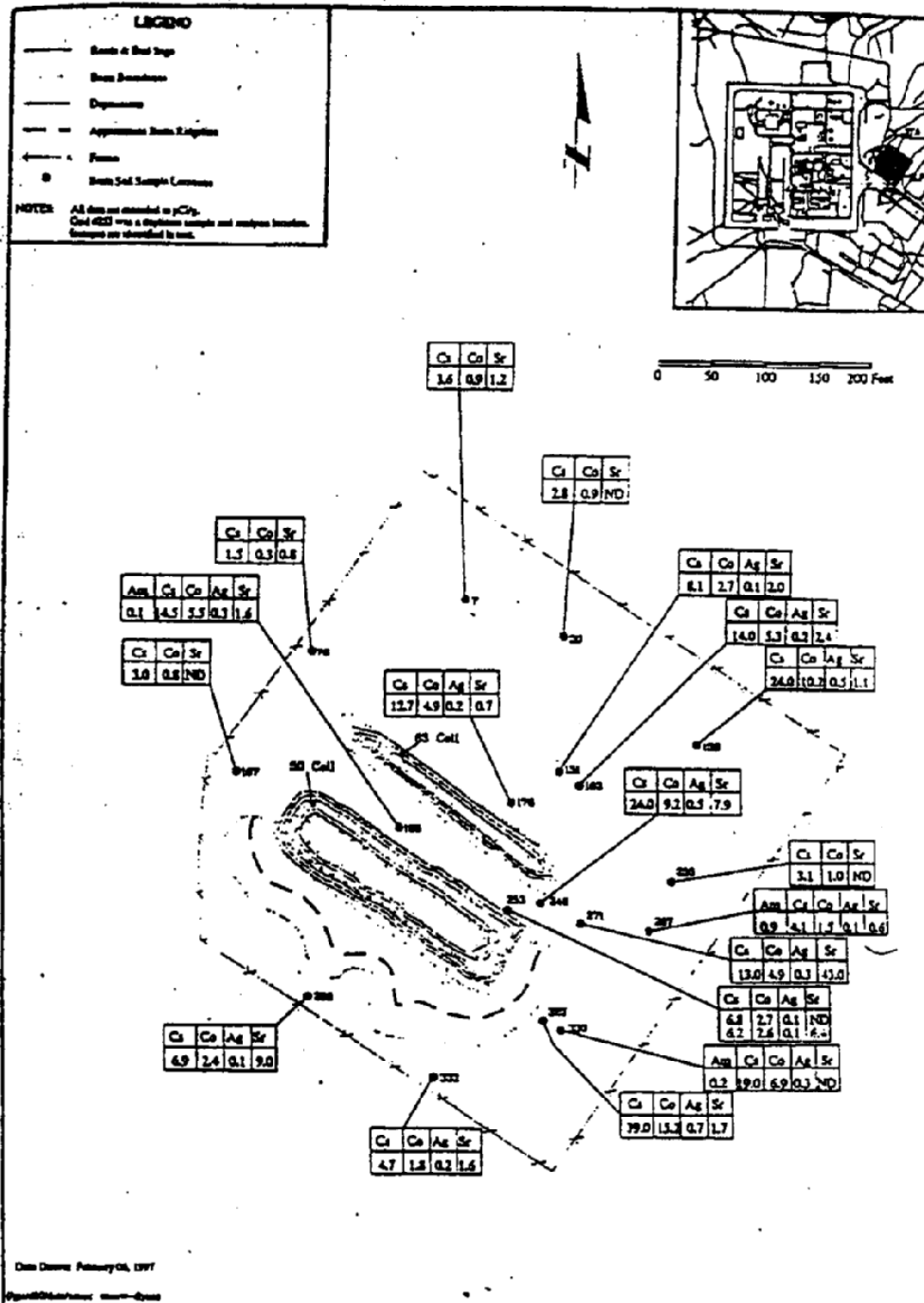


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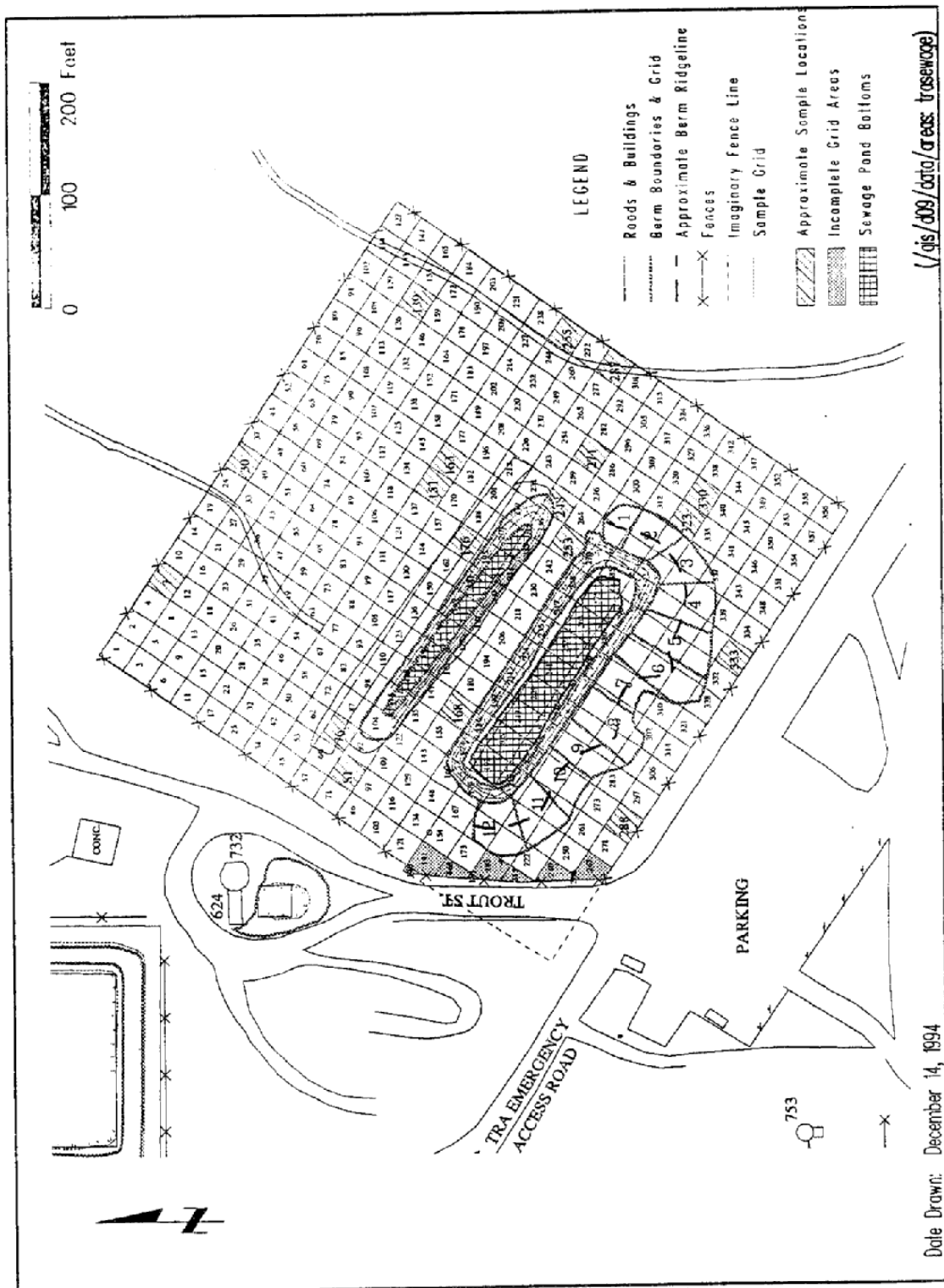


Figure BB-12. Sewage leach pond soil contamination area sampling areas and approximate sample locations for 1995 sampling in support of the Operable Unit 2-13 remedial investigation/feasibility study (Burton and Lientz 1995).

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Appendix C

Waste Area Group 3—Idaho Nuclear Technology and Engineering Center Supporting Analysis

Appendix C

Waste Area Group 3—Idaho Nuclear Technology and Engineering Center Supporting Analysis

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ACRONYMS

bgs	below ground surface
COC	contaminant of concern
COPC	contaminant of potential concern
cpm	counts per minute
EE/CA	engineering evaluation/cost analysis
EPA	Environmental Protection Agency
INTEC	Idaho Nuclear Technology and Engineering Center
OU	operable unit
PRG	preliminary remediation goal
RD/RA	remedial design/remedial action
RI/BRA	Remedial Investigation/Baseline Risk Assessment
ROD	Record of Decision
WAG	waste area group

Waste Area Group 3—Idaho Nuclear Technology and Engineering Center Supporting Analysis

C-1. INTRODUCTION

The risk assessment performed in the Remedial Investigation/Baseline Risk Assessment (RI/BRA) for Operable Unit (OU) 3-13 (DOE-ID 1997) and the RI/BRA for OU 3-14 (DOE-ID 2001) compared concentrations to slope factors provided by the Environmental Protection Agency (EPA) at that time and used preliminary remediation goals (PRGs) developed for use at the Idaho National Laboratory Site (Fromm 1996). Since that time, the EPA has provided updated slope factors and PRGs for radionuclides, presented on the EPA website (<http://epa-prgs.ornl.gov/radionuclides/>) (EPA 2004). These changes were discussed in Appendix A of the previous 5-Year Review Report (DOE-ID 2007a); but because they remained protective, the new values were not incorporated into any site-specific evaluation. Although, radionuclides are commonly the only contaminant of concern (COC) at sites of concern, other changes in the values used in risk assessment have occurred. At Waste Area Group (WAG) 3, sites addressed in the technical reevaluation are those impacted by changes to toxicity and other risk values that are under institutional controls. Note that many of the remedial action reports produced after 2004 use the newer worker PRG (EPA 2004) to establish institutional control release dates for radionuclides. These sites are also presented here.

C-2. GROUP 3—PHASE I

The OU 3-13 Phase I Other Surface Soils Remedial Action Report (DOE-ID 2007b) documents the completion of remedial actions for WAG 3, OU 3-13, Group 3, Phase I soil sites located within the boundaries of the Idaho National Laboratory Site at the Idaho Nuclear Technology and Engineering Center (INTEC) (previously the Idaho Chemical Processing Plant [ICPP]). Section 13 of the Phase I Remedial Action Report (DOE-ID 2007b) documents the dates for release from institutional controls, based on the OU 3-13 remediation goal at $1\text{E-}04$ for Cs-137 for the resident (2.3 pCi/g) and using the newer EPA 2004 PRG for the worker (11.3 pCi/g). Table C-1 is modified from Table 13-1 presented in the Phase I Remedial Action Report. It lists the average remaining Cs-137 activity for each site, based on confirmation sampling that was calculated to determine the period required for institutional controls.

Based on the EPA (2004) PRG for Cs-137, all sites addressed in Table C-1 can be released from institutional controls. Note that the Phase I Remedial Action Report addressed CPP-34A and B; however, these sites were evaluated more thoroughly in the OU 3-13 Phase II Other Surface Soils Remedial Action Report (DOE-ID 2009). Sites CPP-34A and B are included in the Phase II Remedial Action summary in the next section.

C-3. GROUP 3—PHASE II

The OU 3-13 Phase II Remedial Action Report (DOE-ID 2009) documents completion of remedial actions for WAG 3, OU 3-13, Group 3, Phase II, soil sites located at INTEC. The Phase II Remedial Action Report presents the length of time (if any) that institutional controls will be necessary for the sites addressed therein. The tables modified to address the EPA (2004) PRGs for radionuclides are taken from Section 13 of the Phase II Remedial Action Report. The same report also addressed CPP-44 and found that this site no longer needed to be under institutional controls. That discussion is also included in this section.

Table C-1. Expected institutional controls period for the sites reported in this 5-year review of CERCLA actions.

Operable Unit 3-13 Soil Site	95% UCL Residual Cs-137 Activity after Remediation (pCi/g)	95% UCL Residual Total Strontium Activity after Remediation (pCi/g)	Reference for the Values in Columns 2 and 3	Period of Institutional Control ^a (year)	Confirmation Sampling (date)	Original Date Calculated for Termination Institutional Controls ^b	Expected Date for Terminating Institutional Control
CPP-03	1.95	NA	Section 2.2.4 of DOE-ID (2007b)	NA	NA	NA	NA
CPP-34A	1.5 ^c	1.5	Kirchner (2005)	NA	NA	NA	NA
CPP-34B	1.5 ^c	1.5	Kirchner (2005)	NA	NA	NA	NA
CPP-37A	3.6	NA	DOE-ID (2007b)	20	1991	2011	NA
CPP-67, Pond 1	3.13	NA	DOE-ID (2007b) Table C-6 ^e	14	November 2004	2019	NA
CPP-67, Pond 2	6.15	NA	DOE-ID (2007b) Table C-7 ^e	43	November 2004	2049	NA
CPP-92	NA	NA	NA	NA	NA	NA	NA
CPP-97	3.82 ^f	5.14	ICP (2006)	23	November 2005	2029	NA
CPP-98	NA	NA	NA	NA	NA	NA	NA
CPP-99	NA	NA	NA	NA	NA	NA	NA

a. The period for implementing institutional controls was based on a PRG of 6 pCi/g for Cs-137. The values were calculated and are discussed in the text of the Phase I Remedial Action Report (DOE-ID 2007b).

b. Original expected dates for terminating institutional controls taken from Table 13-1 of DOE-ID (2007b).

c. The 95% UCL is the same for CPP-34A/34B because they are adjacent to each other, and the remediation and sampling were conducted over both at the same time.

d. Results are for the 0- to 3-m (0- to 10-ft) -depth region.

e. These values are found in Table C-6 and C-7 in Appendix C of the Phase I Remedial Action Report (DOE-ID 2007b).

f. The value of 3.82 pCi/g is the inverse natural logarithm of the value reported in ICP (2006) ($1.34 \ln[\text{pCi/g}]$), which characterized the sample results as a log-normal distribution.

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act (42 USC § 9601 et seq.)

NA not applicable

PRG preliminary remediation goal

RA remedial action

UCL upper confidence limit

C-3.1 Institutional Controls for Sites where Remedial Actions Were Not Required

The Phase II Remedial Action Report (DOE-ID 2009) discusses the Group 3 Phase II sites where remedial actions were not required. However, hazards at these sites could preclude unrestricted residential use, thus requiring institutional controls and annual assessment, maintenance, and reporting. Eight of the sites that did not require remedial actions will require institutional controls, based on a thorough review of existing data, additional specific site risk evaluations, and a review of post-Record of Decision (ROD) information. Four no further action sites are subject to OU 3-13 remedial action objectives and remediation goals.

Table C-2 provides a summary of the length of institutional controls required for these sites in order to meet applicable OU 3-13 remediation goals. Table C-3 addresses the three no further action sites within the OU 3-14 industrial use area that are subject to OU 3-14 remedial action objectives and remediation goals. The data for site CPP-36 are utilized for CPP-91 for the purposes of applying institutional controls because the sites are adjacent to one another, and the boundary between the sources of contamination is uncertain. Table C-4 addresses CPP-36 and CPP-124, which are two other remedial action sites where remedial actions were determined unnecessary to meet the revised remediation goal, in accordance with the OU 3-14 ROD (DOE-ID 2007c).

Table C-2. Operable Unit 3-13 no further action sites meeting Operable Unit 3-13 remediation goals.

Group 3 Phase II Site	Remedial Action Determination	Remaining Cs-137 Concentration (pCi/G)	Concentration Measured (year)	Forecast Year to Decay to 2.3 pCi/g Cs-137	Forecast to Decay to 6 pCi/g Cs-137 (year)
CPP-14	No further action	6.21	1991	2034	Current
CPP-37B	No further action	7.3	2005	2055	2014
CPP-37C	No further action	19	2005	2097	2056

Note: This table was modified from Table 13-2 of the OU 3-13, Group 3 Other Surface Soil (Phase II) Remedial Action Report (DOE-ID 2009).

ROD Record of Decision

Table C-3. Operable Unit 3-13 no further action sites meeting Operable Unit 3-14 remediation goals.

Group 3 Phase II Site	Remedial Action Determination	Remaining Cs-137 Concentration (pCi/g)	Concentration Measured (year)	Forecast to Decay to 11.3 pCi/g Cs-137 ^a (year)
CPP-48 (>4 ft bgs)	No further action	59	1993	2065
CPP-91 (0–4 ft bgs)	No further action	93	1993	2085
CPP-91 (>4 ft bgs)	No further action	1,800	1993	2214

Note: This table was modified from Table 13-3 of the OU 3-13, Group 3 Other Surface Soil (Phase II) Remedial Action Report (DOE-ID 2009).

a. This value is the updated EPA (2004) PRG for the outdoor worker at 1E-04.

bgs below ground surface
EPA Environmental Protection Agency
PRG preliminary remediation goal
ROD Record of Decision

Table C-4. Operable Unit 3-13 remedial action sites not requiring remediation.^a

Group 3 Phase II Site	Remedial Action Determination	Remaining Cs-137 Concentration (pCi/g)	Concentration Measured (year)	Forecast to Decay to 11.3 pCi/g Cs-137 ^c (year)
CPP-36 (0–4 ft bgs)	Remedial action ^a	93	1993	2085
CPP-36 (>4 ft bgs)	Remedial action ^a	1,800	1993	2214
CPP-124 (>4 ft bgs)	Characterization ^b	NA	NA	2095

Note: Information in this table has been modified from Table 13-4 of the Phase II Remedial Action Report (DOE-ID 2009).

- a. In accordance with the OU 3-14 ROD (DOE-ID 2007c), those OU 3-13 sites within the industrial use area require remediation only to OU 3-14 remediation goals. Therefore, no remediation was necessary at CPP-36 because contamination higher than the remediation goal was deeper than 1.2 m (4 ft) bgs.
- b. CPP-124 was not characterized individually but is presumed to be similar to CPP-58. The OU 3-14 ROD determined that, by 2095, CPP-58 would not present an unacceptable risk to the future worker. Similarly, CPP-124 is not expected to present an unacceptable risk after 2095.
- c. The value in Table 13-4 of the Phase II Remedial Action Report is incorrectly presented as 2.3 pCi/g. As discussed in the text, these sites should be addressed under the industrial use scenario.

bgs below ground surface
 NA not available
 OU operable unit
 RA remedial action
 ROD Record of Decision

CPP-124 has not been characterized, but is believed to be similar to CPP-58. CPP-124 is approximately 2.7 m (9 ft) below ground surface (bgs) and located within the OU 3-14 recharge control zone inside the industrial use area. As noted with CPP-58, the institutional controls inherent in controlling the recharge control zone will also be sufficient to protect CPP-124. In addition, CPP-124 will be covered by merging the earthen caps above the tank farm and CPP-601. Separate institutional controls are not necessary for this site. Implementation of the institutional controls inherent in the recharge control zone will be sufficient to protect future workers at CPP-124 located within that zone.

C-3.2 Institutional Controls for Sites Remediated under Operable Unit 3-13, Phase II

This section describes the length of time that institutional controls will be necessary for sites remediated under OU 3-13, Group 3, Phase II. All calculations in the following tables are based on 2009 for the source of the data. Tables C-5 and C-6 show OU 3-13, Group 3, Phase II sites where remedial actions took place and show the time necessary for remaining radioactivity to decay to the levels identified in the Phase II Remedial Action Report (DOE-ID 2009). The OU 3-14 ROD, Section 4.2 (DOE-ID 2007c), states that OU 3-13 sites within the industrial use area will be cleaned up under the OU 3-13, Group 3, Phase II Remedial Design/Remedial Action Work Plan (DOE-ID 2006), but to the OU 3-14 remediation goals. Those sites within the industrial use area include CPP-13, CPP-35, the northern portion of CPP-93 (simulated calcine trench), and CPP-132 (DOE-ID 2009). Table C-6, as taken from the Phase II Remedial Action Report, presents the institutional control end dates for these sites.

Table C-7 shows the concentrations of mercury in CPP-93 at the completion of remedial activities. There were no releases from the pipe that constituted CPP-81; with the removal of the pipe, no contamination remains. Therefore, no institutional controls are necessary.

Table C-5. Operable Unit 3-13, Group 3, Phase II sites remediated to the Operable Unit 3-13 remediation goal for residential use.

Operable Unit 3-13 Soil Site	Contaminant of Concern	95% Upper Confidence Level (pCi/g)	Preliminary Remediation Goal ^a (1E-04) for Resident (pCi/g)	Previously Calculated Institutional Controls End Date ^b	Institutional Controls End Date ^b (year)
CERCLA sites adjacent to CPP-603 (CPP-01, -04/05, -08/09, -10, -11)					
Slopes (0–10 ft bgs)	Cs-137	5.2	6.0	2045	2010
	Total strontium	7.9	23.1	NC	NA
	Eu-154	8.1	4.99	NC	2019
Excavation floor (10–21 ft bgs)	Cs-137	165	6.0	NC	2154
	Total strontium	4,000	23.1	2226	2223
	Eu-152	2	4.16	NC	NA
	Eu-154	2	4.99	NC	NA
CPP-19					
Slopes (0–10 ft bgs)	Cs-137	5.1	6.0	2042	NA
	Total strontium	108.5	23.1	NC	2074
	Eu-152	1.3	4.16	NC	NA
	Eu-154	1.0	4.99	NC	NA
Excavation floor (10–13 ft bgs)	Cs-137	65.6	6.0	NC	2114
	Total strontium	595,357	23.1	2435	2431
	Eu-152	14.5	4.16	NC	2,030
	Eu-154	3.0	4.99	NC	NA
Construction surface (0 ft bgs)	Cs-137	5.2	6.0	2045	NA
	Eu-152	1.7	4.16	NC	NA
	Eu-154	1.5	4.99	NC	NA
CPP-130					
Zones 1–7 inclusive (0–4 ft bgs)	Cs-137	5.1	6.0	2044	NA
Zone 8, construction surface (0–4 ft bgs)	Cs-137	3.2	6.0	2023	NA
CPP-135 (new site, east of CPP-603)	Cs-137	559	6.0	2248	2207
	Total strontium	2,289	23.1	NC	2200
	Eu-152	14.5	4.16	NC	2030
	Eu-154	3.2	4.99	NC	NA
Note: Information in this table is taken from Table 13-5 of the Phase II Remedial Action Report (DOE-ID 2009). a. EPA (2004). b. Original expected dates for terminating institutional controls taken from Table 13-5 of DOE-ID (2007b). The date was based on the radionuclide specified in the table. This table has been modified to show all the dates. c. End date based on specific isotope decay calculation (Sr-90 for total strontium). bgs below ground surface CERCLA Comprehensive Environmental Response, Compensation, and Liability Act NA not applicable NC not calculated					

Table C-6. Operable Unit 3-13, Group 3, Phase II sites remediated to Operable Unit 3-14 remediation goal for Cs-137.

