FMC Idaho LLC, Pocatello, Idaho

REMEDIAL DESIGN WORK PLAN for the FMC OU

December 2013

MWH

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LIST OF ACRONYMS

AFLB	American Falls lake bed
AFM	Anderson filter media
ANSI	American National Standards Institute
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
ASME	American Society of Mechanical Engineers
ASTM	ASTM International (formerly known as the American Society for Testing and Materials)
As	arsenic
bgs	below ground surface
BMP	Best Management Practice
CCM	criteria committee meeting
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
COC	contaminant of concern
CQAP	Construction Quality Assurance Plan
CV	comparative value
DG	data gap
EPA	United States Environmental Protection Agency
EMF	Eastern Michaud Flats
EPCRA	Emergency Planning and Community Right-to-Know Act
ERP	emergency response plan
ET	evapotranspirative
EZH	extraction zone hydrogeologic
GC	gamma cap
GW	groundwater
FeP	ferrophos
FMC	FMC Corporation
FMC OU	FMC Operable Unit
FS	Feasibility Study
FSP	Field Sampling Plan
gpm	gallons per minute
GSR	Green and Sustainable Remediation
HASP	Health and Safety Plan
IC	institutional control
ICIAP	Institutional Control Implementation and Assurance Plan
IDEQ	Idaho Department of Environmental Quality
IROD	Interim Record of Decision Amendment
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MWH	MWH Americas, Inc.

NESC	National Electric Safety Code
NO3-N	nitrate as nitrogen
O&M	operations and maintenance
OM&M	operations, monitoring and maintenance
OSHA	Occupational Safety and Health Administration
OSWER	EPA Office of Solid Waste and Emergency Response
OU	Operable Unit
P4	elemental phosphorus
pcf	pounds per cubic foot
pCi/g	picoCuries per gram
P.E.	Professional Engineer
POTW	publically-owned treatment works
PRG	preliminary remediation goal
PSVP	Performance Standards Verification Plan
PT	performance testing
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RA	Remedial Action
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RDWP	Remedial Design Work Plan
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
RU	remediation unit
SFS	Supplemental Feasibility Study
SPCC	Spill Prevention, Control, and Countermeasures
SRI	Supplemental Remedial Investigation
SUA	southern undeveloped area
SWHASP	Site-Wide Health and Health and Safety Plan
SWMU	Solid waste management unit
TI	technical impracticability
TODP	Transportation and Off-Site Disposal Plan
UAO	Unilateral Administrative Order
WQC	Water Quality Criteria
WUA	western undeveloped area

1.0 INTRODUCTION

1.1 PURPOSE AND OBJECTIVES

This Remedial Design (RD) Work Plan has been prepared on behalf of FMC Corporation (FMC) and presents the organization, objectives, and activities associated with designing the remedy for the FMC Plant Operable Unit (FMC OU) of the Eastern Michaud Flats (EMF) Superfund Site. The FMC OU is located in Power County in Idaho, approximately 2.5 miles northwest of Pocatello (see Figures 1-1 and 1-2). The EMF Site includes two adjacent production facilities, the former FMC Corporation elemental phosphorus (P4) processing plant that ceased operation in 2001 and a phosphate fertilizer processing facility currently operated by the J.R. Simplot Company. The EMF Site is shown on Figure 1-1 and encompasses both the FMC and Simplot plants and surrounding areas (Off-Plant OU) affected by releases from these facilities.

The FMC OU, consisting of the FMC Plant Site and other FMC-owned properties at the EMF Site, is on privately-owned fee land, most of which is located within the exterior boundaries of the Fort Hall Indian Reservation. As shown on Figure 1-2, the FMC Plant OU consists of the FMC Plant Site (i.e., the former operating facility located south of Highway 30), the Southern and Western Undeveloped Areas (SUA and WUA) that are also located to the south of Highway 30, and FMC-owned Northern Properties located to the north of Highway 30. The easternmost portions of the FMC OU are located outside the reservation boundary.

This RD Work Plan is one of the work elements being conducted pursuant to the remedial actions set forth in the Interim Amendment to the Record of Decision for the EMF Superfund Site FMC Operable Unit (IROD; Environmental Protection Agency [EPA], 2012) and a RD/Remedial Action (RA) Unilateral Administrative Order (UAO) issued by the EPA on June 10, 2013 which became effective on June 20, 2013. This RD Work Plan describes specific activities that are necessary to prepare the designs for the selected remedy identified in the IROD and the UAO. The Selected Remedy includes capping or covering and in-place management of soil and fill material at the FMC OU, removal and treatment of residual wastes in storm drain piping and groundwater extraction and treatment, and requires long-term monitoring and land use controls. A more detailed description of the selected remedy for the FMC OU is presented in Section 2.4.2.

The objectives of the FMC OU RD are to prepare engineering plans and technical specifications that meet UAO requirements and are suitable for procuring construction contractors to implement the Selected Remedy. In accordance with the UAO, the RD Work Plan provides the general approach to construction, operation, maintenance, and monitoring of remedial actions as necessary to fully implement the Selected Remedy. As specified in UAO Paragraph 30.c., this RD Work Plan contains:

1. Descriptions of plans that will be necessary to construct the Selected Remedy and schedules for implementation of all RD and pre-design tasks identified in the UAO.

2. The Remedial Action contracting strategy.

3. The overall project delivery strategy for performing design investigations and remedial design and a general approach to contracting, construction, monitoring, and operation and maintenance as necessary to implement the Selected Remedy.

4. The preliminary plan for phasing of the pre-design, RD and remedial construction, including determining if an Intermediate (60%) design is necessary. The responsibility and authority of all organizations and key personnel involved with implementation of the remedial design, including a description of qualifications of key personnel directing the remedial design.

5. Identification of design elements (e.g., data gaps) necessary to complete or refine the design basis and plans to obtain the identified design data / information, including the performance testing work plans generally described in Paragraph 30.d. of the UAO.

6. A schedule for preparation and implementation of specified deliverables.

In addition, this RD Work Plan includes example design sheets and specifications to be used in the design.

Although this RD Work Plan describes the process and strategy for preparing the design for the FMC OU remedy, it does not contain design details such as design calculations, assumptions, technical specifications, etc. These details will be developed during the actual design process by the design team and will be included in the design submittals. Moreover, this RD Work Plan presents the RD approach and process as it is anticipated at the pre-design stage. Components of the RD approach and process may change or evolve as the design progresses and additional data and detailed design information is developed. Any unanticipated changes to the RD approach or processes described in this RD Work Plan identified during its implementation will be communicated and resolved with EPA. Additional details regarding the project delivery strategy for the FMC OU RD are presented below.

1.2 PROJECT DELIVERY STRATEGY FOR THE FMC OU REMEDIAL DESIGN

The overall strategy is to deliver the RD efficiently, cost-effectively, and in a manner that satisfies the concepts and requirements described in the UAO. The project delivery strategy includes the following components:

1.2.1 Project Delivery Method

The FMC OU RD/RA will be a traditional design-bid-build project delivery. The design team (described below in Section 1.3) will prepare the design and bid documents in accordance with this RD Work Plan. These design/bid documents then will be used to obtain bids from qualified remediation contractors, and the selected remediation contractor(s) will perform the RA construction activities. During the RA, the design team or other qualified engineering or construction-manager entity will act as FMC's agent to review the progress of the work and confirm that the RA is performed in accordance with the approved design.

1.2.2 Technical Manager Meetings/Design Review Meetings

Throughout the FMC OU RD process, periodic meetings will be held with EPA and design-team project managers and technical staff to review progress and important or significant technical issues, discuss design parameters and assumptions, and discuss potential design changes. The goals of these meetings are to keep the lines of communication open and to get EPA input and consensus early in the RD process (as opposed to relying solely on the traditional review/ response-to-comments approach to communicate and address potential issues). As specified in Paragraph 29 of the UAO, the EPA and FMC Project Coordinators, and other project team managers / technical staff as appropriate, will meet in person or via teleconference every two weeks at a minimum during the RD, unless otherwise agreed upon by EPA and FMC. Additional details regarding the Technical Manager Meetings are included in Appendix A (Remedial Design Quality Assurance and Quality Control).

In addition to the Technical Manager Meetings discussed above, Design Review Meetings will be scheduled to be held within two weeks (if possible) of receiving EPA comments on the 30 percent and, if submitted, the 60 percent design submittals. The purpose of the Design Review Meetings is to allow the design team the opportunity to seek clarification on EPA comments and to resolve any significant comments prior to initiating subsequent designs.

1.2.3 Design Sequencing

The RD (described in Section 5.0) will be sequenced to mirror the anticipated chronological order (or phases) of the RA construction. For example, the site-wide grading and stormwater management/control system will be first in the construction sequence for the soil RA and the plans for that work accordingly will be developed early during the RD. In addition, design elements that are sufficiently defined will proceed earlier in the RD process, whereas those elements impacted by current data gaps or where performance testing is necessary to define / refine the design basis will progress after the needed design data or performance testing results are obtained. This staggered design effort is expected to streamline the overall schedule for completion of the RD. The anticipated RD schedule is presented in Section 6.0.

1.2.4 Value Engineering

Construction contractors and outside technical experts will be consulted during the design process to help identify procedures, processes, and construction techniques that could improve quality, or streamline implementation or future operation and maintenance of the Selected Remedy. For example, construction contractors will be solicited at key points during the design process where it is determined that outside expertise would enhance the design and the performance of the remedy. The objective is to identify value engineering ideas early such that they can be incorporated into the RD.

1.2.5 Compliance during Remedial Design with Regulatory Requirements

This RD Work Plan has been prepared, and the actual RD activities will be performed, in accordance with the *Superfund Remedial Design and Remedial Action Guidance* (EPA, 1986). This will contribute to assuring that the design the selected remedy is protective of human health and the environment, complies with the IROD, and fulfills the requirements of the UAO. The requirements specific to the various planning documents are described in in Section 5.0.

1.2.6 Applying EPA Principles for Greener Cleanups

The RD process will include an evaluation of applicable Green and Sustainable Remediation (GSR) technologies and best management practices (BMPs). The goal of the GSR evaluation is to identify technologies and/or BMPs that may reduce the environmental footprint of the RA and the associated long-term operation and maintenance. The results of this evaluation will be included in the 30 percent design submittal. GSR technologies and BMPs will not be employed, where they might compromise the cleanup objectives, community interests, reasonableness of cleanup timeframes, or protectiveness of the cleanup actions.

The GSR technology evaluation will reference the following information sources:

- EPA Principles for Greener Cleanups (http://www.epa.gov/oswer/greenercleanups/principles.html#attachment).
- EPA Superfund Green Remediation Strategy (http://www.epa.gov/oswer/greenercleanups/strategy.html).
- EPA Region 10 Superfund, RCRA, LUST, and Brownfields Clean and Green Policy.
- EPA Technology Primer – Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites (EPA 542-R-08-002).
- EPA Hazardous Waste Clean-Up Information (CLU-IN) Web Site (http://www.clu-in.org/greenremediation/).

1.3 PROJECT ROLES AND RESPONSIBILITIES

The overall organizational structure showing the key personnel for the FMC OU RD is illustrated in Figure 1-3. The responsibility and authority of each organization is presented below. Additional discussion regarding the project roles and responsibilities related to the overall RD project quality assurance/quality control (QA/QC) is included in Appendix A.

1.3.1 Environmental Protection Agency

EPA is the lead agency governing the remediation of the FMC OU. EPA issued the IROD and UAO, and is responsible for approving all plans and reports related to implementing the Selected Remedy. The EPA Remedial Project Manager is Mr. Kevin Rochlin.

1.3.2 FMC Corporation

As the responsible party, FMC is implementing the Selected Remedy in accordance with the UAO. FMC has overall responsibility for procuring consultants and contractors to perform the work, budgeting and securing the necessary funds, and assuring that the requirements of the UAO are met. The FMC Project Coordinator is Ms. Barbara Ritchie and the Alternate FMC Project Coordinator is Dr. Marguerite Carpenter.

1.3.3 MWH Americas, Inc.

MWH Americas, Inc. (MWH) will serve as the Supervising Contractor. MWH is a global technical consulting, engineering, and construction firm, with a reach-back capacity to more than 7,000 employees. MWH provides expertise in all aspects of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) projects, including remedial investigations, human health and ecological risk assessments, feasibility studies, RD/RA, treatability testing, permitting, construction, and operation and maintenance of completed designs. The various technical issues that will be involved with the FMC OU RD/RA work require access to personnel with experience in specific technical areas. MWH provides these capabilities, and can draw on specific personnel for additional resource support and input as necessary.

The core MWH FMC OU project team will consist of a select group of professionals based in Salt Lake City, Utah that specialize in CERCLA compliance, remedial earthwork design, and groundwater extraction system design. Many of the MWH team have worked together on other projects, and several have worked on FMC Pocatello projects for over 15 years. The specific individuals involved and their respective roles are as follows:

Project Director. Mr. Marc Bowman is the MWH Project Director. He will be responsible for the contractual commitments and for ensuring that the necessary resources are dedicated to the project. He also will assure the technical, budget, and schedule requirements are met. Mr.

Bowman has over 26 years of CERCLA experience and has managed several complex, interdisciplinary remediation projects for CERCLA and RCRA sites throughout the western United States, including in EPA Region 10.

Remedial Design (RD) Manager. Mr. Rob Hartman will serve as the MWH Remedial Design Manager. Mr. Hartman will be responsible for day-to-day communication with the FMC Project Coordinator as well as with the MWH staff assigned to perform the various project tasks. As MWH RD Manager, he will define and clarify the scope of work and objectives for each major activity. Mr. Hartman has over 25 years of experience including 16 years in the mining and mineral processing industry as a project manager and remediation project director. His experience has focused on CERCLA RI/FS, RD/RA and emergency removal actions, RCRA waste unit closure and corrective action, and facility decommissioning and asset recovery.