Operable Unit 3-13 Site	Cs-137 95% Upper Confidence Level (pCi/g)	Time Required to Reach Institutional Control Level of 11.3 pCi/g (years)	Institutional Control End Date (year)
CPP-13			
Excavation floor (4–5 ft bgs)	8.5	0	2009
West slope (0–5 ft bgs)	8.8	0	2009
East slope (0–5 ft bgs)	5.0	0	2009
West top (0–1 ft bgs)	30.8	44	2053
East top (0–1 ft bgs)	14.4	0	2009
Construction surface (0 ft bgs)	5.6	0	2009
CPP-35			
Excavation bottom (4–5 ft bgs)	57.5	71	2080
Slopes (0–5 ft bgs)	18.7	22	2031
Excavation pad (0 ft bgs)	4.9	0	2009
West slope (0–5 ft bgs, new site CPP-136)	292	See CPP-136	NA
CPP-132 (along Olive Avenue)	5.7	0 ^a	2009
CPP-136 (new site, east of building CPP-633)	292	142	2151
a. Section 9.5 of the Phase II Remedial Action Report (DOE-ID 2009) states that the remediation goals were met for CPP-132. The contamination remaining (5.7 pCi/g Cs-137) does not prevent unrestricted use as it presents a risk less than 1E-4. Therefore, institutional controls are not necessary for this site.			
Note: Information in this table was modified from Table 13-6 the Phase II Remedial Action Report (DOE-ID 2009).			
bgs	below ground surface		
NA	not applicable		

Table C-7. Concentrations of mercury in CPP-93 at the completion of remedial activities.

CPP-93	Depth (ft bgs)	Mercury 97.5% Upper Confidence Limit (mg/kg)	Remediation Goal for Mercury (mg/kg)	Institutional Control End Date
Residential use area – slopes	0–10	4	23	NA
Residential use area – excavation floor	10–12	26	23	NA
Industrial use area – slopes	0–4	7	23	NA
Industrial use area – excavation floor	>4	49	23	NA
Note: Information in this table comes from Table 13-7 of the Phase II Remedial Action Report (DOE-ID 2009).				
bgs	below ground surface			
NA	not applicable			

C-3.3 Other Group 3 Sites—No Action

C-3.3.1 CPP-44, Grease Pit South of CPP-608

Site CPP-44 is a grease pit located north of building CPP-1619 that was used for discharging oil and grease from the vehicle service facility. The pit was in service from 1950 until 1953 when the Central Facilities Area construction was completed, after which construction-vehicle maintenance was conducted at the Central Facilities Area. The grease pit consists of a concrete pad, approximately 5.2×12.5 m (17×41 ft) in size. In the middle of this pad is a trench that measures $0.9 \times 7.6 \times 1.7$ m ($3 \times 25 \times 5.5$ ft). The trench walls are constructed of concrete block, and the floor is poured concrete. In the bottom center of the trench is a sump measuring 1.0×0.85 m (3.25×2.8 ft) that has poured-concrete sides with an open bottom to the underlying soil. After this grease pit was removed from service, the trench was filled in and the concrete pad covered with soil.

The OU 3-13 Remedial Design/Remedial Action Work Plan (DOE-ID 2006) assigned no action, no further action, or remedial action status to all of the OU 3-13, Group 3, Phase II sites. There are three sites where the terminology between no action and no further action was inconsistent or inaccurately applied. Reviewing the data for CPP-44 in Table A-29 of the OU 3-13 Remedial Design/Remedial Action Work Plan (DOE-ID 2006) reveals no constituents above levels that would preclude unrestricted release. The OU 3-13 Phase II Remedial Action Report (DOE-ID 2009) determined that CPP-44 should be considered a no action site.

C-4. GROUP 3—NO FURTHER ACTION SITES

Several sites were identified in the OU 3-13 RI/BRA (DOE-ID 1997) that have been identified as no further action, but were not placed into a soil group. These sites include CPP-06, CPP-17, CPP-22, CPP-61, CPP-88, CPP-90, and CPP-95. All of these sites have been reevaluated, based on changes to risk values for radionuclides. However, CPP-61 cannot be reevaluated. CPP-61 is a polychloride biphenyl site that has been further evaluated by the Agencies (DOE-ID 2004), using existing information, after the OU 3-13 ROD (DOE-ID 1999) was issued. In the 2004 OU 3-13 Explanation of Significant Differences (DOE-ID 2004), CPP-61 is designated as a no further action site. The decision is consistent with the no further action decision, as defined in the OU 3-13 ROD, which includes sites that require only institutional controls to remain protective. As with other OU 3-13 no further action sites, CPP-61 will be subject to 5-year reviews. However, the polychloride biphenyl values have not changed, and no date for release of CPP-61 can be determined at this time.

C-4.1 CPP-06

Site CPP-06 consists of a trench near the southern border of INTEC that was used to dispose of fuel storage basin water from building CPP-603. During the late 1950s or early 1960s, the CPP-06 trench was used to dispose of nearly 1.9M L (502,000 gal) of CPP-603 basin water that was generated during basin maintenance activities. The southern basin in building CPP-603 was drained for removal of guide pins in the basin floor after the Savannah River fuel storage racks were removed. The water was piped across Willow Avenue and discharged into the trench on the south side of Willow Avenue. Personnel assigned to building CPP-603 confirmed the release of the basin water and identified the location of discharge to be the trench adjacent to Willow Avenue. Based on the volume of water released and surface topography, the trench dimensions have been estimated at 3×76.2 m (10×250 ft). The trench was abandoned in place after the disposal of basin water. Basin water sent to the trench reportedly contained chloride ion up to 50 ppm, and a former employee who worked at building CPP-603 during the release

reported the basin water was surveyed before release and did not contain elevated levels of radioactivity. The area is now covered with soil backfill.

The reported location of site CPP-06 was changed from outside the northeast corner of building CPP-603 to a trench area south of CPP-603, based on information gathered during preparation of the Preliminary Scoping Track 2 Summary Report for OU 3-09 (LITCO 1995a). No soil samples have been collected in the CPP-06 trench area; however, personnel familiar with the release of basin water to the trench reported that the water was surveyed and contained radioactivity levels near background.

One soil boring was drilled approximately midway along the length of the trench as part of the OU 3-09 Track 2 work. Samples from this borehole were used to determine possible contaminants and concentrations present from the release of basin water during maintenance activities.

Samples were collected in the CPP-06 borehole from 0.0 to 0.5 cm (0 to 0.5 ft) bgs, 0.8 to 1.2 m (2.5 to 4 ft) bgs, 1.9 to 3 m (9.5 to 10 ft) bgs, and at the soil–basalt interface at 9.1 m (30 ft) bgs. Radiation readings in all samples measured less than background (i.e., 150–200 counts per minute [cpm]).

A compilation of analytical results for the four samples collected to characterize the release at CPP-06 is contained in the OU 3-09 Track 2 Report (LITCO 1995a). The OU 3-13 RI/BRA (DOE-ID 1997) identified Cs-137 and Sr-90 as contaminants of potential concern (COPCs) for CPP-06. The analytical results for COPCs are summarized in Table 20-1 of the OU 3-13 RI/BRA (DOE-ID 1997). Results are based on samples collected from one boring, CPP-06-1. In this boring, Cs-137 activities decreased from 14.4 pCi/g in the surficial sample to 1.09 pCi/g in the interval from 0.7 to 1.2 m (2.5 to 4 ft) bgs, to below background in the interval 2.7 to 3.2 m (9 to 10.5 ft) bgs. Sr-90 decreased from 6.98 pCi/g in the surficial sample to 1.16 pCi/g in the sample from 0.8 to 1.2 m (2.5 to 4 ft) bgs.

Results of the risk assessment, presented in Section 20 of the OU 3-13 RI/BRA, indicate that the increased cancer risk, from exposure to site-related contaminants, is within the EPA-recommended target range at CPP-06. The increased cancer risks to hypothetical future onsite workers and residents are both within the EPA target range. The noncarcinogenic hazard for all receptors was found to be well below the EPA hazard index goal of one.

The site was retained in the OU 3-13 ROD because of elevated levels of Cs-137 and Sr-90. Table 4-1 of the OU 3-13 ROD (see Appendix CA, Figure CA-1) indicates that CPP-06 is a No further Action site, and it was not placed into a site group. Therefore, CPP-06 is evaluated for release from institutional controls in this 5-year review. The maximum concentrations of the COCs are presented in Table C-8. Cs-137 remains the only COC at CPP-06 and will have decayed to acceptable levels for release from institutional controls by 2033.

Table C-8. Concentrations of contaminants of concern at CPP-06 and date for release from institutional controls.

Contaminant of Concern	Maximum Concentrations Detected (pCi/g)	Date Analyzed (year)	2004 EPA Preliminary Remediation Goal (1E-04) for Residential (pCi/g)	Date Decayed to Release (year)
Cs-137	14.4	1994	6	2033
Sr-90	6.98	1994	23.1	NA

EPA Environmental Protection Agency
NA not applicable

C-4.2 CPP-17

Site CPP-17 consists of two areas east of building CPP-603 and south of the CPP Peach Bottom Fuel Storage area (Figure C-1). Site CPP-17 is divided into Areas 17a and 17b. The initial area of CPP-17a was expanded to the south because of the presence of COCs at activity levels above background in boring CPP-17-2. CPP-17a now covers an area of 1,570 m² (16,900 ft²). The initial area of CPP-17b has been expanded to the south because of the presence of COPCs at activity levels above background in boring CPP-17-03. CPP-17b now covers an area of 940 m² (10,120 ft²). These areas were once used for storing piles of soil, asphalt, concrete, metal debris, and other items over a period of at least 5 years. The stored material reportedly came from various construction and maintenance activities within the INTEC perimeter fence. It has been reported that before these sites were used for storing construction soil and debris, sludge and liquids generated during maintenance activities at the CPP-603 fuel storage basin may have been deposited in these areas, resulting in contamination of the underlying soil. The areas were classified as radioactive Zone 1 and roped off to prevent entry.

During summer 1991, a U.S. Department of Energy tiger team identified soil and debris pile areas as radioactively contaminated surface soils that were exposed to wind and water erosion. In July 1991, surveys were conducted on the two piles, and radiological contamination was detected, ranging from 100 to 22,000 cpm above background. Because of these results, a decision was made to control and containerize the contaminated soil and debris. Removal of the soil-pile mounds—without excavating belowgrade—at Site CPP-17 was initiated on October 16, 1991, and completed on February 13, 1992. The mounds were sprayed with a light water mist to reduce transport of dust from wind erosion. After the contaminated soil was removed from site CPP-17, the area was leveled to grade.

Radiation surveys were performed in October 1993 on the two areas in CPP-17. The survey was conducted using a Ludlum 2A portable survey instrument and a 14C-GM counter. Area 17a was divided into 182 grids measuring 3 × 3 m (10 × 10 ft) and surveyed. Area 17b was divided into 112 grids measuring 3 × 3 m (10 × 10 ft) and surveyed. Background levels in Area 17a ranged between 80 and 220 cpm, while background levels in Area 17b ranged between 140 and 240 cpm.

Most readings taken in Area 17a ranged between 100 and 240 cpm, but two locations with elevated levels of radioactivity were identified. One location along the western edge of Area 17a showed radiation readings near 1,200 cpm, while radioactivity levels of 1,000 cpm were recorded along the south-central edge of Area 17a. While most readings taken in Area 17b ranged between 160 and 240 cpm, one location—along the south-central boundary of the area—showed radioactivity levels near 400 cpm.

A decision was made to resurvey the two areas to determine whether contamination extended outside the boundaries of two areas. Several isopleths on the plot produced for 17a were not bounded, creating concern that contamination might be present outside the areas covered by the October 1993 surveys. An additional area (6.1 × 21 m [20 × 70 ft]) was surveyed along the southern edge of Area 17a on December 9, 1993. Radiation levels were near background levels except for one reading of 4,500 cpm, which was located approximately 3 m (10 ft) from the 1,200-cpm reading detected during the October survey. Coordinates of the second borehole (Figure C-1) were based on the location of the 4,500-cpm survey reading. The second borehole location lies slightly outside the arbitrary boundary of Area 17a. An additional 6.1- × 24-m (20- × 80-ft) area along the southern edge of Area 17b was also surveyed to verify that no surface contamination was present outside the boundaries of Area 17b. Except for one reading of 500 cpm, all surface radiation readings were only slightly above background. The location of the Area 17b soil boring was based on the October 1993 survey results, during which several inches of snow covering the ground had to be scraped away from the location of each field reading before radiation measurements could be taken.

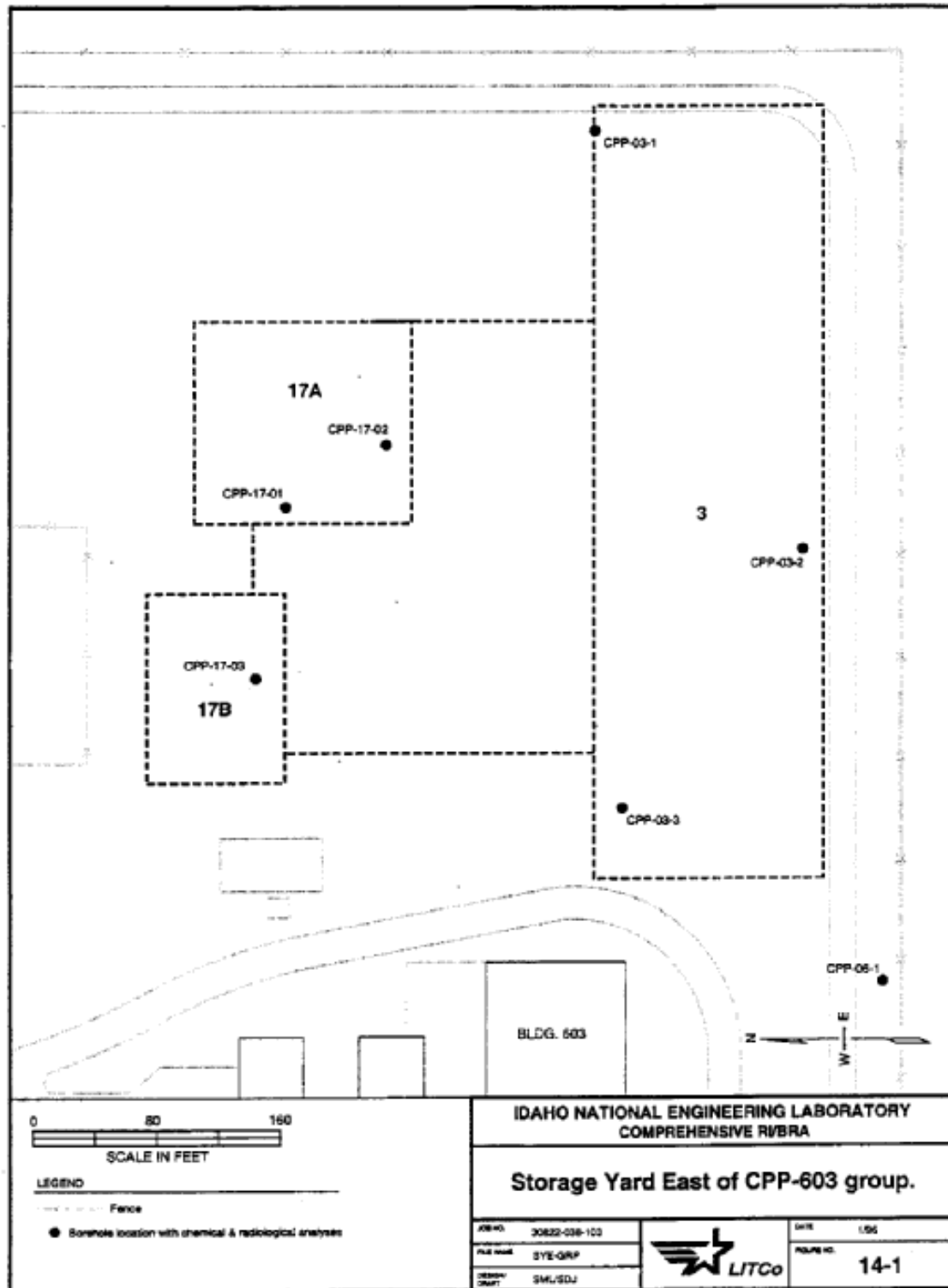


Figure C-1. Storage yard east of CPP-603, showing locations of Areas 71a and 17b (DOE-ID 1997).

In 1994, as part of the OU 3-09 Track 2 characterization activities at CPP-17, three soil borings were sampled to characterize Areas 17a and 17b. Soil boring locations were based on the October and December 1993 radiological surveys. Borehole CPP-17-1 was drilled in Area 17a at the south-central location that surveyed at 1,000 cpm, while borehole CPP-17-2 was drilled at the location along the western edge of Area 17a that surveyed at 1,200 cpm. Borehole CPP-17-3 was drilled at the south-central boundary in Area 17b at the location surveyed at 400 cpm.

A sample was collected between 0 and 0.15 m (0 and 0.5 ft) bgs in each of the three boreholes. Continuous samples were taken between 0.15 and 1.2 m (0.5 and 4 ft) bgs, and the sample collected from the interval having the highest radiation level was sent for laboratory analyses. Continuous samples were also taken between 1.2 and 3 m (4 and 10 ft) bgs, and the sample collected from the interval having the highest radiation level was also sent for laboratory analyses. Radiation levels in soil at 3 m (10 ft) bgs were at or below background levels for each of the three CPP-17 boreholes; therefore, the boreholes were not extended down to the soil–basalt interface. Analytical results identified Cs-137 and Sr-90 as the most widely distributed COCs at Area 17a. Cs-137 activity ranged from 19.4 to 3.19 pCi/g in surficial samples and from 1.83 pCi/g to below background in samples collected in the interval 0.15 to 0.6 m (0.5 to 2.0 ft) bgs. Sr-90 was not detected above background in surficial samples; however, it was detected at activities ranging from 2.72 to 0.875 pCi/g in samples collected from 0.15 to 0.6 m (0.5 to 2.0 ft) bgs. Sr-90 was also detected at an activity of 0.627 pCi/g in a sample from 2.4 to 2.9 m (8.0 to 10.0 ft) bgs. The depth of contamination at Areas 17a and 17b is, therefore, estimated to be 1.2 m (4.0 ft) bgs.

Results of the risk assessment presented in Section 14 of the OU 3-13 RI/BRA (DOE-ID 1997) indicate that the total cancer risk for the future resident, from exposure to site-related chemicals in soil at Areas 17a, and 17b, is estimated to be 1E-04 and 5E-05, respectively. Ingestion of homegrown produce and external radiation exposure are the major exposure routes contributing to this risk. For Area 17a, the risk from ingestion of homegrown produce is driven by Cs-137 (1E-05) and Sr-90 (5E-06). External radiation exposure at Area 17a has Cs-137 (8E-05) as the primary contributor to risk. For Area 17b, the risk from ingestion of homegrown produce is driven by Cs-137 (6E-06).

Table 4-1 of the OU 3-13 ROD (see Appendix CA, Figure CA-1) indicates that CPP-17 is a no further action site, and it was not placed into a site group. Therefore, CPP-17 is evaluated for release from institutional controls. The exposure-point COC concentrations calculated in the OU 3-13 RI/BRA are presented in Table C-9. Cs-137 remains the only COC at this site and will have decayed to acceptable levels for release from institutional controls for Area 17b by 2020 and for Area 17a by 2046.

Table C-9. Concentrations of contaminants of concern at CPP-17 and the release date from institutional controls.

Area	Contaminant of Concern	Exposure-Point Concentration (pCi/g) ^a	Collected (year)	2004 EPA Preliminary Remediation Goal ^b (1E-04) for Resident (pCi/g)	Decayed to Release from Institutional Control (year)
CPP-17a	Cs-137	19.4	1994	6	2046
CPP-17a	Sr-90	2.72	1994	23.1	NA
CPP-17b	Cs-137	10.5	1994	6	2020
CPP-17b	Sr-90	NA	1994	23.1	NA

a. Exposure-point concentration from Table 14-7. Area-weighted soil concentrations for the Storage Yard Group (0 to 10 ft) (DOE-ID 1997).

b. EPA (2004).

EPA Environmental Protection Agency

NA not applicable

C-4.3 CPP-22

Site CPP-22 is the location of potential surface contamination associated with a 1958 air release that resulted from the failure of a high-efficiency particulate air filter associated with the Fuel Element Cutting Facility. Acid used in the decontamination solutions apparently entered the vent line for the decontamination activities and breached the high-efficiency particulate air filters, enabling airborne contamination to spread over an estimated surface area of 12,200 m² (131,302 ft²). Fire hoses were used to spray down the entire area to prevent the contamination from being transported by the wind. The initial area of site CPP-22 was expanded due to results from sampling that indicated above-background activity levels. The revised area of site CPP-22 is 13,935 m² (150,000 ft²), as shown on Figure C-2.

Contamination from this airborne release has most likely been removed or covered over with soil during from 1958 to 1993 as a result of construction activities that have disturbed the area.

As part of the OU 3-13 remedial investigation/feasibility study (RI/FS) field sampling program, three boreholes were drilled within site CPP-22. Locations of boreholes CPP-22- 1, CPP-22-2, and CPP-22-3 were based on a radiation survey conducted June 16, 1995. Boreholes were sited at locations found to have the highest radiation levels above background.

At borehole location CPP-22-1, surficial radiation was measured at 200 cpm, with background measured at 100 cpm. Borehole CPP-22-1 was advanced to 3 m (10 ft) bgs. The sample collected from 0.9 to 2.1 m (3 to 7 ft) bgs was measured at 80 cpm above background, and was therefore submitted for analysis. Samples from 0 to 0.15 m (0 to 0.5 ft) bgs and 0.15 to 0.9 m (0.5 to 3 ft) bgs were also analyzed for radiological parameters.

At borehole location CPP-22-2, surficial radiation was measured at 200 cpm, with background measured at 100 cpm. Borehole CPP-22-2 was advanced to a total depth of 3.4 m (11 ft) bgs. Soil from 0.15 to 0.8 m (0.5 to 2.5 ft) bgs measured 50 cpm above background. The remaining soil samples collected measured at background radiological levels. Samples were collected for radiological analysis from 0 to 0.15 m (0 to 0.5 ft), 0.15 to 0.8 m (0.5 to 2.5 ft), and 2.1 to 3 m (7 to 10 ft) bgs.