Engineering Manager. Mr. Chad Tomlinson will serve as the MWH Engineering Manager and the primary design interface to the MWH RD Manager. He will be responsible for coordinating the necessary resources to accomplish the design of the various elements and to complete the soil remedy RD phase. He will ensure that the various plans and design submittals meet the requirements of the UAO and SOW. Mr. Tomlinson has over 20 years of experience with the development, design, permitting, construction, operation, and reclamation of mine facilities. Project experience has included tailings impoundments, heap leach facilities, water storage dams, sedimentation dams, and storage ponds. Mr. Tomlinson is a registered professional (civil) engineer (registered PE in Idaho) with a technical specialty in geotechnical engineering.

Groundwater Extraction System Manager. Mr. Jesse Stewart will serve as the MWH Hydrological Manager for the groundwater RA component of the Selected Remedy and the primary design interface to the MWH RD Manager. He will be responsible for coordinating the necessary resources to accomplish the design of the hydrogeologic study and the remedy RD phase. Mr. Stewart has over 13 years experience as a hydrogeologist working on a wide variety of groundwater and water resources projects. Mr. Stewart has extensive experience in site characterization, the design and implementation of field programs, and data interpretation. He has designed, implemented, and analyzed aquifer tests and has been active in the development of conceptual site models and remedial systems for numerous projects.

Program QA/QC Leader. Mr. Michael Gronseth will serve as the Program Quality Assurance / Quality Control (QA/QC) Manager. Mr. Gronseth will oversee all quality QA/QC related to the RD of the FMC OU. Mr. Gronseth has over 25 years of experience with environmental remediation and has served as the QA/QC manager for the MWH's Federal Operations for the past 8 years. In this capacity, Mr. Gronseth has been involved with the development of Corporate QA/QC policies and is responsible for the implementation of contract and corporate QA/QC programs.

1.4 ORGANIZATION OF WORK PLAN

The remainder of this RD Work Plan is comprised of the following sections:

- Section 2.0 describes the site background, site characteristics, nature and extent of contamination, a summary of the remedial actions completed to date, and a summary of the ROD and Selected Remedy.
- Section 3.0 presents a summary of the pre-design activities (both completed and ongoing).
- Section 4.0 summarizes the RD considerations relevant to the overall RAOs and the performance standards defined under the UAO.
- Section 5.0 describes the contents of the RD deliverables.
- Section 6.0 presents the schedule for the RD/RA and general approach to the RA for the FMC OU.

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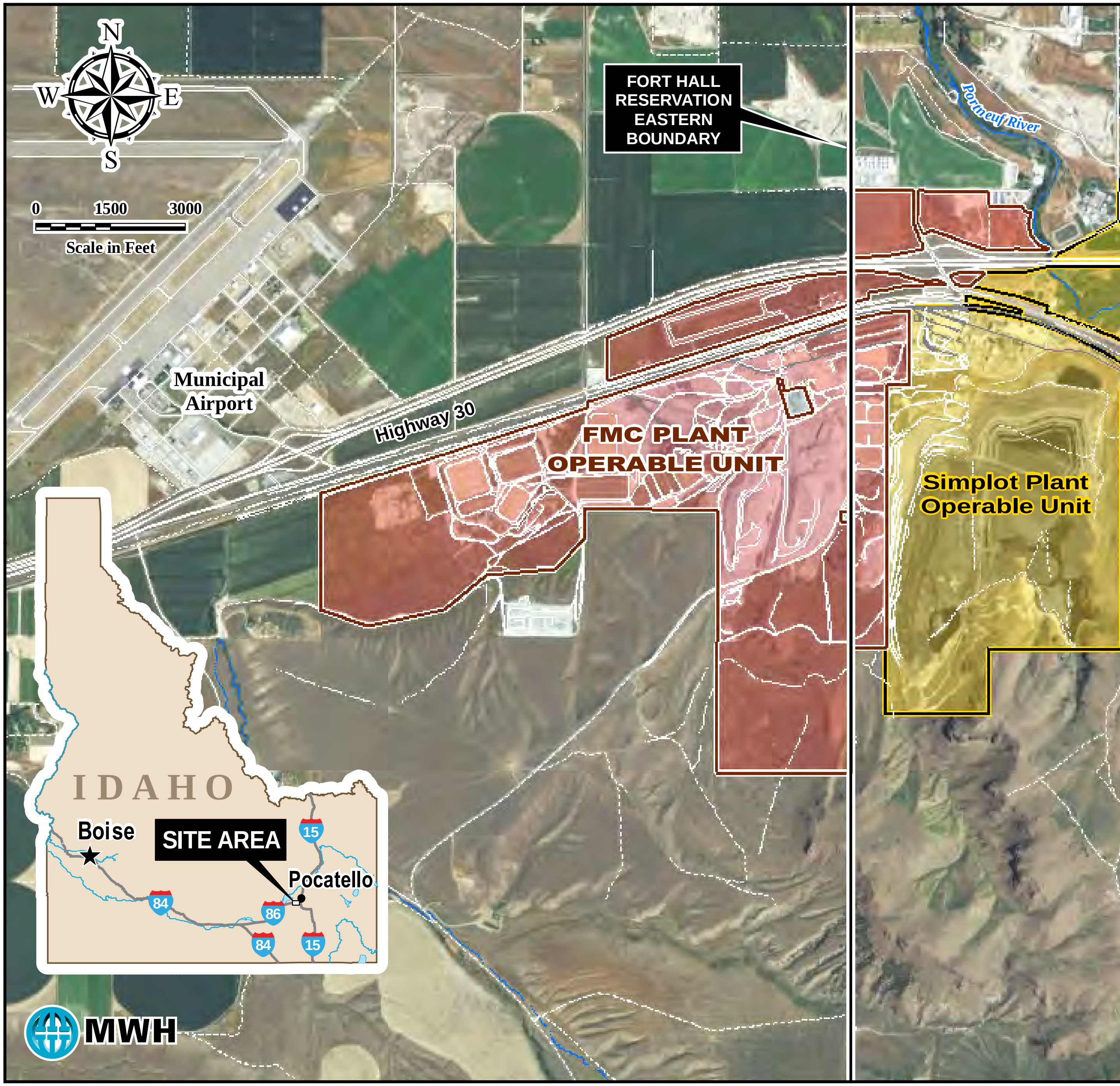
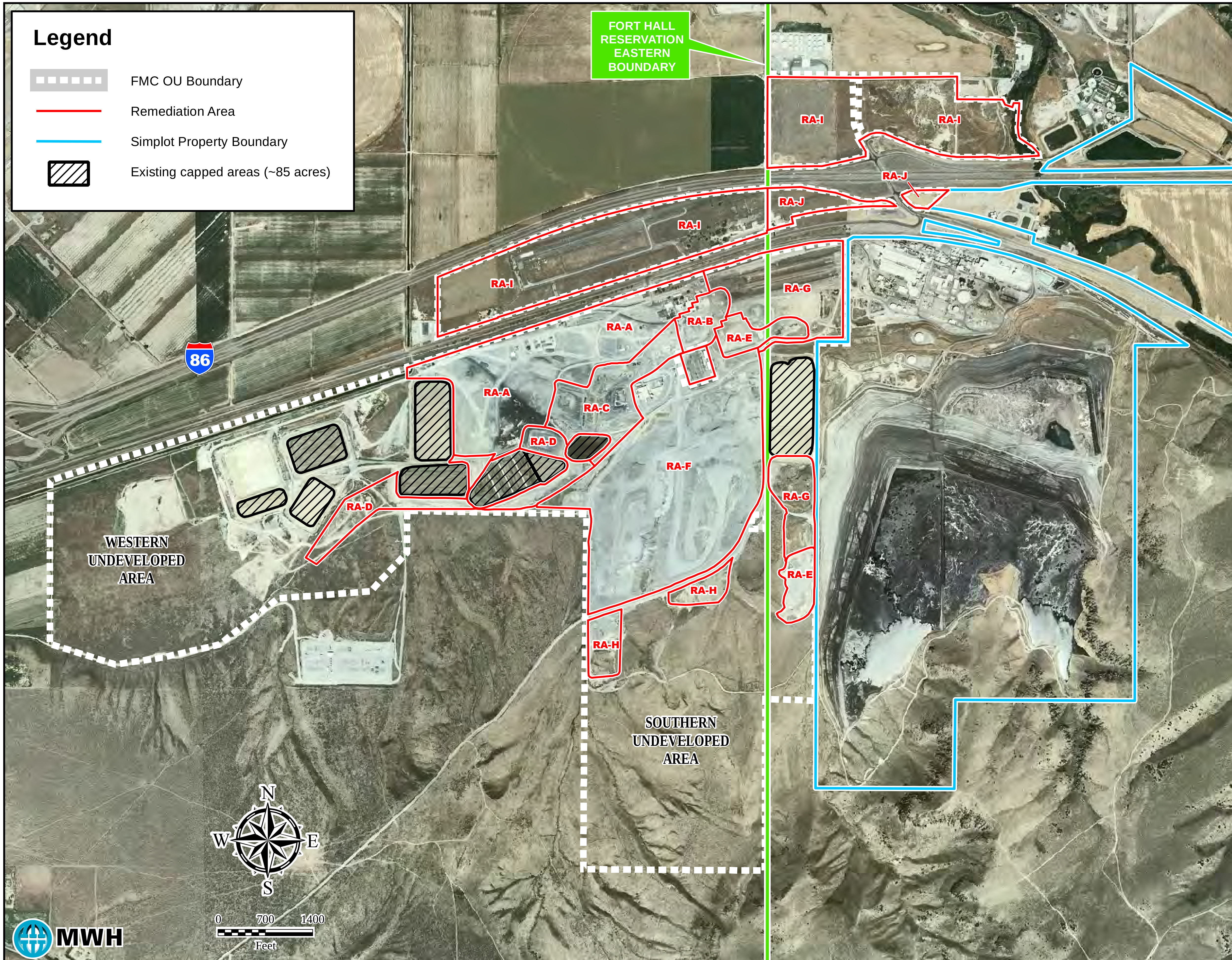