Borehole CPP-22-3 was advanced to a total depth of 3.4 m (11 ft) bgs. The radiological survey of surface soil indicated 150 cpm, with local background measuring 100 cpm. All soil samples collected between the surface and 3 m (10 ft) bgs measured less than 100 cpm, and therefore, the sample from 2.4 to 3 m (8 to 10 ft) bgs was sent for analysis of radiological parameters. Samples from intervals 0 to 0.15 m (0 to 0.5 ft) bgs and 0.15 to 0.9 m (0.5 to 3 ft) bgs were also sent for analysis.

The OU 3-13 RI/BRA (DOE-ID 1997) identified Sr-90, Technetium-99, and Cs-137 as COCs for site CPP-22. No COCs were detected above background activity levels in samples from boring CPP-22-1. Cs-137, Sr-90, and Technetium-99 were detected in samples from 0 to 0.15 m (0 to 0.5 ft) bgs in borings CPP-22-2 and CPP-22-3. Cs-137 ranged from 3.7 to 14.3 pCi/g, Sr-90 ranged from 2.7 to 5.4 pCi/g, and Technetium-99 ranged from 0.9 to 2.3 pCi/g in those surficial samples. Cs-137 and Sr-90 were not detected above background activity in any of the subsurface samples [below 0.15 m (0.5 ft) bgs]. Technetium-99 was detected at 3.5 pCi/g in the sample from boring CPP-22-3 between 0.15 and 0.8 m (0.5 and 2.5 ft) bgs. Cs-137 was the highest radionuclide activity in the samples collected, at 14.3 pCi/g, in the sample from boring CPP-22-2, between 0 and 0.15 m (0 and 0.5 ft) bgs. No COCs were detected above background in samples from boring CPP-22-1. Samples from boring CPP-22-3, at the interval 2.4 to 3 m (8 to 10 ft) bgs, and from boring CPP-22-2, at the interval 2.1 to 3 m (7 to 10.0 ft) bgs, also showed no COCs above background. Consistent with an air release, contamination is evidently limited to shallow depth. The zone of contamination is assumed to extend from ground surface to 1.2 m (4 ft) bgs.

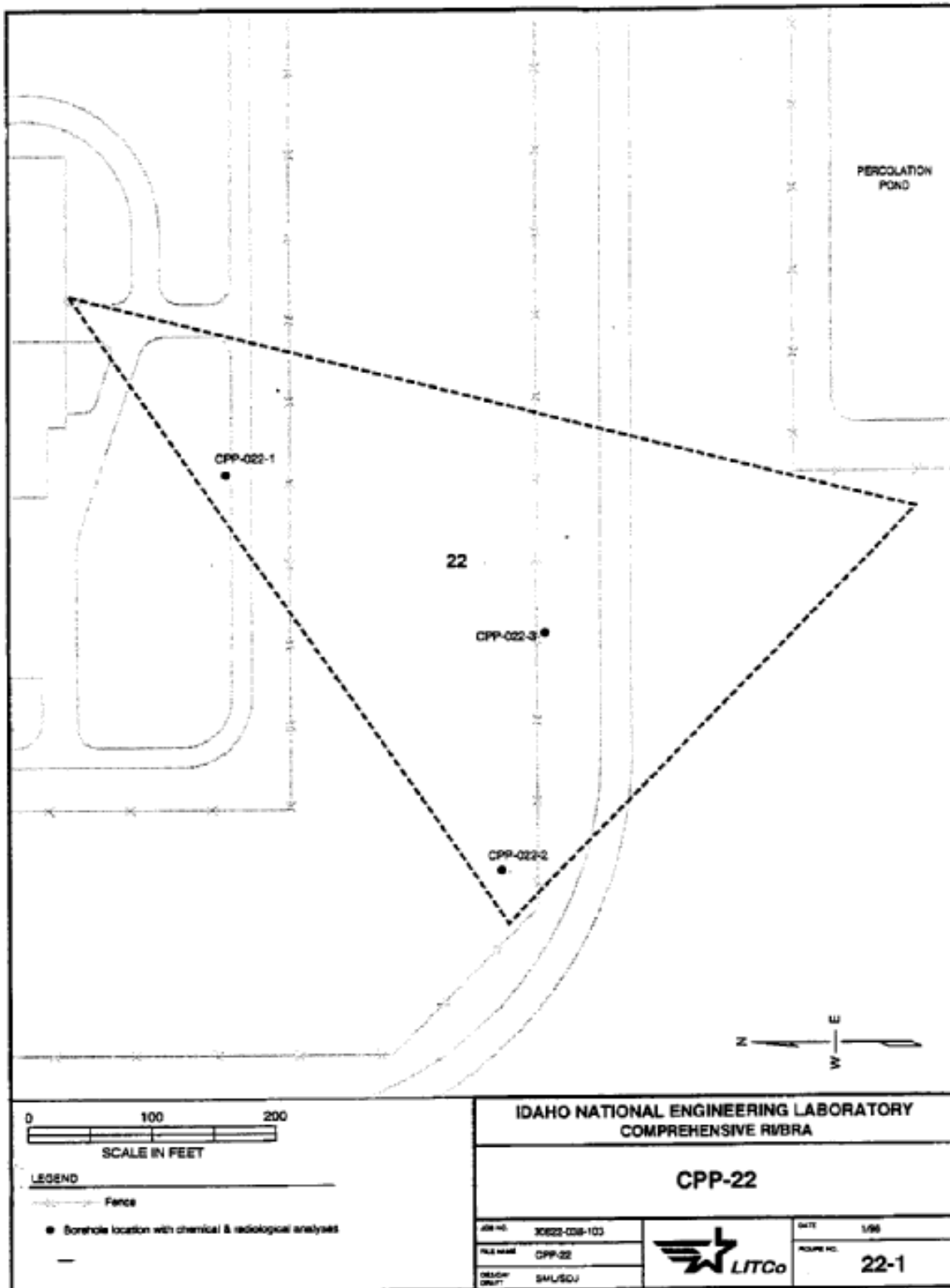


Figure C-2. CPP-22 and borehole locations (DOE-ID 1997).

The OU 3-13 RI/BRA found that total cancer risk to the current onsite worker, from exposure to site-related chemicals in surface soil, is estimated to be 1E-04. The risk is attributed to external radiation exposure, with the primary COC being Cs-137 (1E-04). There was no noncarcinogenic hazard to the current worker from contaminants at the site. The total cancer risk to the future resident, from exposure to site-related chemicals in soil, is estimated to be 6E-05. Under this land-use scenario, the excess cancer risk is driven by exposure to ionizing radiation from Cesium 137 (6E-05). The total noncarcinogenic hazard index to the future resident was estimated to be 1E-01. There were no hazard indices above unity for the future resident.

Table 4-1 of the OU 3-13 ROD (see Appendix CA, Figure CA-1) indicates that this is a no further action site; consequently, CPP-22 was not placed into a site group. Therefore, this site is evaluated for release from institutional controls. Maximum concentrations of the COCs are presented in Table C-10 and are decayed to 2010. Cs-137 remains the only COC at CPP-22 and will have decayed to acceptable levels for release from institutional controls by 2034.

Table C-10. Concentrations of contaminants of concern CPP-22 and the date for release from institutional controls.

Contaminant of Concern	Maximum Concentration (pCi/g)	Counted ^a (date)	Concentration as of 2010 (pCi/g)	2004 EPA Preliminary Remediation Goal ^b (1E-04) for Resident (pCi/g)	Decayed below 2004 EPA Preliminary Remediation Goals ^b (year)
Cs-137	14.3	July 6, 1995	10.25	6	2034
Sr-90	5.4	July 6, 1995	3.81	23.1	NA
Technetium-99	3.5	July 6, 1995	3.5	25.0	NA

a. Date counted from Table 3-3 of DOE-ID (1997).

b. EPA (2004).

EPA Environmental Protection Agency

NA not applicable

OU operable unit

C-4.4 CPP-88

Site CPP-88 includes the radioactively contaminated soils that have not been attributed to a release site identified in the Federal Facility Agreement/Consent Order (FFA/CO) (DOE-ID 1991). During construction activities at INTEC, primarily digging and excavation, radiological contamination is occasionally discovered in the soil. Areas of contamination that are not located within other sites are included in site CPP-88. This contamination is measured by radiological control technicians using field instruments and is reported in health physics survey reports. These measurements are not isotope-specific (usually reported as total beta-gamma activity) and only provide a qualitative estimate of radioactivity, reported as cpm, or mR/hour, depending on the instrument. Site CPP-88 includes only measurements made on soil and excludes contamination associated with buildings, structures, and concrete or asphalt pads.

Initial data-compilation efforts for this unit involved the following activities:

- Acquisition of historical health physics records that mostly consisted of health physics survey forms and some excavation permits. These records covered the period from December 1988 to March 1994.

- Examination of approximately 20,000 pages of these records was performed to identify soil-related radiation measurements. This examination also identified the headings or categories that are likely to indicate soil-related records. An additional 180,000 pages of records were then searched under headings or categories likely to contain soil-related records.

Only the records that could be located by position (i.e., coordinates) were retained for the database. The precision with which measurement locations could be determined was designated with a degree of confidence. Four indicators were used to convey this information:

- Excellent—Map point located within 0.3 m (1 ft) of the measurement
- Good—Map point located within 4.5 m (15 ft) of the measurement
- Fair—Map point located within general area
- Poor—Map point location is a guess, with little verification; actual measurement location may be hundreds of meters (feet) from the location shown on the map.

From the records search, measurements indicating contamination above background—that could be located using the confidence designation listed above—were plotted. Whenever a range of radiation measurements were recorded in the health physics survey report, the highest reading was used for plotting. In a few instances, the radiation measurements were reported in mR/hour. These values were converted in health physics survey reports from mR/hour to cpm by multiplying by 3,000. This multiplication factor is an approximate estimate used at the INTEC to convert mR/hour to cpm. To better identify areas of concern, the radiation measurements were screened using the following criteria:

- All data points contained within an radiologically controlled area (RCA) were excluded
- For collocated data points (i.e., located within approximately 4.6 m [15 ft] of each other), the measurement from the most recent date was used and the other data were excluded
- For collocated data points (i.e., located within approximately 4.6 m [15 ft] of each other), that were sampled at the same date, the highest measurement was used and the lower measurements were excluded.

Radiation measurements remaining after these screening steps are plotted in the WAG 3 Comprehensive RI/FS Work Plan Volume 1 (INEL 1995a). As part of the OU 3-13 RI/FS field sampling program, a total of 16 boreholes were completed to further evaluate distribution of radiological constituents in soil at site CPP-88. Based on evaluation of the surficial radiation measurements described previously, site CPP-88 was divided into 15 subareas (subareas and associated boreholes designated CPP-88-1 through 88-15), each of relatively equal area. These 15 subareas included approximately 90% of the elevated soil radiation measurements discussed above. Each of the subareas was divided into grids measuring 3 × 3 m (10 × 10 ft), the grids were numbered, and then a sample grid was selected, using a random number generator. A borehole was then completed at the center of the chosen grid. An additional boring was completed in Area CPP-88-9, at a location where surface radiation surveys have routinely detected radioactivity levels above 50,000 cpm. Locations of the 16 borings are shown in Figure 23-1 and discussed in detail in Section 23 of the OU 3-13 RI/BRA (DOE-ID 1997).

Analytical results for COPCs identified for site CPP-88 are summarized on Table 23-1 of the OU 3-13 RI/BRA (DOE-ID 1997). Based on the chemical screening, Sr-90, Cs-137, arsenic, and thallium were identified as COPCs for CPP-88 soils.

The OU 3-13 RI/BRA found that excess cancer risk to the current onsite worker, from exposure to site-related chemicals in surface soil, is estimated to be 1E-04. The risk is attributed to the external-radiation-exposure route. Cs-137 is the primary COC for the external-radiation-exposure route. The noncarcinogenic hazard index to the current worker is 0.

The OU 3-13 RI/BRA calculated that the excess cancer risk to the future resident, from exposure to site related chemicals in soil, is estimated to be 7E-05. Arsenic (1E-05) is the major contributor within the soil-ingestion-exposure route. However, examination of arsenic indicates that it should be considered to within background at CPP-88. Within the produce-ingestion-exposure route, the major contributor to risk is Sr-90 (4E-06). The risk from Cesium 137 (5E-05) is the major contributor for external radiation exposure. The noncarcinogenic hazard index to the future resident was estimated to be 1E-09. There are no hazard indices above unity for the future resident.

Table 4-1 of the OU 3-13 ROD (see Appendix CA, Figure CA-1) indicates that CPP-88 is a no further action site and was not placed into a site group. Therefore, CPP-88 is evaluated for release from institutional controls. The exposure-point COC concentrations calculated in the OU 3-13 RI/BRA (DOE-ID 1997) are presented in Table C-11. Cs-137 remains the only COC at this site and will have decayed to acceptable levels for release from institutional controls by 2025.

Table C-11. Concentrations of contaminants of concern at CPP-88 and the date to release from institutional controls.

Area	Contaminant of Concern	Exposure Point Concentration (pCi/g) ^a	Date Collected (year)	2004 EPA Preliminary Remediation Goal ^b (1E-04) for Resident (pCi/g)	Date Decayed to Release (year)
CPP-88	Cs-137	11.8	1994	6	2025
CPP-88	Sr-90	1.57	1994	23.1	NA

a. Exposure point concentration from Table 14-7. Area-weighted soil concentrations for the Storage Yard Group (0 to 3 m [0 to 10 ft]) (DOE-ID 1997).

b. EPA (2004).

EPA Environmental Protection Agency

C-4.5 CPP-90

CPP-90 consists of soil contaminated by leaks in service waste transfer lines between building CPP-709 and the CPP-23 injection well. The leak associated with site CPP-90 is believed to have resulted in the detection of trace amounts of ruthenium (Ru-106) in the INTEC (previously ICPP) production wells in May 1959. Service waste from the Process Equipment Waste Evaporator system, CPP-633 (Waste Calcining Facility), floor drains, steam condensate lines, and equipment cooling jackets was routed through the service waste line through the monitoring station in building CPP-709 to the CPP-23 injection well. From 1953 to 1984, service waste was routed through CPP-709 to the injection well, after which service waste was routed to the percolation ponds. The waste stream with the greatest potential for contamination was condensate from the process equipment waste system, which was a source of Sr-90, Cs-137, Ru-106, and Co-60 (LITCO 1995b).

The service waste transfer line originally consisted of a 61-cm (24-in.) concrete pipeline that ran approximately 164.6 m (540 ft) from CPP-709 to the CPP-23 injection well. Because of suspected deterioration of the line, assumed to be correlated to detections of trace amounts of ruthenium in

upgradient CPP production wells, the concrete pipe was replaced in 1959–1960. The concrete pipe was replaced with salt-glazed vitrified clay pipe, and the joints were sealed with a synthetic rubber polymer. In 1969, because of suspected releases of tritium from leaks in the transfer line—assumed to be related to increases of tritium in the production wells—the vitrified clay pipe was abandoned in-place and replaced with a stainless steel line. In 1976, a leak in the stainless steel line released approximately 70,000 L (18,492 gal) of contaminated water containing approximately 60 μCi of radioactivity. At that time, the line was repaired, and in 1982, approximately two-thirds of the line was replaced. During construction of building CPP-684 (Remote Analytical Laboratory) and the 1982 upgrade of the service waste line, hotspots were detected along the pipeline. The service waste transfer line has not been used regularly since service waste was directed to the percolation ponds in 1984. The transfer line and injection well were used only for emergency disposal purposes from 1984 to 1986 when the injection well and transfer line were permanently taken out of service. Most of the transfer lines were abandoned in place; however, the abandoned vitrified clay line was removed, except underneath building CPP-684, where it was grouted in place.

The equipment in building CPP-709 monitored radiological constituents in the service wastewaters before transfer to the CPP-23 injection well. The building was equipped with an alarm that signaled ICPP plant operators to terminate operations or divert the contaminated flows when radiological contamination was indicated by the monitoring equipment.

Three borings along the 164.6-m (540-ft) long pipe were drilled and sampled as part of the OU 3-13 RI/FS field investigation. Boring CPP-90-1 was drilled near the ICPP injection well, boring CPP-90-2 was drilled near building CPP-684, and boring CPP-90-3 was drilled near the CPP-709 pump house. These locations are shown in Figure C-3 (Figure 24-1 from the OU 3-13 RI/BRA [DOE-ID 1997]). The boreholes were drilled to the soil–basalt interface, and five samples were collected from each borehole from within the alluvium. Samples were analyzed for Contract Laboratory Program (CLP) inorganics, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), gross alpha/beta radiation, and gamma spectroscopy. Samples were also analyzed for Sr-90 and Technetium-99 if gross beta was higher than 30 pCi/g; and for Am-241, Np-237, and uranium and plutonium isotopes if gross alpha was greater than 20 pCi/g.

Based on the investigative results, the primary COCs associated with this site are Cs-137 and Sr-90. These radionuclides were detected above background in borings drilled along the former pipeline that transferred service waste water to the injection well through building CPP-709. Cs-137 concentrations above background were limited to the upper 3 m (10 ft) in all three borings. Sr-90 was only detected above background in three soil samples collected below a depth of 3 m (10 ft) bgs.

Several polyaromatic hydrocarbons were detected in the surface sample from boring CPP-90-3, but detections of these compounds do not appear to correlate with elevated Cs-137 concentrations and are not likely to be related to leaks from the transfer lines. The distribution of inorganics detected above background (i.e., mercury, arsenic, and antimony), suggests that these inorganics are not related to contamination at the site. Based on the distribution of radionuclides in soil, the zone of contamination at this site extends from the ground surface down the soil/basalt interface at a depth of about 15 m (48 ft). Elevated Cs-137 levels are confined to the upper 3 m (10 ft), while Sr-90 concentrations above background are present from about 6 to 13 m (20 to 42 ft). The volume of contaminated soil was estimated for the purpose of calculating a source term for the model, using a depth of 14.7 m (48.1 ft), a length of the site of 164.6 m (540 ft), and a width of 3 m (10 ft) along the service waste line.

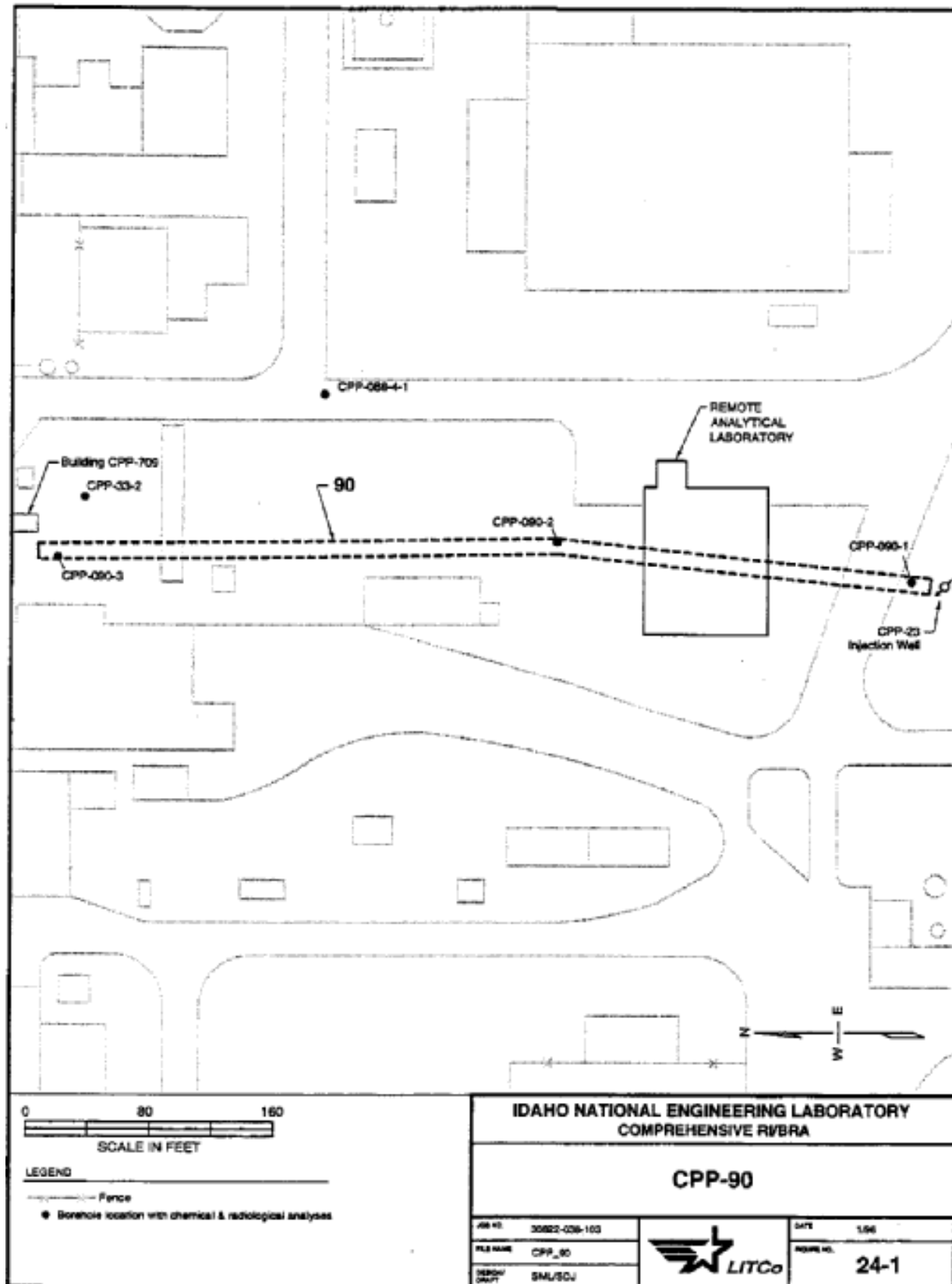


Figure C-3. CPP-90 and borehole locations (Figure 24-1 from DOE-ID [1997]).

Section 24 of the OU 3-13 RI/BRA presents the assessment of this site. The calculated total cancer risk to the current onsite worker from exposure to site-related chemicals in surface soil is estimated to be 7E-05. The risk is attributed to the ingestion-of-soil and external-radiation exposure pathways. The primary COC for the ingestion-of-soil exposure route is arsenic (6E-06). The primary COC in the external-radiation exposure route is Cs-137 (7E-05). The total noncarcinogenic hazard index to the current worker was estimated to be 3E-09. There are no hazard indices above unity for the current onsite worker.

The total cancer risk to the future resident from exposure to site-related chemicals in soil is estimated to be 7E-05. Within the ingestion-of-soil exposure route, the major contributors are benzo(a)pyrene (2E-06) and arsenic (3E-05). Within the homegrown-produce-ingestion exposure route, the major contributor to risk is arsenic (3E-06). The risk from Cs-137 (3E-05) is the major contributor for external radiation exposure. The total noncarcinogenic hazard index to the future resident is estimated to be 1E-01. There are no hazard indices above unity for the future resident.

Table 4-1 of the OU 3-13 ROD (see Appendix CA, Figure CA-1) indicates that CPP-90 is a no further action site, and it was not placed into a site group. Therefore, CPP-90 is evaluated for release from institutional controls. The exposure-maximum COC concentrations from the OU 3-13 RI/BRA (DOE-ID 1997) are presented in Table C-12, which shows that both Cs-137 and Sr-90 have decayed below acceptable levels for institutional controls at this time.

Table C-12. Concentrations of contaminants of concern at CPP-90 and the date to release from institutional controls.

Area	Contaminant of Concern	Maximum Concentration (pCi/g) ^a	Collected (date)	2004 EPA Preliminary Remediation Goal ^a (1E-04) for Resident (pCi/g)	Decayed below 2004 EPA Preliminary Remediation Goal ^a (Yes/No)
CPP-90	Cs-137	7.50	June 14, 1995	6	Yes
CPP-90	Sr-90	6.3	June 14, 1995	23.1	Yes

a. EPA (2004).

EPA Environmental Protection Agency

C-4.6 CPP-95—Windblown Area

The area surrounding the ICPP (now INTEC) was identified as a potential windblown radionuclide-contaminated soil area by a 1990 aerial survey (EMI 1992). Figure C-4 (i.e., Figure 9-1 of the OU 10-06 Engineering Evaluation/Cost Analysis (EE/CA) [INEL 1995b]) shows the isopleths produced from data collected during the 1990 survey over ICPP. Windblown Area CPP-95, located outside the INTEC perimeter fence, has been investigated as a portion of OU 10-06 radionuclide-contaminated soil. A detailed description of this investigation is presented in the OU 10-06 EE/CA (INEL 1995b); therefore, this section will only summarize the findings of that investigation.

The 1990 isopleths near ICPP were identified by Energy Measurements, Inc., to result from gamma rays emitted by Cs-137 in the northeastern and southwestern portion of the ICPP Windblown Area. Cs-137 was detected at elevated levels in OU 10-06 Phase I and Radiological and Environmental Sciences Laboratory samples collected in these areas, indicating that the Energy Measurements isopleth is a result of gamma-rays emitted by Cs-137 contained in surface soil.

To determine the nature and extent of radionuclide-contaminated soil in the ICPP Windblown Area, samples were collected during Phase I of OU 10-06. The vertical extent of radionuclide-contaminated soils in the ICPP Windblown Area is believed to be restricted to the upper 10 cm (4 in.) of soil. An evaluation of the Phase I and Radiological and Environmental Sciences Laboratory data sets was performed to determine the horizontal extent of radionuclide-contaminated soil. Most of the elevated Cs-137 concentrations observed in the ICPP Windblown Area occur near the facility and in the primary wind directions. Contaminant concentrations generally decrease with increasing distance from the facility. These observations are indicative of windblown contamination, possibly from a stack release. OU 10-06 presents the kriging results generated using the Phase I and Radiological and Environmental Sciences Laboratory data sets and bounds the horizontal extent of Cs-137 contamination to 5 pCi/g or greater within the kriging contour, as depicted in Figure C-4 (Figure 9-1 in the OU 10-06 EE/CA [INEL 1995b]).

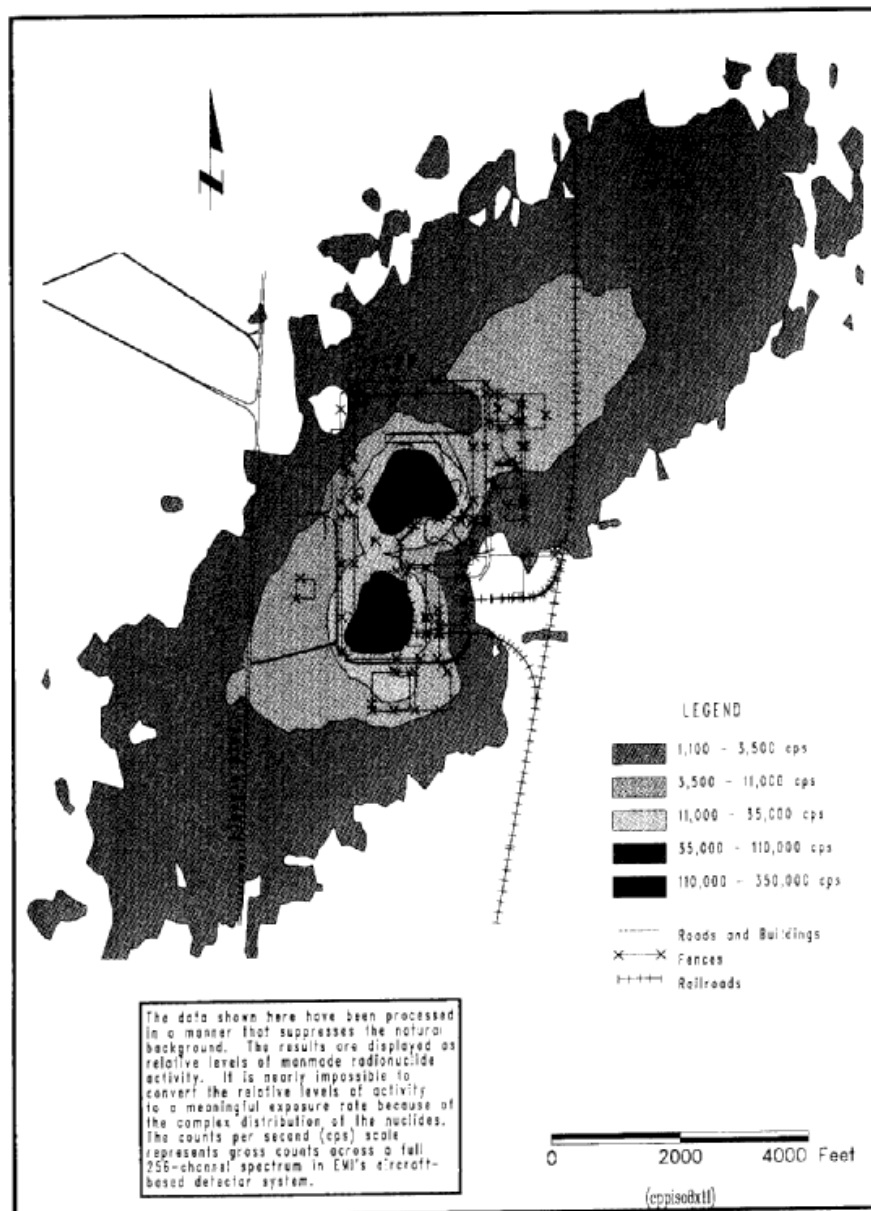


Figure C-4. Isopleths in the ICPP Windblown Area of the Idaho Nuclear Technology and Engineering Center, circa 1995 (copy of Figure 9-1 from INEL [1995b]).

The ICPP Windblown Area was evaluated for potential adverse health effects to current workers and hypothetical future residents. The COPCs evaluated in the risk assessment included Am-241, Cs-137, Pu-238, Sr-90, U-233, U-235 and uranium. These radionuclides were COPCs because either they were detected above background concentrations in surface soil at the ICPP Windblown Area or because no background values were available (i.e., Cs-134, U-233, and U-235). The exposure-point concentrations developed for use in the risk assessment are presented in Table C-13.

OU 10-06 evaluated the risk from the exposure pathways identified for the current occupational scenario. The risk from all radionuclides for all exposure pathways is 3E-07. The hazard quotient for uranium is below 1. The total risk from exposure for the future resident is 8E-06, which is from food-crop ingestion. The contributing risk is Sr-90, with a risk of 2E-06. The hazard quotient for uranium is below 1.

The ICPP Windblown Area (OU 10-06) was retained in the OU 3-13 ROD because of elevated levels of Cs-137. Table 4-1 of the OU 3-13 ROD (see Appendix CA, Figure CA-1) indicates that this is a no further action site, and it was not placed into a site group. Therefore, this site is evaluated for release from institutional controls in this 5-year review. The concentrations of COCs determined in the OU 10-06 EE/CA (INEL 1995b) are presented in Table C-13. Cs-137 remains the only COC at this site and will have decayed to acceptable levels for release from institutional controls by 2021.

Table C-13. Concentration terms for the contaminants of potential concern at the ICPP^a Windblown Area.

Contaminant of Potential Concern	Concentration Term (pCi/g)	2004 EPA Preliminary Remediation Goal ^b (1E-04) for Resident (pCi/g)	Concentration as of 2010	Decayed for Release (year)
Am-241	0.017 ^c	187	NA	NA
Cs-137	11 ^d	6	7.79	2021
Pu-238	0.08 ^c	297	NA	NA
Sr-90	5.3 ^e	23.1	NA	NA
U-233	1.08 ^c	386	NA	NA
U-235	0.05 ^c	20.5	NA	
Uranium	3.47 mg/kg ^f	NA	NA	NA

Note: Assumed date of calculation for decay is January 1, 1995.

a. ICPP is now called the Idaho Nuclear Technology and Engineering Center.

b. EPA (2004).

c. 95% upper confidence limit.

d. Based on the kriging results.

e. Maximum concentration detected.

f. This soil concentration is derived from the maximum soil concentration of U-238.

EPA	Environmental Protection Agency
ICPP	Idaho Chemical Processing Plant
NA	not applicable

C-5. GROUP 4—PERCHED WATER (CPP-83)

The OU 3-13 ROD (DOE-ID 1999) defined CPP-83 to include all perched water zones beneath INTEC. Figure 4-29 of that document shows the lateral extent of the northern shallow perched water zone in 2009. A smaller perched water zone exists in the southern portion of INTEC beneath CPP-603. Much of the perched water is contaminated with radionuclides and other constituents as a result of historical releases.

The perched water beneath INTEC does not pose a direct human health threat because it is not currently used for consumption; and, in the absence of anthropogenic recharge, the perched water zones do not yield sufficient water to sustain permanent residence. Therefore, a hypothetical future water supply well completed in the perched water would not be capable of providing sufficient water for domestic purposes. However, the perched water does pose a threat as a contaminant transport pathway to SRPA groundwater, and contaminants already in the perched water constitute a secondary contaminant source that could result in future contamination of the SRPA. For comparison purposes, perched water quality results are compared to drinking water MCLs, but such comparison is for reference only.

Sr-90 is by far the most significant contaminant in the perched water beneath INTEC. Although several other constituents still exceed drinking water standards at a few monitoring well locations, Sr-90 is the only constituent that consistently exceeds the MCL by a large margin. As of 2009, the highest Sr-90 concentration in perched water was 130,000 pCi/L at monitoring well ICPP-2018. The MCL for Sr-90 is 8 pCi/L.

In order to assess the duration of the institutional control period for CPP-83 (perched water), calculations were performed to estimate how long Sr-90 activities will continue to exceed the drinking water MCL. The calculation used the highest Sr-90 concentration observed in perched water during 2009 (130,000 ±10,300 pCi/L at monitoring well ICPP-2018 on March 24, 2009) and a half-life for Sr-90 of 29.1 years. Using the conservative assumption that radioactive decay is the only process resulting in declining Sr-90 levels, the following equation would apply:

$$t = (T_{1/2} / \ln 2) * \ln (N_0/N)$$

Where

- t = elapsed time (yr) until perched water no longer exceeds the Sr-90 MCL
- $T_{1/2}$ = Sr-90 half life (29.1 yr)
- N_0 = Sr-90 activity at time zero (130,000 pCi/L in 2009)
- N = Sr-90 MCL (8 pCi/L).

Figure C-5 shows the projected decay rate for Sr-90 in perched water. The actual rate of decrease in Sr-90 concentrations would be faster as a result of dilution and dispersion. However, these conservative calculations indicate that institutional controls for the perched water will need to be maintained for approximately 400 more years (until the year 2416).

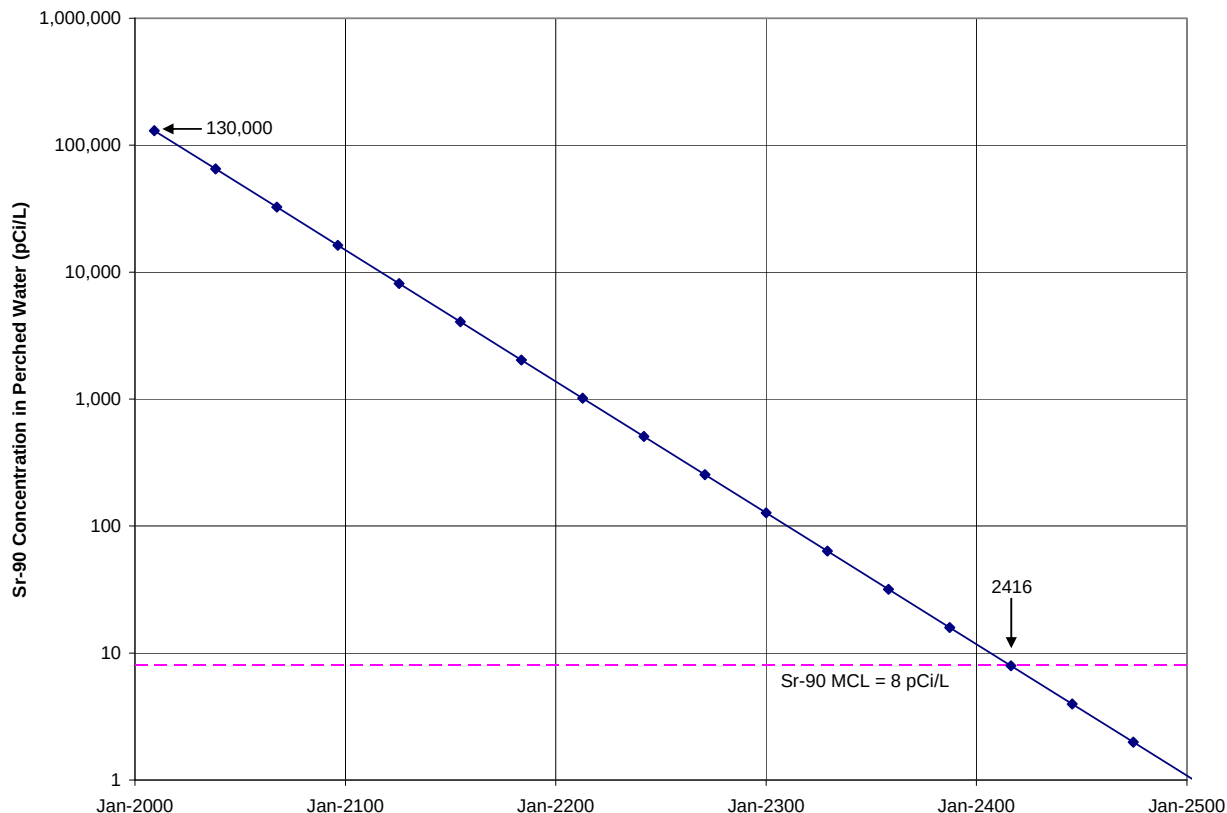


Figure C-5. Decay rate for Sr-90 in perched water.

C-6. REFERENCES

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Appendix CA

Copy of Table 4-1 from the Operable Unit 3-13 Record of Decision

Appendix CA

Copy of Table 4-1 from the Operable Unit 3-13 Record of Decision

Appendix CA refers to information and data from “Table 4-1, WAG 3 CPP release sites and site grouping,” from the *Final Record of Decision Idaho Nuclear Technology and Engineering Center, Operable Unit 3-13* (DOE ID 1999). A copy of that table is provided in this appendix.

Table 4-1. WAG 3 CPP release sites and site grouping.

Site	Operable Unit	Description	Site Group	OU 3-13 ROD Decision
CPP-01	OU 3-09	Concrete settling basins and dry wells east of CPP-603	3	RD/RA
CPP-02	OU 3-09	French drain west of CPP-603	2	RD/RA
CPP-03	OU 3-09	Temporary storage area southeast of CPP-603	3	RD/RA
CPP-04	OU 3-09	Contaminated soil area around CPP-603 settling tank	3	RD/RA
CPP-05	OU 3-09	Contaminated soil around CPP-603 settling basin	3	RD/RA
CPP-06	OU 3-09	Trench east of CPP-603 fuel storage basin	none	"No Further Action"
CPP-07	OU 3-02	Soil contamination northwest of CPP-642	none	"No Action"
CPP-08	OU 3-09	CPP-603 basin filter system line failure	3	RD/RA
CPP-09	OU 3-09	Soil contamination at northeast corner of CPP-603 south basin	3	RD/RA
CPP-10	OU 3-09	CPP-603 plastic pipeline break	3	RD/RA
CPP-11	OU 3-09	CPP-603 sludge and water release	3	RD/RA
CPP-12	OU 3-02	Contaminated paint chips and pad south of CPP-603	none	"No Action"
CPP-13	OU 3-08	Pressurization of solid storage cyclone northeast of CPP-633	3	RD/RA
CPP-14	OU 3-05	Old Sewage Treatment Plant west of CPP-664	3	RD/RA
CPP-15	OU 3-08	Solvent burner east of CPP-605	1	RD/RA
CPP-16	OU 3-07	Contaminated soil from leak in line from CPP WM-181 to PEW Evaporator	1	RD/RA-OU 3-14 ^a
CPP-17	OU 3-09	Soil storage area south of CPP Peach Bottom fuel storage area	none	"No Further Action"
CPP-18	OU 3-02	Gas storage building, current location of CPP-668	none	"No Action"
CPP-19	OU 3-09	CPP-603 to CPP-604 line leak	3	RD/RA
CPP-20	OU 3-07	CPP-604 radioactive waste unloading area	1	RD/RA
CPP-21	OU 3-02	Solid waste storage bin south of CPP-601	none	"No Action"
CPP-22	OU 3-09	Particulate air release south of CPP-603	none	"No Further Action"
CPP-23	OU 3-02	CPP injection well (MAH-FE-PL-304)	5	RD/RA ^b
CPP-24	OU 3-07	CPP Tank Farm area bucket spill	1	RD/RA-OU 3-14 ^a

Figure CA-1. Table showing Waste Area Group 3 Chemical Processing Plant release sites and site grouping (DOE-ID 1999).

Table 4-1. (continued).

Site	Operable Unit	Description	Site Group	OU 3-13 ROD Decision
CPP-25	OU 3-07	Contaminated soil in the Tank Farm area north of CPP-604	1	RD/RA
CPP-26	OU 3-07	Contaminated soil in the Tank Farm area from steam flushing	1	RD/RA
CPP-27	OU 3-08	Contaminated soil in the Tank Farm area east of CPP-604	1	RD/RA
CPP-28	OU 3-07	Contaminated soil in the Tank Farm area south of WM-181 by Valve Box A-6	1	RD/RA
CPP-29	OU 3-08	Contaminated soil north and west of the main stack (CPP-708)	none	"No Action"
CPP-30	OU 3-07	Contaminated soil in the Tank Farm area near Valve Box B-9	1	RD/RA-OU 3-14 ^a
CPP-31	OU 3-07	Contaminated soil in the Tank Farm area south of Tank WM-183	1	RD/RA
CPP-32	OU 3-07	Contaminated soil in the Tank Farm area southwest and northwest of Valve Box B-4	1	RD/RA
CPP-33	OU 3-06	Contaminated soil in the Tank Farm area near WL-102, northeast of CPP-604	1	RD/RA
CPP-34	OU 3-06	Soil storage area (disposed trenches) in the northeast corner of the ICPP	3	RD/RA
CPP-35	OU 3-08	CPP-633 decontamination spill	3	RD/RA
CPP-36	OU 3-08	Transfer line leak from CPP-633 to WL-102	3	RD/RA
CPP-37a	OU 3-02	Gravel pit—outside INTEC fence	3	RD/RA
CPP-37b	OU 3-02	Gravel pit and debris landfill inside INTEC fence	3	RD/RA
CPP-38	OU 3-04	Friable transite on CPP-601 through -606, -640, -644, and -648 ^c	Closure under another program	
CPP-39	OU 3-13	CPP HF storage tank (YDB-105) and dry well. OU 3-13 no Track 1 or Track 2.	none	"No Action"
CPP-40	OU 3-06	Lime pit at the base of the CPP-601 berm and french drain	none	"No Action"
CPP-41a	OU 3-02	Fire training pits between CPP-666 and CPP-663, under asphalt	2	RD/RA
CPP-41b	OU 3-02	Fire training pits between CPP-666 and CPP-663	none	"No Action"
CPP-42	OU 3-10	Drainage ditch west of CPP-637	none	"No Action"

Figure CA-1. (continued).

Table 4-1. (continued).

Site	Operable Unit	Description	Site Group	OU 3-13 ROD Decision
CPP-43	none	Grease pit south of CPP-637	none	"No Action" per FFA/CO
CPP-44	OU 3-10	Grease pit south of CPP-608	3	RD/RA
CPP-45	OU 3-11	CPP-621 chemical storage area spills	none	"No Action"
CPP-46	OU 3-10	CPP-637 courtyard pilot plant release	none	"No Action"
CPP-47	OU 3-06	Pilot plant storage area west of CPP-620	none	"No Action"
CPP-48	OU 3-13	French drain south of CPP-633	3	RD/RA
CPP-49	OU 3-01	PCB transformer yard (CPP-705)	none	"No Action"
CPP-50	OU 3-01	PCB transformer yard (CPP-731)	none	"No Action"
CPP-51	OU 3-01	PCB staging area west of CPP-660	none	"No Action"
CPP-52	none	Pickling shed east of CPP-631	none	"No Action" per FFA/CO
CPP-53	OU 3-02	Paint and paint solvent area south of CPP-697	none	"No Action"
CPP-54	OU 3-02	Drum storage area west of CPP-660	none	"No Action"
CPP-55	OU 3-02	Mercury-contaminated area south of CPP T-15	3	RD/RA
CPP-56	OU 3-10	Nitric acid contamination south of CPP-734	none	"No Action"
CPP-57	OU 3-02	Sulfuric acid spills east of CPP-606	none	"No Action"
CPP-58	OU 3-11	CPP PEW evaporator overhead pipeline spills	1	RD/RA
CPP-59	OU 3-02	Kerosene tank overflow west of CPP-633	none	"No Action"
CPP-60	OU 3-02	Paint shop at present location of CPP-645	2	RD/RA
CPP-61	OU 3-01	PCB spill in CPP-718 transformer yard	none	OU 3-14 RI/FS ^d
CPP-62	OU 3-02	Mercury-contaminated area near CPP TB-4	none	"No Action"
CPP-63	OU 3-02	Hexone spill by CPP-710	none	"No Action"
CPP-64	OU 3-02	Hexone spill west of CPP-660	none	"No Action"
CPP-65	OU 3-02	CPP Sewage Treatment Plant lagoons	Closure under another program	
CPP-66	OU 3-02	CPP coal-fired steam generation facility Fly Ash Pit	WAG 10	RD/RA
CPP-67	OU 3-03	CPP Percolation Ponds #1 and #2	3	RD/RA
CPP-68	OU 3-02	Abandoned gasoline tank CPP VES-UTI-652 (North of Building 606)	2	RD/RA

Figure CA-1. (continued).