REMEDIAL DESIGN WORK PLAN

FIGURE 1-1

FMC OPERABLE UNIT VICINITY MAP



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REMEDIAL DESIGN WORK PLAN

FIGURE 1-2
FMC OPERABLE UNIT
SITE PLAN

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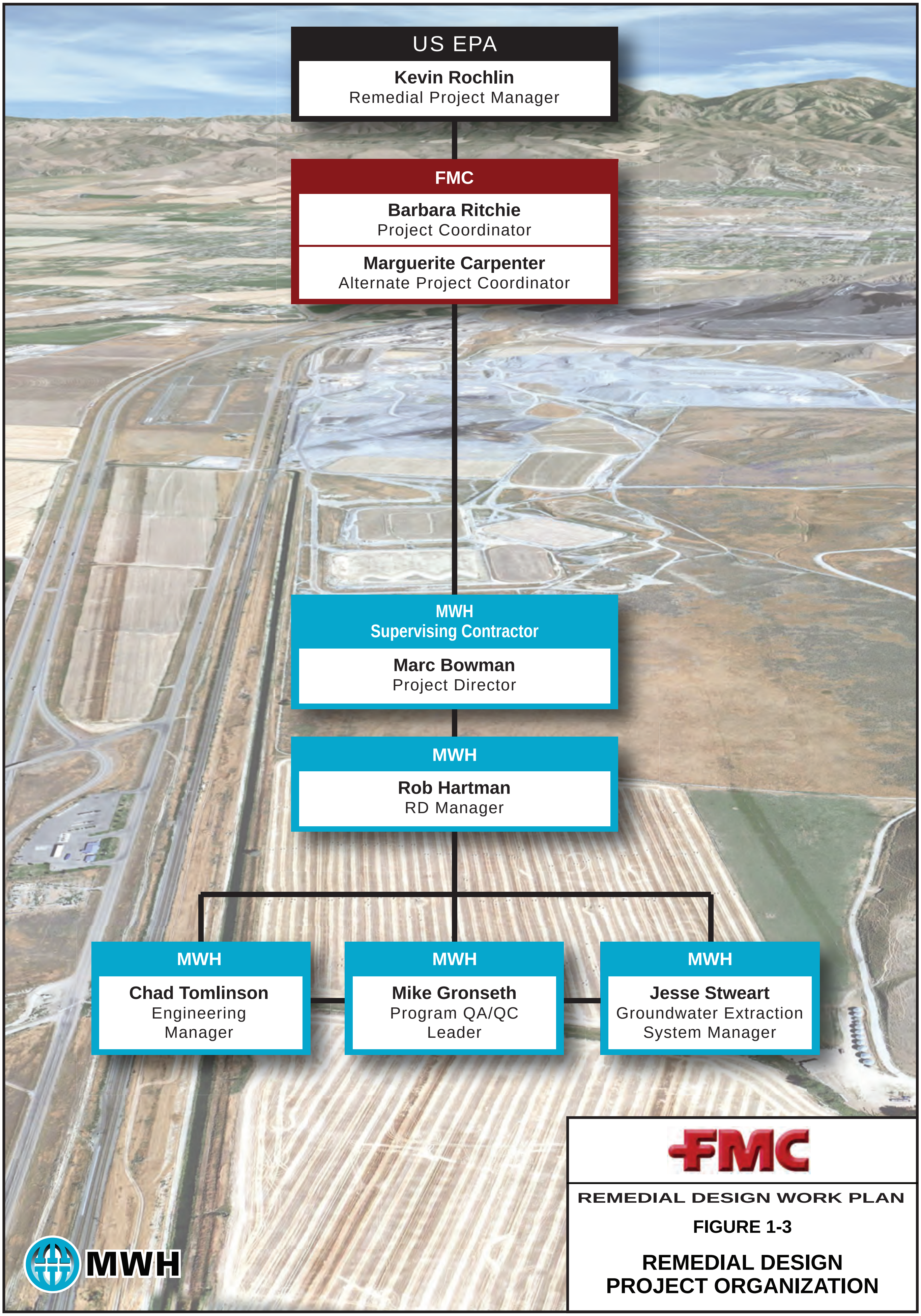

FMC

REMEDIAL DESIGN WORK PLAN

FIGURE 1-3

REMEDIAL DESIGN PROJECT ORGANIZATION

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2.0 BACKGROUND SUMMARY

This section provides an overview of the FMC OU and a summary of information assembled during the EMF Superfund Site Remedial Investigation/ Feasibility Study (RI/FS) and FMC OU Supplemental Remedial Investigation and Supplemental Feasibility Study (SRI/SFS). This section includes a brief description of the site including the physical setting, brief synopsis of the history and response actions, and a summary of the nature and extent of contaminants as identified during the RI and SRI at the site. More detailed information is contained in the Remedial Investigation for the Eastern Michaud Flats Site (EMF RI Report; BEI, 1996); Supplemental Remedial Investigation Report for the FMC Plant Operable Unit (SRI Report MWH, 2009a); Groundwater Current Conditions Report for the FMC Plant Operable Unit (GWCCR; MWH, 2009b); and Supplemental Remedial Investigation Addendum Report for the FMC Plant Operable Unit (SRI Addendum Report; MWH, 2009c), which are in the Administrative Record for the Site.

2.1 SITE DESCRIPTION

2.1.1 Location

The FMC OU, which includes the former plant process areas, other areas related to the plant operation, and adjacent FMC-owned areas, occupies approximately 1,450 acres in Power County, Idaho approximately 2.5 miles northwest of the city of Pocatello (see Figures 1-1 and 1-2. Over the years, numerous names have been used to describe FMC-owned properties. As part of the IROD, EPA developed a table to clarify the terminology and definitions below to describe different geographic areas within and adjacent to the FMC Plant. Table 2-1 contains the definition of terms for geographic areas at the FMC facility as adapted from the inset table on pages 2 and 3 of the IROD. The same IROD terminology for the geographic areas of the site is used in this RD Work Plan and will be used consistently throughout the RD/RA.

2.1.2 Topography

The EMF Site is located approximately 2.5 miles northwest of the city of Pocatello in the funnel-shaped Portneuf River Valley. The valley virtually closes at the southern end of Pocatello at the Portneuf Gap. East of Pocatello, the Pocatello Mountain Range rises from about 4,400 feet to about 6,500 feet above mean sea level. The Bannock Range then bounds the west side of Pocatello and the Lower Portneuf River Valley. The north end of the Bannock Range is just south of the FMC OU. The Bannock Range and Michaud Flats meet along an escarpment that runs east–west through the FMC OU.

2.1.3 Meteorology

The EMF Site is semi-arid, with approximately 11 inches of precipitation per year. Net annual evapotranspiration rates typically exceed annual precipitation. Prevailing winds are from the southwest. There is also a secondary wind component out of the southeast which appears to be a drainage wind that flows out of the Portneuf River valley, primarily at night.

2.1.4 Geology

The FMC Plant OU and surrounding area are located at the juncture between the Basin and Range physiographic province to the south and the Snake River Plain to the north (Dohrenwend, 1987). The FMC Plant OU is located at the northern base of the Bannock Range where it merges with the Michaud Flats. The Bannock Range is part of the Basin and Range Province and the Michaud Flats is part of the Snake River Plain. The southern undeveloped area of the FMC Plant OU is located at the northern end of the Bannock Range and the former operational areas of the FMC elemental phosphorus production facility are located primarily on the Michaud Flats. The FMC Plant OU is underlain by a sequence of Starlight Formation volcanics and sediments, overlain by the interfingered American Falls Lake Beds-Sunbeam Formation. These are overlain by Michaud Gravel and Aberdeen Terrace deposits. Finally, a mantling of loess is present at higher elevations and a veneer of alluvium covers lower areas. Loess deposits are much thicker in portions of drainages where they have been reworked and redeposited. The regional geology, including the FMC Plant OU, is shown on Figure 2-1 as mapped by K.L Othberg in an unpublished report by the Idaho Geological Survey in April 1997.

The stratigraphy of the FMC Plant OU generally can be described as discontinuous layers of unconsolidated sediments deposited on an erosional surface that was incised in volcanic bedrock. Fill material encountered during drilling and excavating consists of reworked native soil, imported soil and other materials generated during the facility operations. The materials were stored and/or placed around the FMC Plant Site during the operation of the facility and during decommissioning activities. Fill and other source material at the FMC Plant Site observed during SRI drilling includes reworked native (loess, sand, and gravel), slag, ore (including calcined ore and bull rock), ferrophos, concrete, asphalt, silica, calciner pond solids, phossy solids, precipitator solids, and coke (including coke fines). Soil types encountered during SRI drilling include loess, gravels and clays. Material up to boulder size and possibly larger was encountered beneath the site during drilling near the furnace building (RA-B) at depths below 60 feet bgs. Bedrock was encountered during drilling near the calciner solids storage area (RA-E) and included basalt, rhyolite, and tuffs.

2.1.5 Hydrology and Hydrogeologic Setting

Major surface water features of the region near the FMC OU include the Snake River, Portneuf River, and the American Falls Reservoir which are presented in Figure 2-2. There are no naturally-occurring perennial surface water systems within the FMC OU. Surface water runoff from the FMC OU former operations area from rain is infrequent and is entirely contained within the FMC Plant Site property.

Basalt and gravel aquifers underlay the Michaud Flats. These aquifers are recharged by groundwater from the adjoining Bannock and Pocatello mountain ranges and from the Pocatello Valley aquifer. The Michaud Flats aquifer system can be divided into a shallow aquifer and a deeper aquifer. The deeper aquifer is the primary water-producing aquifer within the Michaud Flats. Groundwater flows within the regional aquifer system discharge to the Portneuf River, American Falls Reservoir, or the Fort Hall Bottoms. Between I-86 and the American Falls Reservoir, the Michaud Flats aquifer system discharges approximately 200 cubic feet per second (cfs) of groundwater to the Portneuf River. The American Falls Lake Beds (AFLB) form an aquitard that separates the shallow from the deeper aquifers within the Michaud Flats area, but the AFLB are not present along part of the Portneuf River in the area of Batiste Springs. Groundwater depths range from more than 150 feet (ft) below ground surface (bgs) in the southern portion of the FMC OU to 45 ft bgs in the northwestern area of the FMC plant area. In the northern portion of the FMC OU, groundwater is approximately 60 ft bgs. The SRI sampling encountered groundwater at depths typically greater than 90 ft bgs at the FMC plant area. As presented in Figure 2-3, groundwater flow beneath the former operations area generally flows to the north from the Bannock Range and then to an east-northeasterly flow as the Bannock Range groundwater merges with the Michaud groundwater system. FMC- and Simplot-impacted groundwater discharges and mixes with the Portneuf River in the area between and including Swanson Road Spring and Batiste Spring, and then migrates into the Off-Plant OU as surface water. Total groundwater discharge to the Portneuf River from the west, including flow from the EMF Site, in the area between and including Swanson Road Spring and Batiste Spring has been estimated to be between 36 to 55.5 cfs (Groundwater Model Report; MWH, 2010b) and approximately 20 cfs (Simplot, 2013). From the area of these springs, the Portneuf River flows north through a portion of the Fort Hall Indian Reservation and then enters the American Falls reservoir.