Table 4-1. (continued).

Site	Operable Unit	Description	Site Group	OU 3-13 ROD Decision
CPP-69	OU 3-09	Abandoned liquid radioactive waste storage Tank CPP VES-SFE-20	7	RD/RA
CPP-70	none	Septic tank east of CPP-655	none	"No Action" per FFA/CO
CPP-71	none	Seepage pits west of CPP-656	none	"No Action" per FFA/CO
CPP-72	none	CPP-758 cesspool east of CPP-651	none	"No Action" per FFA/CO
CPP-73	none	Leaching cesspool east of CPP T-15	none	"No Action" per FFA/CO
CPP-74	none	Seepage pit and septic tank west of CPP-626	none	"No Action" per FFA/CO
CPP-75	none	Septic tank and cesspool west of CPP-603	none	"No Action" per FFA/CO
CPP-76	none	Septic tank and cesspool west of CPP-659	none	"No Action" per FFA/CO
CPP-77	none	Seepage pit and cesspool north of CPP-662	none	"No Action" per FFA/CO
CPP-78	OU 3-09	Contaminated soil west of CPP-693, east of dry fuel storage area	none	"No Action"
CPP-79	OU 3-07	Tank farm release near Valve Box A-2	1	RD/RA
CPP-80	OU 3-12	CPP-601 vent tunnel drain leak	2	RD/RA
CPP-81	OU 3-12	Abandoned CPP-637/CPP-601 VOG line	none	OU 3-14 RI/FS ^d
CPP-82	OU 3-12	Abandoned line (3.8 cm [1.5in.]) PLA-766 west of Beech Street	none	OU 3-14 RI/FS ^d
CPP-83	OU 3-08	The entire perched water system at the INTEC	4	RD/RA
CPP-84	OU 3-13	Gas canisters (buried gas cylinders)	6	RD/RA
CPP-85	OU 3-13	Waste Calcining Facility blower corridor	2	Part of WCF closure
CPP-86	OU 3-13	CPP-602 waste trench sump	2	RD/RA
CPP-87	OU 3-13	CPP-604 VOG blower cell sump and floor drain	2	RD/RA
CPP-88	OU 3-13	Radiologically contaminated soil	none	"No Further Action" - Conduct 5-year review
CPP-89	OU 3-13	CPP-604/-605 tunnel excavation	2	RD/RA
CPP-90	OU 3-13	CPP-709 ruthenium detection	none	"No Further Action" - Conduct 5-year review

Figure CA-1. (continued).

Table 4-1. (continued).

Site	Operable Unit	Description	Site Group	OU 3-13 ROD Decision
CPP-91	OU 3-13	CPP-633 blower pit drain	3	RD/RA
CPP-92	OU 3-13	Soil boxes west of CPP-1617	3	RD/RA
CPP-93	OU 3-13	Simulated calcine disposal trench	3	RD/RA
CPP-94	OU 3-13	Gas canisters (buried gas cylinders)	6	RD/RA
CPP-95	OU 3-13	Airborne plume (also shown in 10-06)	None	"No Further Action" - Conduct 5-year review
CPP-96	OU 3-13	Tank Farm interstitial soils	1	RD/RA
CPP-97	OU 3-13	Tank Farm soil stockpile	3	RD/RA
CPP-98	OU 3-13	Tank Farm shoring boxes	3	RD/RA
CPP-99	OU 3-13	Boxed soil	3	RD/RA

a. No action sites within the Tank Farm are consolidated into Site CPP-96. Because the sites are within the Tank Farm they will be subject to the Group 1 Interim Action and to the OU 3-14 RI/FS.

b. CPP-23 is a source for OU 3-13 Group 5 aquifer contamination outside the INTCE fence. The source will be remediated under OU 3-14.

c. CPP-38 is asbestos on roofs and walls of buildings. The site will be closed under the INEEL Asbestos Abatement Program.

d. Site moved to the OU 3-14 RI/FS because not enough data is available to make a risk-based decision.

Figure CA-1. (continued).

Appendix D

Waste Area Group 4—Central Facilities Area Supporting Analysis

Appendix D

Waste Area Group 4—Central Facilities Area Supporting Analysis

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ACRONYMS

bgs	below ground surface
CLP	Contract Laboratory Program
EPA	Environmental Protection Agency
OU	operable unit
PRG	preliminary remediation goal
RI/FS	remedial investigation/feasibility study
STP	sewage treatment plant
UCL	upper confidence limit

Appendix D

Waste Area Group 4—Central Facilities Area Supporting Analysis

D-1. INTRODUCTION

The risk assessment performed in the Operable Unit (OU) 4-13 Remedial Investigation/Feasibility Study (RI/FS) for the Central Facilities Area (DOE-ID 2000a) compared concentrations to slope factors provided by the U.S. Environmental Protection Agency (EPA) *Health Effects Assessment Summary Tables (HEAST)* (EPA 1994) and used preliminary remediation goals (PRGs) developed for use at the Idaho National Laboratory Site (Fromm 1996). Since that time, EPA has provided updated slope factors and PRGs for radionuclides presented on the EPA Web site (<http://epa-prgs.ornl.gov/radionuclides/>) (EPA 2010). These changes were discussed in Appendix A of the last 5-year review (DOE-ID 2007). Because the previous slope factors and PRGs remained protective, the new values were not incorporated into any site-specific evaluation. Although, radionuclides are commonly the only contaminant of concerns at sites of concern, other changes in the values used in risk assessment have occurred. These changes are addressed in this technical reevaluation.

The Waste Area Group 4 sites addressed in this technical reevaluation are those impacted by changes to toxicity and other risk values and those sites that require institutional control. CFA-08 is the only site that has adequate sampling data to evaluate. Asbestos is present in landfills CFA-01, -02 and -03. The EPA has a new Framework for Investigating Asbestos-Contaminated Superfund Sites (EPA 2008), and the sampling at these sites is not appropriate to that Framework. The CFA-07 French drain site requires institutional control because of the presence of metals and radionuclides. Because metals do not decay and are most likely bound in the soil, a release date for the site cannot be calculated (DOE 1995).

D-1.1 CFA-08 Sewage Treatment Plant Drain Field

The CFA-08 Sewage Treatment Facility was built by the U.S. Navy in 1944 and, with modifications and expansions, was in operation until 1995. CFA-08 consists of potential releases from the components of the Sewage Treatment Plant (STP) (CFA-691), the septic tank (CFA-716), and the drain field (see Figure 4-16 of DOE-ID [2000a]). The CFA-08 STP treated effluent from sewage waste lines from chemical laboratories, craft shops, warehouses, photographic services, vehicle services, a medical dispensary, a maintenance repair shop, and a laundry facility that processed low-level radiologically contaminated clothing. The original system, installed by the Navy in 1944, handled wastewater until 1953. The original Navy system was upgraded in 1953 to include a pump station, trickling filters, and a digester. The Navy plant is presumed to have handled only sanitary wastewater until 1950, when the original hot laundry was built. The hot laundry processed clothing contaminated with low-levels of radionuclides. The wastewater from this process was discharged directly from the plant to the CFA-08 drain field. The STP received effluent from the hot laundry through the laundry drain pipe until the drain pipe was abandoned, in place, in 1980 (Stormberg and Haney 1996). The STP was deactivated in 1995, and the abandoned line from the hot laundry to the STP was removed during deactivation and decommissioning of the hot laundry.

The CFA-08 STP, septic tank, and drain field were evaluated as three separate CFA-08 sites in the OU 4-13 RI/FS (which included the baseline risk assessment) (DOE-ID 2000a) because each of these CFA-08 components is located in a distinct area of CFA-08. Separation of CFA-08 into three sites also

allowed for a more site-specific delineation of the nature and extent of contamination at CFA-08; that is, contaminants of potential concern were identified specifically for the drain field, pipeline, and the CFA-08 STP. The OU 4-13 RI/FS (DOE-ID 2000a) eliminated the CFA-08 pipeline and the CFA-08 STP as risks in the baseline risk assessment. Results of the baseline risk assessment indicate that the CFA-08 sewage plant drain field poses a threat to human health from external radiological exposure to Cs-137 present in the soil.

The CFA-08 drain field is located approximately 450 m (1,476 ft) northeast of the STP (see Figure 4-16 of DOE-ID [2000a]). The drain field measures 61 × 305 m (200 × 1,000 ft), and consists of five distribution areas, each with a distribution box and 20 distribution lines. The drain field distribution lines are made of concrete drain tiles that lie approximately 1.1 m (3.5 ft) below ground level (bgs). The first two drain fields were installed as part of the Navy's sewer system and became operational in 1944. Two additional distribution areas were installed in 1953 as part of the new sewer system, and a fifth distribution area was added in 1961 (EG&G 1988). Based on process knowledge, the CFA-08 drain field received wastewater containing radiological and other effluent.

When the fifth distribution area was added to the drain field in 1961, the two original 10-cm (4-in.) pipelines between the pumping station and the drain field were capped and abandoned in place. The pipelines were replaced with a new 20-cm (8-in.) trunk line and feeder lines going to each of the distribution boxes and drain field batteries. Two influent pipelines connected south of the STP, and a single influent line extended to the STP. To accommodate overflow, a pipeline ran from the adjoining influent lines to the CFA-716 septic tank (Evans et al. 1995).

D-1.2 Sampling

In 1989, limited sampling of the drain field surface soil was conducted in search of radiological contaminants. Five biased samples were collected where areas of elevated radiological contamination were observed, and results ranged from nondetect to 600 pCi/g (Martin et al. 1992). Because of uncertainty as to the sample location, these samples were not included in any assessment.

In 1994, the CFA-08 drain field was sampled as part of the OU 4-08 Track 2 investigation (Evans et al. 1995). As part of this Track 2 investigation, surface and subsurface soil samples collected from eight locations were biased toward areas of highest radioactivity within the drain field (see Figure 4 in the Field Sampling Plan for OU 4-13 [Blackmore et al. 1998]). Several subsurface borings were completed in and around the drain field area to provide information about the soil and subsurface conditions associated with the drain field. Five shallow boreholes were drilled inside the drain field from the ground surface to the soil–basalt interface, which ranged from 5.8 to 8.2 m (19 to 27 ft) bgs. Surface soil samples (0 to 15 cm [0 to 6 in.] deep) were collected from eight locations within the drain field. Soil samples were also collected from shallow borings in the drain field. Samples were analyzed for:

- Alpha-, gamma-, and beta-emitting radionuclides (by alpha and gamma spectroscopy and Sr-90 analysis)
- Contract Laboratory Program (CLP) metals
- CLP volatile organic compounds
- CLP semivolatile organic compounds
- CLP polychloride biphenyls
- CLP pesticides and selected herbicides.

Gamma was not detected in any samples deeper than 2.4 m (8 ft) bgs. A summary of the Cs-137 data collected in 1994 is presented in Table D-1.

In 1997, additional sampling was performed as part of the Work Plan for the OU 4-13 RI/FS (McCormick et al. 1997). Sampling objectives were to determine the following:

- Mean and maximum activity of Cs-137 in the surface and subsurface soil of the drain field
- Vertical and lateral extent of subsurface contamination at the alluvium–basalt interface adjacent to the drain field
- Topographical features of the drain field, for use in evaluating remedial alternatives.

Table D-1 summarizes the 1997 Cs-137 data.

Table D-1. Summary of Cs-137 data collected in 1994 and 1997 at the CFA-08 drain field.

Sample Date	Depth (ft)	Detects	Samples	Minimum Detected (pCi/g)	Maximum Detected (pCi/g)
1994	0–0.5	8	8	0.094	169
	0–4	5	5	0.65	140
	4–8	4	4	17	29
	9.5–10	0	2	ND ^a	ND ^a
1997	0–0.5	22	22	0.343	98.3
	2	1	3	0.0036	52.1
	2.5	0	5	-0.0329	0.054
	3	8	13	-0.0255	185
	4–6	0	5	-0.0189	0.075
	7	0	2	0.001	0.0158
a. Gamma. ND nondetect UCL upper confidence limit					

D-1.3 Risk Assessment

The 1994 and 1997 data were used to assess the CFA-08 drain field in the Comprehensive OU 4-13 RI/FS (DOE-ID 2000a). The extent of contamination was assumed to encompass the entire drain field (approximately 18,605 m² [22,252 yd²]). The volume of soil associated with contamination at the CFA-08 drain field is 184,189.5 m³ (240,000 yd³) (Evans et al. 1995). Summary statistics for the CFA-08 drain field contaminants of potential concern are presented in Tables C-26 and C-27 in Appendix C of the OU 4-13 RI/FS (DOE-ID 2000a). Figure 4-17 of the OU 4-13 RI/FS presents assumptions for the nature and extent of contamination, source-term estimates, and exposure-point concentrations used to evaluate potential risks associated with the site (DOE-ID 2000a).

Based on results of this assessment, the OU 4-13 Record of Decision (DOE-ID 2000b) selected a remedy to mitigate the threat to human health from the soil at the CFA-08 STP drain field. This required

containment of the contaminated-soil area using an engineered evapotranspiration soil cover designed to prevent human exposure to radioactivity plus institutional controls at the drain field (DOE-ID 2000b). The cover was installed over the STP drain field in 2002 (DOE-ID 2003). The cover consists of a layer of pit run gravel as required to smooth the following:

- Grade
- 0.3 m (1 ft) of cobble
- 0.10 m (0.33 ft) of pea gravel
- 1.2 m (4 ft) of native soil (from the Lincoln Boulevard borrow source).

The OU 4-13 Record of Decision determined that Cs-137 was the only contaminant at the CFA-08 drain field that poses an unacceptable risk to human health due to external exposure. The total excess cancer risk for the future-resident scenario, as presented in the OU 4-13 Record of Decision, is 4E-04.

D-1.4 Determining a Termination Date for Institutional Control at CFA-08

The Operation and Maintenance Plan for the Central Facilities Area (DOE-ID 2004) indicates that radioactive decay will reduce the Cs-137 concentration to below the 1E-04 future-resident risk-based level in 189 years. This date was calculated using the maximum concentration detected across all depths and is extremely conservative.

Because new PRGs for radionuclides were updated, the data were reviewed and reevaluated. The EPA software ProUCL (EPA 2009) was used to calculate a new 95% upper confidence limit (UCL) of the mean for determining a termination date for institutional control. The results are found in Table D-2. The ProUCL software determined that the 95% UCL of the mean was 86.5 pCi/g for Cs-137. This was not decayed to the current timeframe in the initial analysis and is a combination of sampling data collected in 1994 and 1997. For conservatism, the concentration was decayed from the latest date (i.e., July 21, 1997). The 95% UCL of the mean at the site would have decayed to 64.98 pCi/g, as of January 1, 2010. As shown in Table D-3, Cs-137 will have decayed lower than the new EPA PRG (5.96 pCi/g) for the resident scenario (i.e., 1E-04) risk by January 1, 2114. Therefore, the institutional control termination date for CFA-08 for the residential scenario is 2114.

Table D-2. ProUCL results calculating a 95% upper confidence level on the mean for Cs-137 data collected in 1994 and 1997.

Table D-2: PROCEL results calculating 95% upper confidence level on the mean for Cs-137 data collected in 1994 and 1997.

General Upper Confidence Level Statistics for Data Sets with Nondetects			
User-Selected Options			
From file	\\Fscip02\Projects\ECORISK\5-year review\WAG4\CFA-08\Crun.wst		
Full precision	OFF		
Confidence coefficient	95%		
Number of bootstrap operations	2,000		
Cs-137 CFA-08			
General Statistics			
Number of valid data	65	Number of detected data	49
Number of distinct detected data	46	Number of nondetect data	16
		Percent nondetects	24.62%
Raw Statistics		Log-Transformed Statistics	
Minimum detected	0.075	Log statistics not available	
Maximum detected	185		
Mean of detected	34.72		
Mean of detected	34.72		
Mean of detected	34.72		
Maximum nondetect	1.18		
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as nondetects	33
For all methods (except KM, DL/2, ^a and ROS methods)		Number treated as detected	32
Observations < Largest ND are treated as nondetects		Single DL nondetect percentage	50.77%
UCL Statistics			
Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk test statistic	0.681	Not Available	
5% Shapiro Wilk critical value	0.947		
Data not normal at 5% significance level			
Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 ^a substitution method		DL/2 ^a substitution method	N/A
Mean	26.19		
SD	48.84	Log ROS method	N/A
95% DL/2 ^a (t) UCL	36.3		
Maximum Likelihood Estimate Method			
Mean	-7.732		
SD	80.63		
95% MLE (t) UCL	8.959		
95% MLE (Tiku) UCL	13.12		

Table D-2. (continued).

General Upper Confidence Level Statistics for Data Sets with Nondetects			
Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
Gamma statistics not available		Data do not follow a discernable distribution (0.05)	
Potential UCLs to Use		Nonparametric Statistics—Kaplan-Meier (KM) Method	
97.5% KM (Chebyshev) UCL	64.12	Mean	26.2
		SD	48.46
		SE of Mean	6.073
		95% KM (t) UCL	36.33
		95% KM (z) UCL	36.19
		95% KM (jackknife) UCL	36.31
		95% KM (bootstrap t) UCL	38.73
		95% KM (BCA) UCL	36.64
		95% KM (Percentile Bootstrap) UCL	36.45
		95% KM (Chebyshev) UCL	52.67
		97.5% KM (Chebyshev) UCL	64.12
		99% KM (Chebyshev) UCL	86.62

a. DL/2 is not a recommended method.

Table D-3. Calculation of the termination date of institutional control for Cs-137. Recalculated concentration to decay to acceptable levels.

Effective Perimeter Concentration Used in Operable Unit 4-13 RI/FS ^a (pCi/g)	Recalculated 95% Upper Confidence Limit on the Mean (pCi/g)	Decayed to January 1, 2010 ^b (pCi/g)	Date Decayed to Below Preliminary Remediation Goal
88.9 ^c	86.62	65.07	January 1, 2114

a. DOE-ID (2000a).

b. Conservatively decayed from July 21, 1997.

c. From Figure 4-18 of the OU 4-13 RI/FS (DOE-ID 2000b).

OU operable unit

RI/FS remedial investigation/feasibility study

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Appendix E

Waste Area Group 5—Auxiliary Reactor Area, Power Burst Facility, and Critical Infrastructure Test Range Complex Supporting Analysis

Appendix E

Waste Area Group 5—Auxiliary Reactor Area, Power Burst Facility, and Critical Infrastructure Test Range Complex Supporting Analysis

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ACRONYMS

ARA	Auxiliary Reactor Area
bgs	below ground surface
CFA	Central Facilities Area
EPA	Environmental Protection Agency
GPRS	global positioning radiometric scanner
OU	operable unit
PBF	Power Burst Facility
PRG	preliminary remediation goals
RAR	remedial action report
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
SL-1	Stationary Low-Power Reactor-1

Appendix E

Waste Area Group 5—Auxiliary Reactor Area, Power Burst Facility, and Critical Infrastructure Test Range Complex Supporting Analysis

E-1. INTRODUCTION

The risk assessment performed in the Operable Unit (OU) 5-12 Remedial Investigation/Feasibility Study (RI/FS) (Holdren et al. 1999) compared concentrations to slope factors available from U.S. Environmental Protection Agency (EPA) sources at that time and used preliminary remediation goals (PRGs) developed for use at the Idaho National Laboratory Site (Fromm 1996). Since that time, EPA has provided updated slope factors and PRGs for radionuclides presented on the EPA website (<http://epa-prgs.ornl.gov/radionuclides/>) (EPA 2010). These changes were discussed in Appendix A of the last 5-year review (DOE-ID 2007). Because the old slope factors and PRGs remained protective, the new values were not incorporated into any site-specific evaluation. Although radionuclides are commonly the only contaminant of concern, other changes in the values used in risk assessment may also be applicable at these sites. These changes are addressed in this technical reevaluation.

For Waste Area Group 5, this technical reevaluation evaluates those institutional control sites impacted by changes in toxicity and other risk values impacting previous decisions made at sites ARA-03, ARA-07, ARA-08, ARA-23, ARA-24, ARA-25, and PBF-10 -12, -21, 22, and -26. A date for release of PBF-13 from institutional control cannot be established because asbestos is present at this site. EPA has a new Framework for Investigating Asbestos-Contaminated Superfund Sites (EPA 2008), and sampling at this site is not appropriate to the Framework (EPA 2008).

E-1.1 ARA-03 Pad near ARA-627 (Lead Sheeting)

The ARA-03 site is a 669-m² (7,198-ft²) contaminated-soil area located east of Auxiliary Reactor Area (ARA) building ARA-627. The area was identified as contaminated in 1979 during a routine radiation survey. The source of the contamination is uncertain, but it may have originated either from a tank truck parked at the facility or from Stationary Low-Power Reactor-1 (SL-1) cleanup operations. The lead sheeting placed over the site for shielding was removed in 1991. Sampling in 1991 indicated levels of concern (Pickett et al. 1993). Co-60, Cs-137, and Eu-154 were detected in the top 15 cm (6 in.) of soil. Only Cs-137 was detected at 0.6 m (2 ft). Volatile organic compounds, semivolatile organic compounds, herbicides, pesticides, metals, and inorganics were below regulatory levels for the toxicity characteristic leaching procedure (Pickett et al. 1993). In 1994, soil to a depth of approximately 0.9 m (3 ft) was removed and disposed of.

Samples collected after the 1994 excavation indicated that Cs-137 was slightly above background and metals were below background (DOE-ID 1997).

The contaminant profile in the soil is shown in Figure 4-15 of the OU 5-12 RI/FS (Holdren et al. 1999). The only contaminant analyzed in the baseline risk assessment was Cs-137 (because it was detected in the post-soil removal verification sampling). Because the site was backfilled to a depth of 0.9 m (3 ft) with clean soil following the soil removal, the maximum detected Cs-137 concentration was assigned to the 0.9- to 1.8-m (3- to 6-ft) interval below ground surface (bgs) for risk assessment purposes (Holdren et al. 1999). Six samples were collected on September 27, 1994. The

maximum Cs-137 detection from this group of samples was 7.4 pCi/g. As of January 1, 2010, this had decayed to 5.21 pCi/g, which is below the EPA PRG of 6 pCi/g, suggesting that ICs can be removed.

E-1.2 ARA-07—ARA-II Seepage Pit to East

The ARA-07 seepage pit (ARA-702A) was constructed of 20.3- × 20.3- × 40.6-cm (8- × 8- × 16-in.) pumice blocks laid on their sides in the shape of a circle (Figure 1-9 of DOE-ID [2005]). The seepage pit was 4 m (13 ft) in diameter and 3 m (10 ft) deep. The top two courses of pumice blocks were set in mortar. As-built Drawing No. 102832 shows the first course of blocks to be set on bedrock, leveled with concrete. The pit had a gravel base and contained approximately 15 to 30 cm (6 to 12 in.) of sludge. The top of the pit extended above the ground and was covered by a wooden roof with lifting rings and had a 0.6- × 0.6-m (2- × 2-ft) -square access port. A 1.2-m (4-ft) -high chain link fence surrounded the entire structure.

The seepage pit was just outside the ARA-II Facility fence and was the terminus of two septic tanks that served the Administration Building (613) and the Technical Support Building (602). The seepage pit was also thought to be the terminating point for an underground waste detention tank (ARA-719), which was removed during decommissioning activities (Nelson and Horsburgh 1999). The system was in use from approximately 1959 to 1986.

ARA-07 was closed, as discussed in the OU 5-12 Remedial Action Report (RAR) (DOE-ID 2005). Closure activities at the ARA-07 seepage pit included removal and disposal of the chain link fencing, roof structure, and top two courses of cinder blocks. This material was surveyed for radiological contamination and disposed of at the Central Facilities Area (CFA) bulky-waste landfill. A single hot particle was detected on the roof structure. It was determined to be a beta emitter, most likely Sr-90, at 10,000 counts/minute. Radiological Control personnel disposed of the hot particle as radiologically contaminated waste, in accordance with Idaho National Laboratory procedures. The seepage pit was abandoned in place in accordance with Idaho Administrative Procedures Act standards, as outlined in IDAPA 58.01.03.007, "Septic Tanks Design and Construction Standards." The backfilled excavation was then compacted and tested to verify that the compaction was at least 85%, in accordance with construction specification, STD-116-02200, "Earthwork." Reseeding was performed to stabilize soil disturbed during remediation activities.

In the OU 5-12 Record of Decision (ROD) (DOE-ID 2000), this site was designated as a no action site, based on the No-Action Documentation Package for ARA-07 (Hover 1992a). The site was placed under institutional control in the OU 5-12 RAR (DOE-ID 2005). The site is currently under institutional control because Cs-137 was detected in a composite characterization sample collected in the early 1990s under the initial characterization of potential waste sources at ARA-I and ARA-II (Meyer 1992). The Summary Report (Meyer 1992) documents analysis results for:

- Toxic characteristic leaching procedure organics
- Toxic characteristic leaching procedure inorganics
- Resource Conservation and Recover Act (42 USC § 6901 et seq.) characteristics
- Total organic halides
- Solvents (i.e., F-listed waste)
- Radiological analysis.

The Summary Report states that no hazardous substances were detected in sediment in ARA-07. However, the sediment did have slightly elevated levels of Cs-137. Table E-1 presents the new institutional control termination date for ARA-07, based on the updated EPA PRG for Cs-137. As shown in Table E-1, the institutional control termination date for ARA-07 is January 1, 2038.

Table E-1. Calculation of new institutional control termination dates for sites ARA-07 and ARA-08.

Site	Maximum Cs-137 Detection	Estimated Duration of Institutional Control in Remedial Action Report ^a	Date Concentration Decays below EPA Preliminary Remediation Goal at 1E-04 (6 pCi/g)
ARA-07	17.6 ^b	June 2078	January 1, 2038
ARA-08	11.6 ^c	December 2059	January 1, 2020

a. DOE-ID 2005.

b. Counted in April 1991.

c. Counted in April 1990.

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E-1.3 ARA-08—ARA-II Seepage Pit to West

The ARA-08 seepage pit (i.e., ARA-720B) was in use from approximately 1959 to 1986. ARA-720B was 4 m (13 ft) in diameter and 3 m (10 ft) deep (see Figure 1-9 of DOE-ID [2005]). The pit was constructed of 20.3- × 20.3- × 40.6-cm (8- × 8- × 16-in.) pumice blocks laid on their sides in the shape of a circle. The top two courses of pumice blocks were set in mortar. The pit had a gravel base and contained approximately 46 to 61 cm (18 to 24 in.) of sludge. Three separate concrete slabs, measuring approximately 0.9 × 3 m (3 × 10 ft), capped the pit. The pit was covered by approximately 0.9 m (3 ft) of soil. The seepage pit was just outside the ARA-II Facility fence and received waste from the Administrative and Technical Support Building (606).

Closure activities at the ARA-08 seepage pit are documented in the OU 5-12 RAR. The activities included excavating the site followed by removing, sizing, and disposing of the three concrete lids covering the seepage pit. Radiological survey of the lids did not reveal any radiological contamination, thus allowing the lids to be dispositioned as conditional industrial waste in the CFA landfill. Clean backfill was hauled to the site and placed inside the seepage pit along with the soil excavated from the top of the seepage pit. The seepage pit was abandoned in place, according to Idaho Administrative Procedures Act standards, as outlined in IDAPA 58.01.03.007. The backfilled excavation was then compacted and tested to verify that compaction was at least 85%, in accordance STD-116-02200. Reseeding was performed to stabilize soil disturbed during remediation activities.

In the OU 5-12 ROD (DOE-ID 2000), this site was designated as a no action site, based on the No-Action Documentation Package for ARA-08 (Hover 1992b). The site was placed under institutional control in the OU 5-12 RAR. The site is currently under institutional control because of the presence of Cs-137 found in characterization samples collected in the early 1990s under the initial characterization of potential waste sources at ARA-I and ARA-II (Meyer 1992). The Summary Report (Meyer 1992) presents analysis results for:

- Toxic characteristic leaching procedure organics
- Toxic characteristic leaching procedure inorganics
- Resource Conservation and Recovery Act characteristics

- Total organic halides
- Solvents (i.e., F-listed waste)
- Radiological waste.

The Summary Report states that no hazardous substances were detected in the ARA-08 sediment. However, the sediment did have slightly elevated levels of Cs-137. Table E-1 presents the new institutional control termination date for ARA-08, based on updated EPA PRG for Cs-137. As shown in Table E-1, the institutional control termination date for ARA-08 is January 1, 2020.

E-1.4 ARA-23—Radiologically Contaminated Soils and Subsurface Structures In and Around ARA-I and ARA-II

The ARA-23 site is a 97-ha (240-acre) soil contamination area, including the ARA-I and ARA-II facilities. The ARA-23 site is defined as the subsurface structures including the SL-1 reactor building foundation and underground utilities, contaminated soil within the ARA-I and ARA-II facility fences, and all surface soil contaminated during the SL-1 accident and cleanup activities. More detailed information about the site can be found in the OU 5-12 RI/FS (Holdren et al. 1999).

In 1993, a Track 1 investigation was initiated for ARA-23, but it was not finalized because the site was reassigned to OU 10-06 for evaluation. The OU 10-06 evaluation, which excluded the areas within ARA-I and ARA-II Facility fences, was only partially completed before ARA-23 was reassigned to Waste Area Group 5 for final disposition. Data gaps identified in the Waste Area Group 5 RI/FS Final Work Plan (DOE-ID 1997) comprised the horizontal and vertical extent of Cs-137 in the windblown soil area and the presence of other radionuclides (e.g., Co-60, Eu-152, Eu-154, Sr-90, and uranium isotopes). Based on sampling and analytical results, combined with the surface gamma radiation survey conducted using the global positioning radiometric scanner (GPRS), a risk assessment was performed in the OU 5-12 RI/FS (Holdren et al. 1999). Cs-137 was identified as the primary contributor to the estimated total risk for all pathways. ARA-23 was screened for evaluation in the ecological risk assessment because the only contaminants above background levels were radionuclides.

The original boundary for OU 5-05 (ARA-06 SL-1 burial ground) was defined as the fence surrounding the SL-1 burial ground. However, the ROD for SL-1 and Boiling Water Reactor Experiment-I Burial Grounds (OUs 5-05 and 6-01), and 10 no action sites (OUs 5-01, 5-03, 5-04, and 5-11) (DOE-ID 1996) redefined the OU boundary to include the northeastern 40% of the windblown contamination area around ARA-I and ARA-II. Dose-equivalent rate measurements outside the burial ground fence indicated radiological field levels at or below the average Idaho National Laboratory Site level of 20 μ rem/hour (Jorgensen 1995). Therefore, no unacceptable external exposure risks were identified for this area, and the U.S. Department of Energy Idaho Operations Office, EPA, and Idaho Department of Environmental Quality reached consensus that no further action would be required for the surface soil outside the burial ground fence. However, this area was surveyed during the 1997 GPRS survey of ARA-I and ARA-II, and Cs-137 was detected at concentrations greater than the 23-pCi/g remediation goal identified for Waste Area Group 5 in the OU 5-12 ROD (DOE-ID 2000). Therefore, the surface soil in OU 5-05 that exceeded the Cs-137 remediation goal was remediated as part of the ARA-23 site (DOE-ID 2005).

The OU 5-12 RAR discusses the activities performed. Excavation of the soil contamination area between Fillmore Boulevard at the ARA-I Facility site was completed in fall 2003. Most of the contamination was removed with the first-cut excavation. Small spot excavations were subsequently performed to remove residual contamination identified using the GPRS. During fall 2003, excavation also took place outside the fence bordering the ARA-II Facility along the southeastern side, between the

entrance gate to the ARA-II Facility and the southwestern corner of the facility, and proceeding along the northeastern side of the facility toward the windblown area. Approximately half the rock area was also excavated at this time. The GPRS was used following each excavation cut to identify those areas where contamination still remained that exceeded the Cs-137 remediation goal of 23 pCi/g. The progress of the excavation can be followed by reviewing the different drawing revisions provided in Appendix B of the OU 5-12 RAR.

The vast majority of the windblown area was remediated through the first 7.6-cm (3-in.) cut excavation, with minimal spot excavations required. Likewise, most of the contamination along the haul road leading from the northeastern side of the ARA-II Facility to the SL-1 burial ground was remediated with the first 15.2-cm (6-in.) cut excavation. Additional excavations of the haul road were required near the SL-1 burial ground. The majority of the contamination in the turnaround area located to the northeast and northwest of the SL-1 burial ground was removed during the first-cut excavation. Some contamination remained adjacent to the fence along the northeastern side of the burial ground and required additional excavation cuts. Within the burial ground itself, a few locations were identified as requiring remediation. A couple of these locations proved to be deeper than originally believed and required additional cuts. One spot in particular, inside the southwestern entrance to the SL-1 burial ground, was difficult. The contamination in this location was attributed possibly to a hot particle. A radiological control technician was able to determine its proximity, thus leading to its eventual removal (DOE-ID 2005).

Areas north of the ARA-II Facility required numerous excavations because the contamination ran deeper than estimated. In viewing the contours of the area surrounding ARA-II, it appears that much of this area might have been contaminated either from water used during removal of the SL-1 reactor and containment structure that ran off the facility into these lower-lying areas or from precipitation run-off from the facility during the years following. Most contamination from the washdown area across Fillmore Boulevard from the ARA-II Facility was removed during the first 7.6-cm (3-in.) cut excavation. Some locations required subsequent excavations, with one location proving particularly troublesome. This single location ran along a steep embankment approximately 18 m (60 ft) from the roadbed. Numerous excavations of this location were made until in situ gamma measurements demonstrated that the remediation goal had been achieved (DOE-ID 2005).

On the northern edge of the washdown area, concrete piers were encountered that were attributed to a trailer that had once been located at the facility, presumably in support of the construction of ARA-II. In addition, the remains of a septic tank were encountered just south of the concrete piers. An in situ gamma scan performed of the soil associated with the tank showed Cs-137 concentrations to be below the 23-pCi/g remediation goal. The tank location was subsequently backfilled with earthen material during the backfill of the ARA-23 facility (DOE-ID 2005).

For the ARA-I Facility, most of the contamination was located along a berm that ran the length of the facility along the northeastern side. Most of this contamination was removed during the first-cut excavation, with a couple of locations requiring subsequent cuts. Spot excavations within the field of the facility were required to remove contamination that remained from the decommissioning of the facility, specifically that remaining from the ARA-626 building. Excavation along the southeastern boundary of the facility also was required removal of contamination that was associated with ARA-03: ARA-I lead sheeting pad near ARA-627. With the exception of the SL-1 foundation, which was poured into the basalt, and the water system valve box that was adjacent to the foundation, the rest of the concrete structures and debris was removed and transported to Idaho CERCLA Disposal Facility for disposal. Numerous excavation cuts were made throughout the facility, with most of the deeper excavations occurring around the SL-1 foundation. Aggressive excavation in the area around the foundation took place in an effort to remove as much of the contamination as possible, including removal of some of the

basalt. To remove the basalt, a separate excavator was used with a pneumatic hammer to effectively chisel the contaminated basalt loose, allowing for its removal. As the excavation progressed, the GPRS could no longer be used to obtain measurements because the heavily undulating terrain would not allow it. The in situ gamma system was relied upon to determine the contamination levels in the area. Some elevated contamination levels remain in the basalt layers surrounding the foundation and water system valve box (DOE-ID 2005).

Following completion of excavation and confirmation that the remediation goal had been achieved using a combination of the GPRS and in situ gamma spectroscopic data, the area was backfilled, contoured to match the surrounding terrain, and revegetated in accordance with the *Remedial Design/Remedial Action Work Plan, Phase II, for Waste Area Group 5* (DOE-ID 2003a). Sampling activities at ARA-23 included in situ field measurements and collection and analysis of confirmation samples of underlying soil following the removal of contaminated soil. Confirmation sampling for Cs-137 at ARA-23 was composed of a combination of field measurements and laboratory analysis. The field measurements were performed using the GPRS and the field portable germanium detector (i.e., ORTEC^a ISO-CART mobile assay system). Because of the expanse of the ARA-23 site and the modes of contaminant deposition, the ARA-23 site was divided into five separate areas for field sampling activities: (1) ARA-I Facility, (2) ARA-II Facility, (3) equipment washdown area, (4) haul road and turnaround area, and (5) windblown area. The area within the boundaries of the SL-1 burial ground was included with the haul road and turnaround areas. The following, taken from the OU 5-12 RAR, provides a summary of the field-screening and confirmation sampling activities:

- Field screening: The GPRS was used to identify hot spots and provide semiquantitative numbers for the Cs-137 concentrations. Subsequent to the GPRS survey, the ISO-CART was used to measure Cs-137 at 149 random locations on a systematic grid and three biased locations. The field-screening samples were collected from the underlying soils following excavation of the top soil.
- Confirmation sampling: Seventy confirmation samples were collected from random locations in the five areas of the ARA-23 site: (a) ARA-I Facility—10 samples, (b) ARA-II Facility—30 samples, (c) equipment washdown area—10 samples, (d) haul road and turnaround area—10 samples, and (e) windblown area—10 samples.

The GPRS provided 100% coverage of the excavated areas and allowed for a rapid assessment of residual contamination exceeding the remedial action goal. Areas identified by the GPRS as containing residual Cs-137 contamination above the goal were excavated further, and the GPRS survey was repeated. This iterative process of excavation and rapid survey was performed until it was apparent that all soil with Cs-137 concentrations above the goal had been removed or the basalt interface was reached (DOE-ID 2000). Once excavation activities were complete, the ISO-CART systems were used to measure discrete locations across the five identified areas at the ARA-23 site. One hundred fifty-two measurements were completed to provide verification of the GPRS data and to complement the confirmation sample data. In addition, three biased locations were identified at the equipment washdown area during the GPRS survey and measured with the in situ hyper-pure germanium system. Verification sampling, analyses, and in situ measurements were performed in accordance with the Field Sampling Plan for the Waste Area Group 5, Remedial Action, Phase II (DOE-ID 2003b). Field measurement results with the ISO-CART system show that residual Cs-137 concentrations at the ARA-23 site range from 0.80 pCi/g at the ARA-I Facility area to 130.0 pCi/g at the ARA-II Facility area. Although the in situ measurements identified a specific number of confirmation samples to be collected in each area,

a. PRODUCT DISCLAIMER—References to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, do not necessarily constitute or imply its endorsement, recommendation, or favoring by the U.S. Government, any agency thereof, or any company affiliated with the Idaho Cleanup Project.

10 samples were collected in the ARA-I Facility, equipment washdown, haul road and turnaround, and windblown areas; and 30 samples were collected in the ARA-II Facility area. Confirmation samples indicated that residual Cs-137 concentrations at the ARA-23 site range from 0.091 to 168.0 pCi/g (DOE-ID 2005).

Summary data from the ARA-23 site are provided in Tables 2-3a through 2-3f of the OU 5-12 RAR, and the in situ measurement and confirmation sample results are displayed in Figures 2-15 through 2-24. Appendix H of the OU 5-12 RAR contains the results of all field-screening and -sampling activities at ARA-23.

Table E-2 presents a summary of the 95% upper confidence level calculated for the area identified within the ARA-23 site. This table also presents the dates when these concentrations will have decayed below the EPA PRG for Cs-137 for the resident at 1E-04 risk. As shown in Table E-2, the ARA-II on-basalt area has higher concentrations of Cs-137 on the basalt and will not decay for free-release until 2120. It is possible that a similar approach to that used for the CFA-04 pond could be used to calculate a concentration for mercury on basalt to provide a more realistic exposure concentration.

Table E-2. ARA-23 data summary by area—95% upper confidence level (as modified from Table 7-4 of the Remedial Action Report^a).

Area for Field Sampling	Cs-137 Concentrations (pCi/g)		Data Decayed to <6 pCi/g EPA PRG ^b
	In Situ	Confirmation Sample	
ARA-I	8.5	22.3	2062
ARA-II	8.6	11.1	2032
ARA-II on-basalt area	52.1	83.8	2120
Equipment washdown area	8.4	12.9	2038
Haul road and turnaround area	7.4	9.5	2025
Windblown area	9.3	9.6	2025

a. DOE-ID 2005.

b. Based on confirmation sample results. Assumed to have been counted October 1, 2004. EPA PRG for residential exposure at 1E-04 risk.

EPA Environmental Protection Agency
PRG preliminary remediation goal

E-1.5 ARA-24—ARA-III Windblown Soil

ARA-24 is a site that combines windblown contamination at the surface and subsurface contamination. Table 33 of the OU 5-12 ROD (DOE-ID 2000) states that institutional control will be placed on this site because of the buried contaminated media that remain at ARA-24. A radiologically contaminated pipe is present 6.1 m (20 ft) bgs. The site identification for this site indicates that nearly all ARA-III surface structures were removed. Building ARA-608 was removed to approximately 6.1 m (20 ft) bgs, and the reactor pit foundation continued down another 3 m (10 ft). The ARA-608 building internals were decontaminated, except for piping internal to the ARA-608 pit foundations and some radiologically contaminated concrete. Some (e.g., 8–10) sections of piping were left within the pit foundations at ARA-608; they could not be removed by the coring operations because of bends in the piping. The piping was empty during decommissioning activities, but the pipes did contain residual radiological contamination. Although some survey results are available, enough characterization is not

available to perform a risk evaluation or to calculate a date for release from institutional control at this site.

E-1.6 ARA-25—Contaminated Soil Beneath ARA-I Hot Cells

ARA-25 is a site that has both radionuclides and metals present. The date for release from institutional control at this site cannot be set due to the presence of metals.

E-1.7 PBF-10—PBF Reactor Area Evaporation Pond (PBF-733)

The PBF-10 site was a lined surface impoundment with an approximate area of 1,820 m² (2,177 yd²). Effluent routed to the pond from 1972 to 1984 included chromium-contaminated water from the Power Burst Facility (PBF) reactor secondary coolant loop and discharges containing resins, sulfuric acid, and sodium hydroxide from the demineralizer system. After 1984, discharges to the pond did not contain chromium.

Pond sediment was sampled in 1987. In 1989, 22 sediment samples were collected and analyzed for gamma-emitting radionuclides. A 1994 interim action (Parsons 1995) included excavation of sediments from the pond in areas with concentrations of chromium higher than 800 mg/kg or concentrations of Cs-137 higher than 30 pCi/g. To implement this action, the pond was divided into 49 grids of 6.1-m (20-ft) squares. Twenty-one of the grids were identified as contaminated, and the contaminated sediment was excavated. Sediments contaminated above the action level were containerized and transported to the Radioactive Waste Management Complex. Following excavation of the contaminated sediment within the evaporation pond grids, samples of the remaining sediment were collected from four locations above the pond liner and four locations below the pond liner. Cs-137 and chromium concentrations were detected but fell below action levels (Parsons 1995). In 1995, the liner was removed and disposed of in the CFA bulky-waste landfill. The berm was pushed into the pond, and the area was graded and seeded with native grasses.

Sample data from 1994 locations (0–15 cm [0–0.5 ft] bgs), collected at unexcavated grid areas, were used for the OU 5-12 assessment. The upper layer of soil at the PBF-10 location came from the berm that originally surrounded the pond; the berm was assumed to be uncontaminated. Cs-137 was the only contaminant retained for quantitative evaluation because it was detected above background values in sediment above the pond liner. As shown in Table E-3, most of the 1994 Cs-137 results for samples collected below the liner are nondetects. However, there is one detect—at 0.04 pCi/g—from below the pond liner. Based on this datum, contamination below the depth of the pond liner is assumed to be zero.

Table E-3. Samples for use in determining depth-weighted average concentration of Cs-137 at PBF-10.