2.1.6 Ecological Setting

Much of the FMC OU was an industrial facility and much of the land surface has been disturbed, resulting in limited areas with vegetation inside the FMC OU. Major terrestrial vegetation cover types and wildlife habitats include agricultural, sagebrush steppe, and wetland/riparian. Wildlife habitats in the vicinity include sagebrush steppe, grassland riparian, cliff, and juniper. The most significant aquatic habitats in the vicinity are the Portneuf River, associated springs and riparian corridor, and the Fort Hall Bottoms. These areas are designated wetlands under the National Wetland Inventory of the U.S. Fish and Wildlife Service. The Portneuf River supports an extensive riparian community, which is an important source of food, cover, and nesting sites for many wildlife species.

2.2 SITE HISTORY

The FMC elemental phosphorus facility, occupying most of the property that FMC owns south of Highway 30 near Pocatello and referred to as the “FMC Plant Site,” ceased production in December 2001. From 2002 through 2006, the facility was decommissioned and its infrastructure was demolished to ground level. The FMC facility operated essentially continuously from 1949 (prior to that time the site was primarily in agricultural use) through 2001.

The FMC facility produced elemental phosphorus from phosphate-bearing shale ore mined regionally. The shale, combined with coke and silica, was fed into four electric arc furnaces located in the furnace building (within RA-B). The furnace reaction primarily yielded gaseous elemental phosphorus, CO gas, slag, and ferrophos (FeP). The elemental phosphorus gas was subsequently condensed to a liquid state and stored in sumps and tanks prior to shipment off-site as product. Elemental phosphorus will burn upon contact with air. Therefore, to prevent oxidation, the condensed phosphorus product was kept covered with water from the time it was produced through loading and transport off-site.

As summarized in Section 2.3, some feed stocks, byproducts (including air emissions) and products of historical operations at the FMC Plant Site contain elevated levels of constituents of potential concern (primarily metals and radionuclides). Historical management of these materials has resulted in impacts to soils and shallow groundwater at the FMC Plant OU. In addition, downgradient discharge of shallow groundwater from beneath the FMC Plant OU into the Portneuf River has contributed to the impairment of surface water quality in the Off-Plant OU; however, based on mass loading calculations performed by Simplot (Simplot, 2012 and Simplot, 2013), it is estimated that FMC-impacted groundwater migrating downgradient from the FMC Plant Site northern boundary accounts for less than 5 percent of the total mass load of EMF Site contaminants migrating to the river (i.e., Simplot is the predominant source of contamination to the river).

2.2.1 RI/FS for the Eastern Michaud Flats Site

FMC, Simplot and EPA entered into a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Administrative Order on Consent (AOC) in May 1991 under which the companies agreed to conduct a Remedial Investigation / Feasibility Study (RI/FS) for the site. During the RI/FS the site was divided into three “Subareas:” 1) the FMC Subarea, consisting of the FMC plant and other FMC-owned properties at the site; 2) the Simplot Subarea, consisting of the Simplot plant and other Simplot-owned properties at the site; and 3) the Off-Plant Subarea, consisting of the remainder of the site. EPA changed these designations to the FMC Plant OU, the Simplot Plant OU, and the Off-Plant OU after its 1998 *Record of Decision for the EMF Site* (*1998 ROD*, EPA, 1998).

As required under the 1991 *Eastern Michaud Flats Administrative Order on Consent* (*1991 AOC*), FMC and Simplot developed a number of EMF Site studies and reports. These included the *Preliminary Site Characterization Summary* (*EMF PSCS*; BEI, 1994) and the *EMF RI Report*. EPA reviewed and approved these reports. EPA conducted the baseline ecological and human health risk assessments concurrently with the companies' RI/FS work and issued the draft and final reports for those risk assessments in July 1995 and July 1996, respectively. The conclusions of those risk assessments were incorporated into the *Feasibility Study Report for the FMC Subarea* (1997 *FMC Subarea FS Report;* BEI, 1997) and the *1998 ROD.*

2.2.2 Key 1998 ROD Elements – FMC Plant Subarea

The *1998 ROD* addressed all three Subareas at the EMF Site (the FMC, Simplot and Off-Plant Subareas). The following were the major remedial action components it prescribed for the FMC Subarea:

- Cap the Old Phossy Waste Ponds (identified in the IROD as RAs C and D) and the Calciner Solids Storage area (identified in the IROD as RA-E), and line the Railroad Swale (identified in the IROD as RA-K) to reduce or eliminate infiltration of rainwater and prevent incidental exposure to contaminants.

- Monitor ground water and implement legally enforceable controls that will run with the land to prevent use of contaminated ground water for drinking purposes under current and future ownership. Ground water monitoring and enforceable controls will continue until site contaminants of concern (COCs) in ground water decline to below the Maximum Contaminant Levels (MCLs) or risk-based concentrations (RBCs) for those substances.

- Implement legally binding land use controls that will run with the land to prevent potential residential use and control potential worker exposures under future ownership.

- Implement a contingent ground water extraction/treatment system if contaminated groundwater migrates beyond Company-owned property and into adjoining springs or the Portneuf River. Containment of contamination shall be achieved via hydrodynamic controls such as long-term ground water gradient control provided by low level pumping. Extracted ground water will be treated and recycled within the plant to replace unaffected ground water that would have been extracted and used in plant operations.

- Conduct operation and maintenance at areas capped to meet CERCLA requirements and, if implemented, at the groundwater extraction system.

IDEQ concurred with the selected remedies. The Shoshone Bannock Tribes did not fully concur with the ROD. Due to the fact that EPA had received only relatively minor comments regarding the proposed Remedial Design/Remedial Action (RD/RA) at the Simplot Subarea, the United States proceeded with entry of an RD/RA consent decree only with Simplot and only with respect to its plant site and its other owned properties, re-designated at that time as the Simplot Plant OU. The consent decree for the Simplot Plant OU was entered in May 2002. Although a RD/RA consent decree was never entered to implement the 1998 ROD remedies for the FMC Plant OU, in the subsequent years, FMC undertook actions consistent with elements of the ROD including:

- FMC continued to monitor groundwater at numerous CERCLA wells at the FMC Plant OU. Pursuant to an EPA-approved reduction in CERCLA groundwater monitoring in 1994, routine groundwater monitoring of CERCLA wells has continued for the following constituents: arsenic, selenium, potassium, chloride, fluoride, ammonia/ammonium as nitrogen, nitrate as nitrogen (NO3-N), orthophosphate, sulfate, pH, specific conductivity, temperature and turbidity (from 1995 to the present). As of the second quarter 2009, FMC sampled sixteen monitoring wells semi-annually under its CERCLA groundwater monitoring program. In addition, FMC samples 36 wells quarterly under its RCRA groundwater monitoring program and 7 wells semi-annually under its Calciner Ponds Remedial Action groundwater monitoring program (conducted under IDEQ oversight).

- FMC also performed periodic supplemental groundwater investigation/monitoring programs or events as requested by EPA or IDEQ. The routine groundwater monitoring programs and special investigation/monitoring events are described in detail and the groundwater data from those programs and special events through the second quarter 2008 are presented in the *GWCCR*.

- In 1995, FMC placed deed restrictions that prohibited any future residential use of the FMC Plant Site and all the other properties at the EMF Site it owned at the time. FMC acquired the Batiste Springs property in 1995 (this parcel includes both the “Spring at Batiste Road” [aka Swanson Road Spring] and Batiste Springs). FMC subsequently placed similar restrictions at the Batiste Springs parcel prohibiting its development for residential use or operation of child-care or schooling facilities.

The remaining *1998 ROD* items were not implemented at the FMC Plant OU due to the fact that a RD/RA consent decree for this OU was never entered and given the supplemental evaluations (SRI/SFS) as described below in Section 2.2.3.

2.2.3 2003 Administrative Order on Consent Requirements – FMC Plant OU

FMC ceased production of elemental phosphorus from phosphate ore at its Pocatello facility in December 2001. This led EPA and FMC to enter into an AOC in October 2003 (SRI/SFS AOC) for an SRI/SFS at the FMC Plant OU. This was driven primarily by EPA’s finding that additional investigations and evaluations were needed at the plant areas that had been actively operated at the time of the RI/FS but where operations had terminated with the plant shutdown.

The FMC OU 2009 SRI evaluated FMC OU areas not investigated during the RI because of ongoing FMC Plant operations, and also re-evaluated and augmented significant portions of the 1991–1996 RI. Areas north, south, and west of the Former Operations Area were also investigated for impacts from windblown contaminants. Sampling from the SUAs and WUAs and the FMC-owned Northern Properties are presented in the 2010 *SRI Addendum Report*. The data presented in the *SRI Report* and *SRI Addendum Report*, *GWCCR*, and the *EMF RI Report* provides the primary basis for the evaluations presented in the *Supplemental Feasibility Study Report* (*SFS Report*; MWH, 2010a) for the FMC OU.

During the SRI/SFS, the impacted areas of the Former Operations Area were divided into 24 remediation units (RUs). An RU was intended to delineate areas analogous to one or more RCRA solid waste management units (SWMU) with similar former processes or characteristics (including types of constituents of potential concern) that were typically in the same geographical area. The SRI Work Plan was framed around investigation of these RUs. Upon completion of the SRI, including additional investigation of the Northern Properties and SUA/WUA in the fall of 2008, the contamination assessment of each RU showed that many have similar characteristics, warranting an evaluation of similar remedial approaches. As the CERCLA process moved into the SFS, the RUs and parcels were combined (or in some cases divided) into new geographical subunits based on remedial action similarities facilitated the SFS process and remedy selection analyses. These subunits are referred to as *remediation areas* (RA). In general, the RAs are defined based on the following: (1) geographic proximity, (2) similarity of contaminants of concern (COC), (3) types of risks present, and (4) consistency of remedial approach.

2.2.4 2012 IROD and 2013 UAO for Remedial Design and Remedial Action

The *Interim Amendment to the Record of Decision for the EMF Superfund Site FMC Operable Unit* (IROD; EPA 2012) was signed by EPA Region 10 on September 27, 2012. The IROD presents the interim remedy for the Site as selected by EPA. A summary of the IROD selected remedy is presented below in Section 2.4.2.

On June 10, 2013, EPA Region 10 issued a Unilateral Administrative Order to FMC for Remedial Design and Remedial Action, EPA Docket No. CERCLA-10-2013-0116 (UAO; EPA 2013), that became effective on June 20, 2013. The UAO defines the specific actions FMC will undertake to design and implement the selected remedy at the FMC OU in accordance with the IROD. This RD Work Plan is a requirement of the UAO, and has been prepared in accordance with the UAO and *Superfund Remedial Design and Remedial Action Guidance* (EPA, 1986).

2.3 NATURE AND EXTENT OF CONTAMINATION

The EMF Site has been the subject of many environmental investigations. Most notable are the RI and SRI, as summarized in the *EMF RI Report*, *SRI Report*, *SRI Addendum Report* and *GWCCR*. These reports provide detailed information on the results of the investigations conducted at the FMC OU. The following subsections summarize the nature and extent of soil and groundwater contamination at the FMC OU.

2.3.1 Nature and Extent of Soil Contamination

The RI completed in 1996 and SRI completed in 2009 delineated the nature and extent of soil contamination at the FMC OU. They revealed that wastes and by-products were disposed of at ground level and used extensively as fill to contour the ground level as operations expanded over time. These waste fill materials were individually characterized based on their constituents. Then, each RA was characterized based on the type of fill disposed in these areas. In many cases, different materials are mixed, including native soil and slag.

Primary release mechanisms of contaminants into the surrounding environment at the FMC OU include erosion and storm water runoff, extensive use of hazardous wastes as fill, disposal of elemental phosphorus-contaminated wastes in CERCLA ponds, and potential migration of soil COCs to groundwater from infiltration of precipitation.

Phosphine gas may be generated in fill within RAs that contain elemental phosphorus because of the reaction of elemental phosphorus with moisture that may be present in fill. Phosphine gas has not been detected in ambient air at levels that would present a risk to human health in the FMC OU (MWH, 2010d). Radium-226 in surface soil has been determined to be a primary COC in surface soil because of risks associated with gamma exposure. Elemental phosphorous and other COCs exist at depths down to approximately 90 feet below ground surface (bgs).

2.3.2 Nature and Extent of Groundwater and Surface Water Contamination

Many groundwater studies, including routine long-term groundwater monitoring, have been completed over the years. The results of these studies were compiled and evaluated in the *GWCCR* that EPA approved in 2009.

Groundwater at the EMF Site flows northward from the western and central portions of the FMC OU and contamination is limited to the area south of I-86 by converging flow of groundwater from the west and northwest (see Figure 2-3). Groundwater from the western and central portions of the FMC OU is swept eastward, south of I-86, and joins groundwater from the Joint Fence Line/Calciner Ponds Area and from the Simplot Plant. In the Joint Fence Line/Calciner Ponds Area, groundwater from the western part of the Simplot gypsum stack flows in a northwesterly sweeping arc across the Simplot property boundary flows beneath FMC OU where it commingles with flows from the eastern portions of the FMC OU, and exits to the northeast near monitoring well 110. Virtually all groundwater beneath the EMF facilities discharges to the Portneuf River between Batiste Spring and the spring at Batiste Road (aka Swanson Road Springs) and as bank seeps and baseflow to the river in the reach bounded by these springs (MWH, 2009b).