Data Analyzed	Sample Number	Concentration of			Comment
		Cs-137 (pCi/g)	Grid ^a		
9/07/1994	PBF00101HC	12.6	4		Above liner
9/07/1994	PBF00201HC	11.2	10		Above liner
9/07/1994	PBF00301HC	13.8	10		Above liner
9/07/1994	PBF00401HC	17.5	22		Above liner
9/07/1994	PBF00501HC	12.1	39		Above liner
9/07/1994	PBF00601HC	ND ^b	9		Below liner
9/07/1994	PBF00701HC	0.0402	49		Below liner

Table E-3. (continued).

Data Analyzed	Sample Number	Concentration of Cs-137 (pCi/g)	Grid ^a	Comment
9/07/1994	PBF00801HC	ND	45	Below liner
9/07/1994	PBF00901HC	ND	1	Below liner
9/07/1994	PBF01001HC	ND	1	Below liner
12/01/1989	PBF0101	19	13	Sampling at grids not remediated
12/01/1989	PBF0102	23	12	Sampling at grids not remediated
12/01/1989	PBF0104	12.9	29	Sampling at grids not remediated
12/01/1989	PBF0105	15.9	42	Sampling at grids not remediated
12/01/1989	PBF0106	14.7	41	Sampling at grids not remediated
12/01/1989	PBF0108	7.5	37	Sampling at grids not remediated
12/01/1989	PBF0110	8.1	32	Sampling at grids not remediated
12/01/1989	PBF0112	14.7	22	Sampling at grids not remediated
12/01/1989	PBF0114	19.3	10	Sampling at grids not remediated

a. Grid locations are presented in Figure 12 in Ludi et al. (1990) and Figure 2-1 in Parsons (1995).

ND nondetect

The 1992 PBF ROD (DOE-ID 1992) states that the remedial action for this interim action site, to remove chromium and Cs-137 contamination, was selected and implemented successfully (Parsons 1995). The post-remediation estimated baseline risk is 2E-05 for the 100-year future residential scenario from exposure to Cs-137 (Holdren et al. 1999).

A depth-weighted average source term concentration for use in calculating risk is presented in Table B-22 of the RI/FS (Holdren et al. 1999). For this site, it was assumed that the top 2.4 m (8 ft) of soil overlying the site—once comprising the berms around the pond—is uncontaminated. The vertical interval for the site is 3 m (10 ft) (because of the liner). The top 2.1 m (7 ft) is uncontaminated. The simulated source term volume is the area times the contaminated vertical interval ($19,600 \text{ ft}^2 \times 10 \text{ ft} = 196,000 \text{ ft}^3$). At the time that the OU 5-12 baseline risk assessment was performed, the maximum Cs-137 detection (17.5 pCi/g) from the 2.1- to 2.4-m (7- to 8-ft) interval was used to calculate a depth-weighted average concentration of 5.25 pCi/g. This value was used as the source term for calculating risk.

E-1.7.1 Reevaluation

Because the cleanup goal for the 1995 interim cleanup at the site was 30 pCi/g, data collected in 1989 at those grid locations that were not remediated were evaluated to ensure that they were below the maximum. All applicable data are presented in Table E-3. The highest detection of Cs-137 collected in 1989 was 23 pCi/g. The depth-weighted average exposure-point concentration for Cs-137 at this site was calculated using the approach documented in the OU 5-12 RI/FS and as shown in Table E-4. Using the highest Cs-137 concentrations detected in 1989 (23 pCi/g) and 1994 (17.5 pCi/g), and assuming this concentration through the 2.1- to 3-m (7- to 10-ft) range, the source term concentrations (representing the average exposure) are 4.35 and 3.69 pCi/g, respectively. The depth-weighted average concentrations are presented in Table E-4.

Table E-4. Calculation of the Cs-137 (pCi/g) depth-weighted average concentration^a at PBF-10.

Soil Depth (ft)	Depth-Weighted Average Concentration, at Depth, Using Decayed 1994 Maximum (pCi/g)	Depth-Weighted Average Concentration, at Depth, Using Decayed 1989 Maximum (pCi/g)
0–1	0	0
1–2	0	0
2–3	0	0
3–4	0	0
4–5	0	0
5–6	0	0
6–7	0	0
7–8	12.31 ^b	14.50 ^c
8–9	12.31 ^b	14.50 ^c
9–10	12.31 ^b	14.50 ^c
Depth-weighted average concentration	3.69	4.35

a. Simulated source term concentrations are depth-weighted averages, calculated as follows:

$$C_I = \frac{\sum_{i=k}^I C_i}{I}$$

Where

C_I = Depth-weighted average concentration over the entire interval I

C_i = 95% upper confidence limit or maximum detected concentration, whichever is less, for the i th 1-ft increment

i = Specific 1-ft increment (i.e., 0–1 ft, 1–2 ft, ..., $I-1-I$ ft)

I = Number of 1-ft increments.

b. 17.5 pCi/g decayed to January 1, 2010, is 12.31 pCi/g.

c. 23 pCi/g decayed to January 1, 2010, is 14.50 pCi/g.

As shown in Table E-4, the depth-weighted average concentrations of 3.69 and 4.35 pCi/g are below the current EPA PRG (1E-04 risk) for Cs-137 of 6 pCi/g, suggesting that institutional controls at PBF-10 are no longer required.

E-1.8 PBF-12—PBF SPERT-I Leach Pond

The PBF-12 site is the historical location of a 14.6- × 13.7-m (15- × 45-ft) surface impoundment called the SPERT-I leach pond. The pond was located approximately 762 m (2,500 ft) northwest of PBF and approximately 9.1 m (30 ft) east of the main road into PBF. The site is a mounded area distinguished from the surrounding desert only by a cement location marker with a brass plate indicating the presence of subsurface residual radioactive contamination 2.4 m (8 ft) bgs. The SPERT-I facility was deactivated in 1964, and decommissioning was implemented in 1984. Decommissioning operations included removing the top 0.8 m (2.5 ft) of soil in the pond area, collecting soil samples, and backfilling the pond with clean soil. Approximately 2.4 m (8 ft) of clean soil covers the area.

After the 0.8 m (2.5 ft) of soil was removed from the PBF-12 site, nine soil samples were collected from those areas most likely to exhibit residual contamination. Concentrations of Co-60, Cs-137, Pu-238,

Sr-90, U-234, and U-238 were detected. Though the data were not validated in accordance with contemporary requirements, samples were collected, handled, and analyzed in a manner consistent with standard 1984 decommissioning protocols (DOE 1993a). In October 1991, a surface contamination survey was conducted over the remediated site. Surface readings were less than 5 mrem/hour (DOE 1993a).

Contaminants detected 2.4 m (8 ft) bgs include Co-60, Cs-137, Pu-238, Sr-90, U-234, U-235, and U-238 (DOE 1993a; see Table B-12 of the OU 5-12 RI/FS [Holdren et al. 1999]). The risk evaluation for this Track 1 site identified no current occupational risk and a 100-year future residential risk of $2\text{E-}05$ from exposure to Cs-137 (DOE 1993b; Holdren et al. 1999). The ROD determined institutional controls would be established to control land use as industrial until 2095, or sooner if released in a 5-year review. In the OU 5-12 RI/FS, depth-weighted averages were calculated for inclusion in the baseline risk assessment. This calculation is shown in Table E-4. The depth-weighted average for Cs-137 used in the OU 5-12 RI/FS is presented in Table E-5 and shown decayed to January 1, 2010. As shown in Table E-5, the depth-weighted average concentration of 4.66 in 1997 is below the revised EPA PRG of 6 pCi/g for the resident ($1\text{E-}04$ risk) for Cs-137. The decayed value of 3.46 in 2010 is even lower. Therefore, institutional control at PBF-12 is no longer required. Institutional controls can be removed from this site, and the site can be released from institutional control.

Table E-5. Decayed depth-weighted average concentration of Cs-137 at PBF-12.

Date	Depth-Weighted Average Concentration (pCi/g)
1997 ^a	4.66
January 1, 2010	3.46

a. 1997 concentration was calculated by decaying the 1984 post-decommissioning concentration as presented in the OU 5-12 RI/FS (Holdren et al. 1999).

OU operable unit
RI/FS remedial investigation/feasibility study

E-1.9 PBF-21—PBF SPERT-III Large Leach Pond

The PBF-21 site is the historical location of a leach pond that received waste from the sump pump in the SPERT-III reactor building from 1958 to 1968. Primary coolant water was drained to the pond. The pond area is approximately 325 m^2 (389 yd^2). The pond was characterized in 1982 and was backfilled and reseeded by the decommissioning program in 1983.

In 1982, 13 pond surface soil and 24 trench samples from the surface to a depth of 76 cm (30 in.) were collected and analyzed. Concentrations of Co-60, Cs-137, Sr-90, U-234, U-238, and Pu-239/240 were detected. In 1993, four soil samples were collected from below the clean fill at three locations ranging in depth between 1.6 and 2.7 m (5.2 and 9 ft) bgs. No contaminant concentrations were detected above risk-based soil concentrations. Analyses were performed for all expected contaminants, and detections were all well below background concentrations (DOE 1994). However, the sample locations did not correspond to probable areas of highest concentrations within the original pond.

Three contaminants—chloride, orthophosphate, and sulfate—detected in 1993 that had no corresponding risk-based concentrations or background values (EG&G 1994). Retained for analysis in the baseline risk assessment, the contaminants were detected at depths between 1.5 and 2.4 m (5 and 8 ft) bgs. Radionuclide concentrations detected in the 1982 post-decommissioning samples also were retained for

evaluation. Because the area was backfilled during decommissioning of the site, the concentrations detected in 1982 were evaluated at levels deeper than 1.8 m (6 ft).

The OU 5-12 RI/FS (Holdren et al. 1999) concluded that estimated risks from exposure to radionuclides for this Track 1 site are below 1E-06 for the current occupational scenario and are 1E-05 for the 100-year future residential scenario. These include Cs-137 at 2.87 pCi/g with 1E-05 risk and U-238 at 1.81 pCi/g with 2E-06 risk in the 0- to 3-m (0- to 10-ft) –deep soil range (future resident). The contamination is covered by a 2.4-m (8-ft) -thick layer of soil (EG&G 1994). The depth-weighted average concentration for Cs-137 is presented in the OU 5-12 RI/FS (2.87 pCi/g) (Holdren et al. 1999). This calculation is also shown in Table E-4. When this value is decayed from January 1, 1997, to January 1, 2010, the concentration is now at an acceptable level (i.e., 2.13 pCi/g). Institutional controls are no longer required at this site; therefore, institutional controls can be removed, and the site can be released from institutional control.

E-1.10 PBF-22—SPERT-IV Leach Pond (PBF-758)

The PBF-22 site was the location of a 5,010-m² (5,992-yd²) unlined surface impoundment (i.e., leach pond) that received effluent from the SPERT-IV reactor from 1961 to 1970. Effluent to the pond consisted of radioactively contaminated wastewater, emergency shower water, and demineralizer discharges. Occasional discharges from the SPERT-IV waste holdup tank were routed to the pond from 1979 to 1981. In the early 1980s, contaminated primary coolant effluents from the PBF reactor were transported to the site by truck and emptied into the pond. Approximately 62,000 L of treated PBF reactor liquid waste were emptied into the leach pond in 1983. A radiological survey was conducted in 1985, and two soil samples were collected. The survey readings were between 200 and 260 counts per minute, and no hot spots were detected. After the survey, approximately six boxes of soil were removed and transported to the Radioactive Waste Management Complex.

Two separate characterizations for hazardous constituents were performed in 1988. Samples were collected from 10 locations at four depth increments. Six biased samples were also collected in discharge zones (Hillman-Mason et al. 1994; see Rohe, Sondrup, and Whitaker [1996] in Appendix J of the OU 5-12 RI/FS [Holdren et al. 1999]). Aroclor-1254, chromium, and mercury were detected at 0.785, 147, and 0.11 mg/kg, respectively. Concentrations above current background values were detected for Cs-137, Sr-90, and Co-60 at 11.1, 5.4, and 2.29 pCi/g, respectively (Hillman-Mason et al. 1994).

Three metal and nine radionuclide contaminants were retained for analysis in the baseline risk assessment, as shown in Figure 4-39 of the OU 5-12 RI/FS. Arsenic, lead, manganese, Th-228, Th-230, Th-232, U-234, and U-238 were detected in the soil profile to a depth of 3 m (10 ft) bgs. Pu-239 detections were limited to depths between 0.3 to 1.2 m (1 and 4 ft) bgs. Concentrations of Am-241, Cs-137, and Pu-238 were detected at depths to 1.2 m (4 ft) bgs.

The OU 5-12 ROD (DOE-ID 2000) concluded that estimated risks for this Track 2 site are twofold: (1) 9E-06 for exposure to Cs-137 for the current occupational scenario and (2) 3E-06 for exposure to Cs-137 for the 100-year future residential scenario (Holdren et al. 1999). As shown in Table B-88 of the OU 5-12 RI/FS (Holdren et al. 1999), the greatest risk at this site was from arsenic concentrations at 2E-04 risk to the resident. However, it was determined in the OU 5-12 RI/FS that the arsenic background is high in this area, and that the samples were within background levels.

The depth-weighted average concentration of 0.714 pCi/g for Cs-137 is presented in Figure 4-39 of the OU 5-12 RI/FS. This concentration is now below the revised residential PRG for Cs-137 (6 pCi/g) at 1E-04 risk, and institutional controls are no longer required at this site. Institutional controls at this site can be removed, and the site can be released from institutional control.

E-1.11 PBF-26—PBF SPERT-IV Lake

The PBF-26 site is a 20,150-m² (24,099-yd³) surface impoundment area constructed in 1960 by raising a soil and rock dike to close off an irregularly shaped natural depression. The approximate volume of the resulting containment area is 6 million gallons, and the impoundment was called a lake even though it was never used at capacity. Typically, only small quantities of water were observed over short durations. The center of the area is approximately 244 m (800 ft) southwest of the Mixed Waste Storage Facility. From 1961 to 1970, the lake received uncontaminated cooling water from the secondary loop of the SPERT-IV reactor. Between 1970 and 1985, the lake was inactive and dry, except for occasional accumulations of natural precipitation. From 1985 to 1992, the only discharges to the lake were uncontaminated effluent from Three Mile Island studies and discharges generated by periodic testing of emergency eye wash and shower stations. The pipeline to the lake was removed in 1992, ending all discharges (DOE 1993b).

Discharges were primarily reactor secondary cooling water containing trace levels of radionuclides and heavy metals. The lake surface soil near the discharge point was sampled in 1985 and 1988. In 1985, Cs-137 was detected at 7.69 pCi/g; this has decayed to approximately 4.4 pCi/g as of 2010. Two samples showed elevated concentrations of Aroclor-1254. In a second sampling effort in 1988, samples were collected at depths ranging from 0 to 1.7 m (0 to 5.6 ft) bgs (DOE 1993b). Additional samples were collected for polychlorinated biphenyl analysis in the second sampling campaign in 1988, and one sample yielded a polychlorinated biphenyl concentration. The two polychlorinated biphenyl detections in 1985 and the one in 1988 all occurred near the discharge point within a small channel that was formed as water flowed from the discharge pipe (DOE 1993b).

The OU 5-12 ROD (DOE-ID 2000) concluded that estimated baseline risks from exposure to radionuclides for this Track 1 site are 7E-05 for the current occupational scenario and 6E-05 for the 100-year future residential scenario (Holdren et al. 1999). As shown in Table B-88 of the OU 5-12 RI/FS (Holdren et al. 1999), the greatest risk at this site was from arsenic, at 2E-04 risk to the resident. However, it was determined in the OU 5-12 RI/FS that the arsenic background is high in this area, and that the samples were within background levels. Risk for the resident at this site was 7E-05 from potential exposure to Aroclor-1254, and the next highest risk was Cs-137, with 3E-05 risk to the resident.

Concentrations of Cs-137 at this site (3E-05) are below the EPA PRG for the resident, at 1E-04 risk level, and institutional controls are no longer required at this site. Institutional controls at this site can be removed, and the site can be released from institutional control.

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Appendix F

Waste Area Group 6—Boiling-Water Reactor Experiment and Experimental Breeder Reactor I Supporting Analysis

Appendix F

Waste Area Group 6—Boiling-Water Reactor Experiment and Experimental Breeder Reactor I Supporting Analysis

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ACRONYMS

bgs	below ground surface
BORAX	Boiling-Water Reactor Experiment
EPA	Environmental Protection Agency
OU	operable unit
PRG	preliminary remediation goal

Waste Area Group 6—Boiling-Water Reactor Experiment and Experimental Breeder Reactor I Supporting Analysis

F-1. INTRODUCTION

The risk assessment performed in the Operable Unit (OU) 10-04 Remedial Investigation/Feasibility Study (DOE-ID 2001) compared concentrations to slope factors provided by the U.S. Environmental Protection Agency (EPA) *Health Effects Assessment Summary Tables (HEAST)* (EPA 1994) and used preliminary remediation goals (PRGs) developed for use at the Idaho National Laboratory Site (Fromm 1996). Since then, EPA has provided updated slope factors and PRGs for radionuclides, as presented on the EPA website (<http://epa-prgs.ornl.gov/radionuclides/>) (EPA 2010). These changes were discussed in Appendix A of the previous 5-year review document (DOE-ID 2007); but because they remained protective, the updated values were not incorporated into any site-specific evaluation. Although, radionuclides are commonly the only contaminant of concern at sites of concern, other changes in the values used in risk assessment may have occurred. All applicable changes are addressed in this technical reevaluation.

At Waste Area Group 6, sites addressed in the technical reevaluation in this appendix are those sites impacted by changes to toxicity and other risk values and those sites that are under institutional control. These sites include BORAX-01 and BORAX-08.

F-2. BORAX-01—BORAX II-V LEACH POND

BORAX-01 consists of the BORAX II-V leach pond, which was used from 1954 to 1964 to collect low-level radioactively contaminated liquid discharges from BORAX II-V experiments. The BORAX II-V leach pond was located approximately 1.2 km (0.8 mi) north of Experimental Breeder Reactor I and approximately 18 m (60 ft) south of the Boiling-Water Reactor Experiment (BORAX) cooling tower. The leach pond was approximately 6 × 27 m (20 × 90 ft) in area and up to 0.9 m (3 ft) deep. Waste was transported underground from the turbine and reactor buildings to the pond through a 3.8-cm (1.5-in.) -diameter iron pipe. Around 1963, the original pipe was capped, abandoned in place, and its flow was diverted to an underground 5.1-cm (2-in.) -diameter iron pipe. The new pipe discharged to the pond adjacent to the original pipe. Discharges to the pond during its operation were intermittent; however, no records were kept pertaining to the amounts and types of effluents. The effluents were allowed to evaporate or seep into the ground. The industrial effluents were believed to be reactor building sump liquids, fluids associated with the regeneration of ion-exchange resin for water purification, and cooling tower blowdown water. BORAX I was separate from BORAX II-V. The pond was constructed to support the BORAX II-V experiments, and no effluents from the BORAX I experiments were disposed of at the site.

In 1982, a radiological survey was conducted before deactivation and decommissioning commenced. Thirty-three biased samples were collected from three excavated trenches at depths ranging from the surface to 2.4 m (8 ft) below ground surface (bgs). The 1982 investigation identified radionuclide contamination in the soil, concentrated at depths from 0.3 to 0.75 m (1 to 2.5 ft). It is assumed that clean fill was placed on the pond when pond use was discontinued. Cs-137 was detected in 26 samples collected from 0 to 2.4 m (0 to 8 ft) bgs, with a maximum value of 175 pCi/g at a depth of 0.6 m (2 ft). There were three to six detections each of Pu-238, Pu-239, Sr-90, U-234, U-235 and U-238 at levels below 2 pCi/g. Co-60 was detected in four samples from 0.6 to 2.4 m (2 to 7.9 ft) bgs, with a maximum value of 25 pCi/g at the 0.6-m (2-ft) depth. K-40 was detected in all of the soil samples, with a

maximum concentration of 21 pCi/g (Crews 1982). Maximum detections for Co-60, Cs-137, U-235, and U-238 occurred at the 0.6-m (2-ft) depth, while U-234 and Sr-90 maximum detected values (1.44 and 0.3 pCi/g, respectively) were located at 2.1 m (7 ft) bgs. Both Pu-238 and Pu-239/240 maximum detected values were associated with the surface interval, from 0 to 0.15 m (0 to 0.5 ft) bgs.

In 1988, a limited soil sampling and analysis program was conducted to determine the possible presence of hazardous constituents at the site. Four samples were collected at two locations near the discharge pipes, from approximately 1.8 to 3 m (6 to 10 ft) bgs. All sample results were associated with two depth intervals: 2 to 2.2 m (6.5 to 7.5 ft) and 2.3 to 2.9 m (7.7 to 9.5 ft) bgs.

Deactivation and decommissioning activities were performed at the BORAX II–V leach pond in 1984 and again between 1991 and 1992. In 1984, contaminated soil was left in place, and the leach pond area was backfilled with approximately 305 m³ (10,800 ft³) of clean soil (about 0.9 m [3 ft] deep); after which, it was graded and reseeded to inhibit erosion (Smith 1985). The associated piping was not addressed in 1984, but was left in place until 1992, when it was removed. Other than a small volume of contaminated soil removed in 1992 from beneath sections of rusted pipe, no other contaminated soil was excavated from the leach pond area as part of deactivation and decommissioning operations (Arave and Rodman 1992).

Soil data collected from the 1982 and 1988 field sampling efforts at the BORAX II–V leach pond were used in the OU 10-04 risk assessment. The OU 10-04 ROD (DOE-ID 2002) states that the estimated baseline risk for this site is 4E-05 for the future-resident scenario because of exposure to Cs-137. Risks to the current and 100-year worker are 2E-04 and 2E-05, respectively, because of external exposure to Cs-137. Institutional control will be maintained until discontinued, based on the results of a 5-year review.

Table F-1 presents the exposure-point concentrations for Cs-137 calculated for this site from the 0- to 1.2-m (0- to 4-ft) bgs range for the worker and the 0- to 3-m (0- to 10-ft) bgs range for the resident. It also presents the 2004 EPA PRGs for Cs-137 for both the worker and the resident at 1E-04 risk and the dates by which concentrations will have decayed to acceptable levels and institutional control can be terminated. In this case, the limiting release date is for the worker scenario (i.e., January 1, 2075).

Table F-1. Concentrations and dates for release from institutional control for BORAX-01.

Depth (ft)	Maximum Cs-137 Concentration (pCi/g)	Effective Perimeter Concentration (pCi/g) ^a	Effective Perimeter Concentration Decayed to January 1, 2010 (pCi/g)	U.S. Environmental Protection Agency PRG for Scenario (pCi/g)	Institutional Control Can Be Terminated (date) ^b
0–4 ^c	175 ^d	95.4 ^d	50.13 ^e	11.3 ^f	January 1, 2075
0–10 ^g	175 ^e	39.5 ^e	20.76 ^e	5.97 ^f	January 1, 2065

a. DOE-ID (2001).

b. Concentration lower than PRG.

c. Worker-scenario depth.

d. Not decayed from 1982.

e. Decayed from January 1, 1982.

f. EPA PRG taken from EPA website (<http://epa-prgs.ornl.gov/radionuclides/>) (EPA 2010).

g. Resident scenario.

EPA Environmental Protection Agency

PRG preliminary remediation goal

F-3. BORAX-08—BORAX DITCH

The BORAX-08 site, known as the BORAX ditch, was the site of a radionuclide-contaminated drainage ditch associated with BORAX II–V reactor experiments. The site consists of an unlined ditch beginning approximately 12 m (40 ft) north of the former BORAX II–V facility. The ditch is approximately 477 m (1,565 ft) long, approximately 1 m (3.25 ft) wide for most of its length, and spreads to 15 m (50 ft) in width at the end where the topography flattens. A 10-cm (4-in.) raw-water line led from the reactor to a 23-cm (9-in.) corrugated underground metal pipe that emptied into the ditch just outside the north security fence of the BORAX II–V Facility. There are no records of the constituents or volumes released to the ditch.

Contamination in the BORAX ditch was characterized during the Phase II sampling of the OU 10-06 Engineering Evaluation/Cost Analysis (Jessmore et al. 1995). The risk assessment in the OU 10-06 Engineering Evaluation/Cost Analysis indicated risks higher than the 1E-04–1E-06 target risk range from exposure to radionuclides under the current-worker scenario and future-resident scenario. The primary contributor to risk was external exposure to Cs-137. In 1995, based on results of the OU 10-06 Engineering Evaluation/Cost Analysis, a decision was made to perform a non-time-critical removal action at the BORAX-08 site. The non-time-critical removal action involved using the Phase II characterization data and hand-held sodium iodide radiation-detection equipment to guide the removal of approximately 890 m³ (1,178 yd³) of radionuclide-contaminated soil from the ditch. After the excavation, composite soil samples were collected in September and October, for verification, using gamma-spectroscopy analysis. The analysis detected only Cs-137; no other gamma-emitting radionuclides from BORAX activities were detected in the verification samples. Disturbed portions of the BORAX ditch area were either backfilled or graded flat and then reseeded with native flora.

The OU 10-04 Remedial Investigation/Feasibility Study (DOE-ID 2001) assessed this site in 2001 using applicable data collected in the 1993 and 1995 samples. The weighted-average concentrations (exposure-point concentrations) calculated for Cs-137 used in the assessment are:

- 7.22 pCi/g for the 0- to 0.15-m (0- to 0.5-ft) depth
- 1.36E+01 pCi/g for the 0- to 1.2-m (0- to 4-ft) depth
- 5.44 pCi/g for the 0- to 3-m (0- to 10-ft) depth.

Table F-2 presents the exposure-point concentrations for Cs-137 calculated for this site from the 0- to 0.15-m (0- to 0.5-ft), and 0- to 1.2-m (0- to 4-ft) range for the worker and the 0- to 3-m (0- to 10-ft) range for the resident. It also presents the 2004 EPA PRGs for Cs-137 for both the worker and the resident at 1E-04 risk. Concentrations of Cs-137 are now decayed to acceptable levels, and institutional control at the BORAX-08 ditch can be terminated.

Table F-2. Exposure-point concentrations for Cs-137 compared to U.S. Environmental Protection Agency preliminary remediation goals.

Depth (ft)	Maximum Cs-137 Concentration (pCi/g)	Effective Perimeter Concentration (pCi/g) ^a	Effective Perimeter Concentration Decayed to January 1, 2010 (pCi/g)	U.S. Environmental Protection Agency PRG for Scenario (pCi/g)	Concentration below PRG?
0–0.5	14.5	7.22	5.21	Used for windblown exposure	Yes
0–4 ^b	14.5	13.6 ^c	9.82 ^d	11.3 ^e	Yes
0–10 ^f	14.5	5.44 ^c	3.93 ^d	5.97 ^e	Yes

a. DOE-ID (2001).

b. Worker scenario depth.

c. Not decayed as presented in comprehensive.

d. Decayed from November 1, 1995.

e. EPA PRG taken from EPA website (<http://epa-prgs.ornl.gov/radionuclides/>) (EPA 2010).

f. Resident scenario.

EPA Environmental Protection Agency

PRG preliminary remediation goal

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Appendix G

Waste Area Group 9—Materials and Fuels Complex Supporting Analysis

Appendix G

Waste Area Group 9—Materials and Fuels Complex Supporting Analysis

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ACRONYMS

EPA	U.S. Environmental Protection Agency
ICC	interceptor canal–canal
ICM	interceptor canal–mound
IWP	industrial waste pond
MCTBD	main cooling tower blowdown ditch
MFC	Materials and Fuels Complex
OU	operable unit
PRG	preliminary remediation goal

Appendix G

Waste Area Group 9—Materials and Fuels Complex Supporting Analysis

G-1. INTRODUCTION

The risk assessment performed in the Comprehensive Remedial Investigation/Feasibility Study for Operable Unit (OU) 9-04 (DOE-ID 1996) compared concentrations to slope factors provided in the *Health Effects Assessment Summary Table (HEAST)* (EPA 1994) and used preliminary remediation goals (PRGs) developed for use at the Idaho National Laboratory Site (Fromm 1996). Since that time, the U.S. Environmental Protection Agency (EPA) has provided updated slope factors and PRGs for radionuclides on the EPA website (<http://epa-prgs.ornl.gov/radionuclides/>) (EPA 2010). These changes were discussed in Appendix A of the last 5-year review document (DOE-ID 2007), but because they remained protective, the new values were not incorporated into any site-specific evaluation. Though radionuclides are commonly the only contaminant of concern at sites of concern, other changes have been made in the values used in risk assessment. These changes are addressed in this technical reevaluation.

Waste Area Group 9 sites addressed in the technical reevaluation in this appendix are those impacted by changes to toxicity and other risk values under institutional control. These sites include ANL-01 and ANL-09.

G-2. ANL-01—INDUSTRIAL WASTE POND

The industrial waste pond (IWP) at the Materials and Fuels Complex (MFC) (previously named Argonne National Laboratory-West) was an unlined, approximately 1.2-ha (3-acre) evaporative seepage pond fed by the interceptor canal and site drainage ditches. The pond was excavated in 1959, with a maximum water depth of about 4 m (13 ft), and is currently in use. Since 1959, the MFC cooling tower blowdown ditches have been rerouted several times. These ditches convey industrial wastewater from the Experimental Breeder Reactor II power plant (ANL-768) and fire station (ANL-759) to IWP. IWP was originally included with the main cooling tower blowdown ditch (MCTBD) as a land disposal unit under the Resource Conservation and Recovery Act (42 USC § 6901 et seq.) and the Federal Facility Consent Order (DOE-ID 1991) on the basis of potentially corrosive liquid waste having been discharged with the cooling tower effluent. However, in July 1988, MFC conducted a field demonstration—with EPA and state of Idaho representatives in attendance—that showed that any potentially corrosive waste discharged to IWP was neutralized in MCTBD before reaching IWP. On that basis, EPA removed IWP as a land disposal unit and redesignated it as a solid waste management unit. Therefore, this site is still under the regulatory authority of the Resource Conservation and Recovery Act in addition to being on the Federal Facility Agreement and Consent Order (DOE-ID 1991) and under the regulatory authority of the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC § 9601 et seq.).

All three ditches (i.e., ditches A, B, and C) discharged to MCTBD, which then discharged to IWP. Because of the physical separation of these ditches from the pond, each ditch and IWP was assessed separately in the OU 9-04 Remedial Investigation/Feasibility Study (Lee et al. 1997). Soil and sediment samples were collected from IWP as part of four different investigations, occurring from 1986 to 1994, for assessment. IWP was identified in the 1998 OU 9-04 Record of Decision (DOE-CH 1998) as a site requiring further action. The OU 9-04 Record of Decision identified Cs-137 at ANL-01 IWP as a contaminant of concern for human health. The ANL-01 IWP and associated ditches A and B were identified as a risk to ecological receptors from metals (Lee et al. 1997). The primary remedy of

phytoremediation was selected, with a contingent remedy of excavation and disposal. At the time the Record of Decision was finalized, IWP was still in use as part of the Sodium Process Facility. Therefore, it was determined that remediation efforts would not commence until the end of the useful life of IWP. The remediation goal for Cs-137 in IWP was established as 23.3 pCi/g, based on the current activity level (i.e., the level to which the activity will decay to acceptable levels after 100 years) (DOE-CH 1998).

The Sodium Process Facility was clean-closed under the Resource Conservation and Recovery Act in summer 2002. IWP was deemed ready to be addressed in compliance with the OU 9-04 Record of Decision. The second Explanation of Significant Differences was submitted in June 2004 (DOE 2004). Results from the bench scale study, as well as the 2- and 4-year sampling efforts at other similarly contaminated sites, suggested that inorganic contaminants in IWP were not conducive to phytoremediation, and that contaminant levels would not be reduced to acceptable levels within an acceptable timeframe through phytoremediation. The contingent remedy of excavation and disposal was selected for IWP; no attempt at phytoremediation was made. In September 2004, 994 m³ (1,300 yd³) of contaminated soil was excavated from IWP and disposed of at the Idaho CERCLA Disposal Facility. In 2004, post-remedial confirmation soil samples collected from IWP showed elevated concentrations of contaminants exceeding the remediation goal in the northwestern portion of IWP (Portage 2005a). In November 2004, an additional 107 m³ (140 yd³) of contaminated soil was excavated from the northwestern portion of IWP and disposed of at the Idaho CERCLA Disposal Facility. Soil was removed until the underlying basalt layer was encountered in a manner encompassing the hot spot. The hot spot and soil were excavated to surrounding sampling locations, which previous sample results showed met the established remediation goal. Based on discussions with the Agencies (i.e., U.S. Department of Energy, U.S. Environmental Protection Agency, and the Idaho Department of Environmental Quality), IWP met all remediation goals after the chromium hot spot had been removed (Portage 2005a), and additional confirmation samples were not required.

Tables 6 and 7 of the OU 9-04 Remedial Action Report (Portage 2005b) provide the calculated 95% upper confidence limit on the mean for surface and subsurface concentrations of Cs-137 at IWP. Subsurface concentrations are 0.208 pCi/g, which is below remediation goals set for free release. The 95% upper confidence limit on the mean surface concentration of Cs-137 is 10.0 pCi/g. By 2028, this will have decayed to below the new EPA PRG for exposure to the resident (i.e., 1E-04). At that time, the site can be released from institutional control.

G-3. ANL-09—INTERCEPTOR CANAL—CANAL AND –MOUND

The interceptor canal–canal (ICC) (Figure G-1) transported industrial waste water to IWP and diverted spring runoff and other natural waters around the MFC Facility to IWP. Between 1962 and 1975, two 10.2-cm (4-in.) pipes transported industrial waste water and cooling tower effluent to ICC. One line transported cooling tower blowdown water and ion exchange column regeneration effluent while the other line originated at the industrial waste lift station and transported industrial waste water. Though liquid radioactive waste was discharged through the same line as the industrial waste water, it was diverted to the Experimental Breeder Reactor II leach pit. The interceptor canal–mound (ICM) was formed when 1,384 m³ (1,810 yd³) of dredged material was placed on the bank of ICC (Figure G-1).

In 1973, discharge of industrial waste water was discontinued; in 1975, discharge of cooling tower blowdown water was discontinued. Soil samples were collected in 1969, 1973, and 1975, as discussed in the OU 9-04 Remedial Investigation/Feasibility Study (Lee et al. 1997). Contaminant screening identified Cs-137 in the soil of ICC and ICM at concentrations that posed unacceptable risk to human health (Lee et al. 1997). Soil samples from ICM were analyzed for only radionuclides; however, inorganic releases to ICC occurred after the canal was dredged, and therefore, radionuclides would not have been

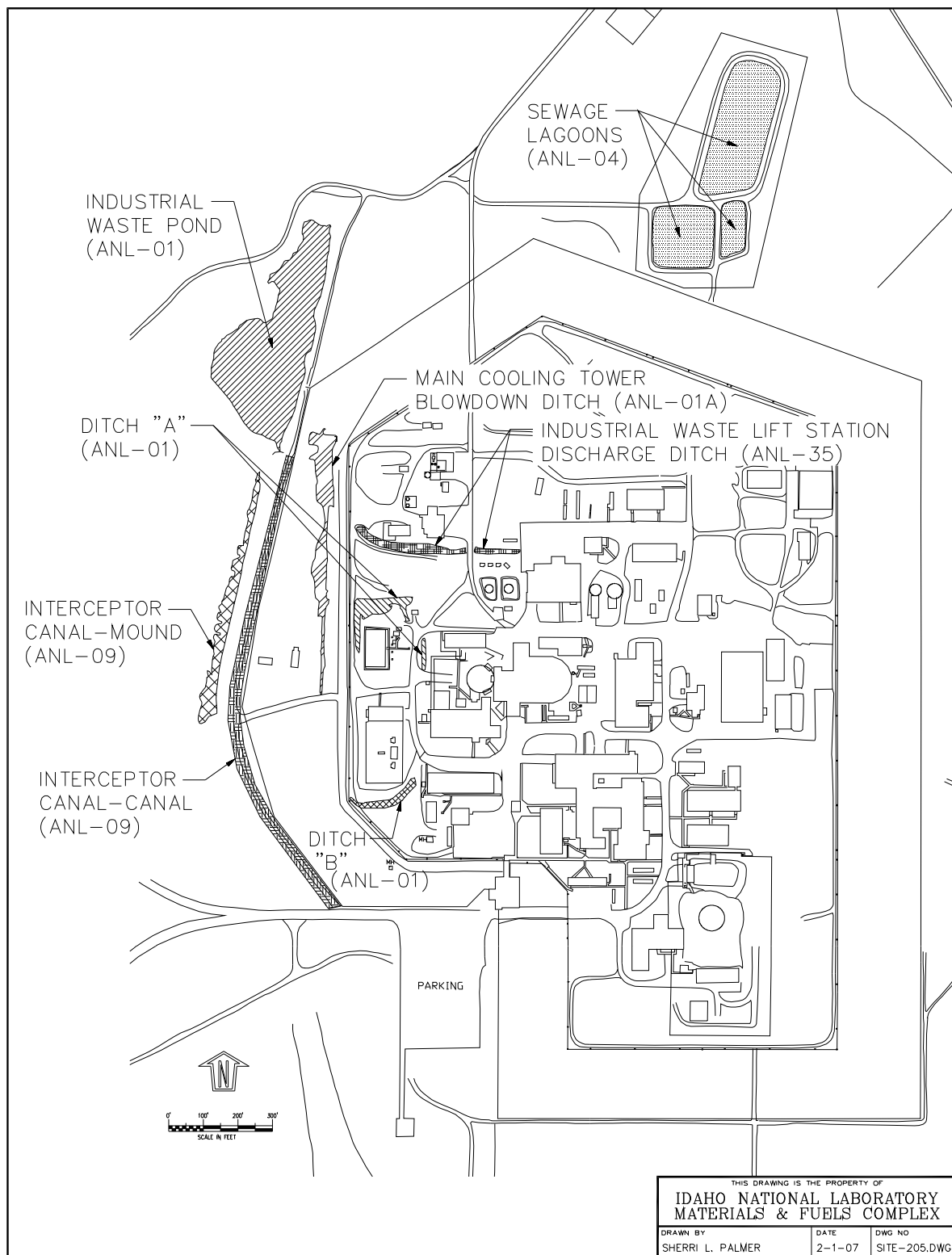


Figure G-1. Areas at the Materials and Fuels Complex that required remediation.

present in the dredged piles. ICC and ICM are identified in the OU 9-04 Record of Decision as sites requiring further action. The primary remedy of phytoremediation was selected with a contingent remedy of excavation and disposal. The remediation goal for Cs-137 at both sites was established as 23.3 pCi/g (DOE-CH 1998). In 1999, it was determined that the Cs-137 levels in soil at ICC would naturally decay to an acceptable activity level over 100 years (2098). Therefore, ICC would not require further remediation, but would require institutional control to limit land use until the Cs-137 decayed to an acceptable level (DOE 1999).

Results from the 1998 bench scale treatability study indicated that phytoremediation was a viable option for removing Cs-137 from ICM (Negri, Hinchman, and Albright 1998), and phytoremediation efforts were initiated at ICM in 1999. Soil samples collected from ICM in 2001 indicated that the phytoremediation effort was progressing as planned (DOE 2001). In 2003, post-remedial confirmation soil samples were collected from ICM—after 4 years of phytoremediation. Confirmation sampling demonstrated that the phytoremediation effort had been a success, that the remediation goals had been met, and that the 95% upper confidence limit on the mean was less than the established remediation goal for Cs-137 (Portage 2005b).

In 2003, final confirmation samples were collected from post-remediation soil at ICM. Soil was analyzed for Cs-137. The post-remediation sample set from the western portion of MCTBD consisted of 16 surface soil samples, 0 to 15 cm (0 to 6 in.) below ground surface; 16 subsurface soil samples, 15 to 61 cm (6 to 24 in.) below ground surface; and two rinsate samples. The two rinsate samples collected from equipment used in obtaining soil samples were analyzed to determine whether equipment may have contributed to concentrations of Cs-137 detected in the soil samples. At each sampling location, one surface sample was collected for analyses as well as one subsurface sample composited from 15 to 16 cm (6 to 24 in.) below ground surface.

Tables 6 and 7 of the OU 9-04 Remedial Action Report (Portage 2005b) provide the calculated 95% upper confidence limit on the mean for surface and subsurface concentrations of Cs-137 at ICC and ICM. At ICM, the subsurface concentration was 2.48 pCi/g, which is below the remediation goal set for free release. At ICM, the 95% upper confidence limit on the mean surface concentration of Cs-137 is 9.54 pCi/g (collected in 2003). By 2024, this will have decayed to below the new EPA PRG (EPA 2004) for exposure to the resident (i.e., 1E-04). At that time, the ICM area can be released from institutional control.

At ICC, the surface and subsurface concentration was 18 pCi/g (collected in 1999). By 2048, this will have decayed below the new EPA PRG for exposure to the resident (i.e., 1E-04). At that time, the ICC area can be released from institutional control.

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Appendix H

Waste Area Group 10—Site-Wide Area Supporting Analysis

Appendix H

Waste Area Group 10—Site-Wide Area Supporting Analysis

H-1. OMRE-01 LEACH POND

The Organic-Moderated Reactor Experiment leach pond was used for wastewater disposal from the Organic-Moderated Reactor Experiment reactor. The reactor, which operated from 1957 to 1963, was located approximately 3.25 km (2 mi) east of the Central Facilities Area. The pond was located approximately 91 m (300 ft) east of the Organic-Moderated Reactor Experiment facility and was a shallow depression surrounded by an earthen berm. Pond dimensions at the berm top were approximately 8 × 22 m (26 × 72 ft) and at the base were approximately 5 × 15 m (16 × 49 ft). Soil depth to basalt in the base varied from 30 cm (12 in.) at the east end to 46 cm (18 in.) at the west end (Chapin 1979). A portion of the pond soil was excavated in 1979 and sent to the Radioactive Waste Management Complex. However, the cleanup goal was 1,000 pCi/g, and it is believed that contaminated soil up to this limit may have been left in place. The pond was then backfilled, and the entire area is revegetated with grass. The former pond location was identified in 1997 as a slightly mounded area with more lush vegetation.

During Organic-Moderated Reactor Experiment operations, reactor wastewater sent to the pond either evaporated or infiltrated into the ground. Suspected contaminants in the pond were primarily short-lived radionuclides, metals, and organics. The coolant organics were generally associated with high-boiling-point components similar to wax; however, neutron bombardment was expected to have decomposed some components to low-boiling-point organics, including benzene, toluene, ethylbenzene, and xylene (Chapin 1979). It was presumed that a high percentage of the liquids that were discharged into the Organic-Moderated Reactor Experiment pond flowed into basalt fractures. This was based on the 1979 decommissioning report (Chapin 1979).

Section 11 and Appendix J of the Operable Unit 10-04 Remedial Investigation/Feasibility Study (DOE-ID 2001) provided an extensive characterization of this site. It is evident that radionuclide-contaminated soil is present in the Organic-Moderated Reactor Experiment area, and Cs-137 is the most abundant radionuclide. The global positioning radiometric scanning survey results and the aboveground and downhole in situ measurements have helped refine and confirm the Organic-Moderated Reactor Experiment conceptual model.

Due to the character of this site, the sampled data were evaluated for hot spots before calculating the exposure point concentration. An area containing elevated contaminant concentration or activity concentration relative to the surrounding area is a hot spot. Since the exposure point concentration is an indication of average contamination across the site, hot spots were eliminated from the exposure point concentration calculation.

The results show that a high percentage of the Cs-137 soil contamination is in the top 0.61 m (2 ft), except in the location of the former Organic-Moderated Reactor Experiment leach pond, where contamination is present at depths down to the soil/basalt interface at approximately 1 to 4 m (3 to 13 ft) deep. The surficial contamination outside the former pond is scattered near the pond and present in a nearby ditch but is localized in small areas of elevated activity that are generally less than 0.61 m (2 ft) in diameter. The site was assessed for risk using the exposure point concentrations presented in Table 11-4 of DOE-ID (2001).

Table H-1 presents the Cs-137 exposure point concentrations from that table and the concentrations that they would be decayed to by January 1, 2010. As is shown, the site has decayed to below the U.S. Environmental Protection Agency preliminary remediation goal for occupational scenario at 1E-04 risk (11.3 pCi/g). It will decay to below the U.S. Environmental Protection Agency preliminary remediation goal for a future resident at 1E-04 risk (6 pCi/g) by the year 2039.

Table H-1. OMRE-01 Cs-137 exposure point concentrations compared to U. S. Environmental Protection Agency preliminary remediation goals.

Depth (feet)/Scenario	Cs-137 EPC (pCi/g) ^a	Cs-137 EPC Decayed to 01/01/2010 (pCi/g) ^b	Year Decayed to Below EPA PRG
0–4 (occupational)	12.2	9.92	NA
0–10 (resident)	14.3	11.63	2039
a. From Table 11-4 of DOE-ID (2001). b. Decayed from 01/01/2001. EPA Environmental Protection Agency EPC exposure point concentration NA not applicable PRG preliminary remediation goal			

H-2. REFERENCES

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