The *GWCCR* concluded that the groundwater quality and the area of EMF-impacted groundwater essentially remained unchanged from 1991 through 2010. Table 2-2 shows maximum detected groundwater concentrations during the 1991 through 2008 period, the range of contaminants, and associated MCLs.

2.4 INTERIM RECORD OF DECISION AMENDMENT

The IROD presents the selected remedy for the FMC OU. The selected interim amended remedy will protect human health and the environment by eliminating, reducing, or controlling risks posed by the FMC OU through containment of contaminated soils with engineering controls and institutional controls. Groundwater extraction from the shallow aquifer will provide hydraulic containment of contaminated groundwater, thereby preventing further down-gradient migration of FMC OU COCs. Land use restrictions will limit FMC OU activities to commercial/industrial uses, prohibit activities that may disturb the implemented remedial actions, and restrict human consumption of groundwater. Land use restrictions will also strictly manage when, where, and how non-remedial action excavation can occur (for example, digging to access utility lines).

2.4.1 Remedial Action Objectives

The RAOs for contaminated media at the FMC OU include the following elements:

1. Prevent human exposure via all potential pathways (external gamma radiation exposure, inhalation of radon in potential future buildings, incidental soil ingestion, dermal absorption, and fugitive dust inhalation) to soils and solids contaminated with COCs thereby resulting in an unacceptable risk to human health assuming current or reasonably anticipated future land use.

2. Minimize generation of and prevent exposure to phosphine and other gases that represent an unacceptable risk to human health and the environment.

3. Prevent direct exposure to elemental phosphorus under conditions that may cause it to spontaneously combust, posing a fire hazard as well as resultant air emissions that represent a significant threat to human health or the environment, and prevent such conditions.

4. Prevent potential ingestion of groundwater containing COCs in concentrations exceeding risk-based concentrations (RBC) or ARARs, or site-specific background concentrations if RBCs or ARARs are more stringent than background.

5. Reduce the release and migration of COCs to the groundwater from FMC OU sources resulting in concentrations in groundwater exceeding RBCs or ARARs, or site-specific background if RBCs or ARARs are more stringent than background.
6. Restore groundwater that has been impacted by the FMC Facility to meet RBCs or ARARs for COCs, or site-specific background levels if RBCs or ARARs are more stringent than background, within a reasonable restoration timeframe.
7. Reduce the release and migration of COCs to surface water from FMC OU sources at concentrations exceeding RBCs or ARARs, including water quality criteria pursuant to Sections 303 and 304 of the Clean Water Act.

2.4.2 Selected Remedy Summary

The selected remedy for the FMC OU replaces the remedy selected in the 1998 ROD. The remedy addresses metals, radionuclides, and other COCs identified in soils, fill, and groundwater at the FMC OU. The selected remedy for the FMC OU includes the following components:

- Place evapotranspiration (ET) caps over areas that contain non-slag fill (such as elemental phosphorus, phossy solids, precipitator solids, kiln scrubber solids, industrial waste water sediments, calciner pond solids, calcined ore, and plant/construction landfill debris) to (1) prevent migration of contaminants to groundwater, preventing the infiltration of rainwater, and (2) prevent direct contact with contaminants by current and or future workers. ET caps will be placed over the following remediation areas (RA): RA-B, RA-C, RA-D, RA-E, RA-F1, RA-F2, RA-H, and RA-K as shown on Figure 2-4;
- Place approximately 12 inches of soil cover over (1) areas containing slag fill, (2) ore stockpiles, and (3) the former Bannock Paving areas to prevent gamma radiation and fugitive dust exposure to potential future workers. Gamma radiation-protective soil covers will be placed over RA-A, RA-A1, RA-F, and RA-G, as shown on Figure 2-4;
- Excavate contaminated soil from Parcel 3 of FMC's Northern Properties, also known as RA-J, and consolidate that soil onto the Former Operations Area to prevent exposure of residents and future workers to elevated levels of radionuclides in surface soil;
- Clean underground reinforced concrete pipes that contain elemental phosphorus and radionuclides to prevent exposure to potential future workers;
- Install an interim groundwater extraction/treatment system to contain contaminated groundwater, thereby preventing contaminated groundwater from migrating beyond the FMC OU and into the Simplot OU and/or adjoining springs or the Portneuf River. The preliminary design is based on 5 extraction wells located along the northeastern FMC Plant Site boundary as shown on Figure 2-5. Extracted groundwater will either be (1)

pumped to a municipal treatment facility in Pocatello for treatment and released in accordance with a National Pollution Discharge Elimination System (NPDES) permit (see Figure 2-5), or (2) treated within the FMC OU to drinking water standards and/or risk-based cleanup levels and discharged to an infiltration basin(s) within the FMC OU, where it would percolate down to recharge groundwater or evaporate into the atmosphere (see Figure 2-6). The treatment option for groundwater will be selected and finalized during the RD;

- Implement a long-term groundwater monitoring program to evaluate the performance of the soil and groundwater remedial actions to determine their effectiveness in reaching the cleanup levels, and provide information needed for developing a final groundwater remedy protective of human health and the environment if the current interim remedy cannot meet cleanup requirements within an acceptable timeframe. The long-term groundwater monitoring program will be based on the current groundwater monitoring program, which may be refined during the Remedial Design/Remedial Action phase;

- Implement a gas monitoring program at the FMC OU capped ponds (also referred to as *CERCLA Ponds* to distinguish them from the RCRA-regulated ponds) and subsurface areas where elemental phosphorus is present to identify potential phosphine and other potential gas generation at concentrations that could pose a risk to human health;

- Implement and maintain institutional controls that include environmental land use easements prohibiting activities that may disturb implemented remedies (such as digging in capped areas) and restrict the use of contaminated groundwater;

- Install engineering controls or barriers, such as additional fencing to further limit site access;

- Implement a remedy management system to integrate the existing RCRA Pond caps with the development of new caps, access roads, groundwater extraction system, and utility lines;

- Implement an FMC OU-wide storm water runoff management plan to minimize cap erosion and the infiltration of contaminants of concern to groundwater, including FMC OU-wide grading and the collection of storm water in retention basins; and,

- Conduct operations and maintenance of implemented remedial actions.

Other actions, including post-closure activities at the RCRA-regulated units, have been and continue to be performed at the FMC Facility. These actions are not part of the FMC OU because they are conducted under RCRA requirements for closed hazardous waste management units. The post-closure work performed at these units remains regulated under RCRA.

Table 2-1. Definition of Terms for Geographic Areas at the FMC Facility
(Adapted from Inset Table on Pages 2 and 3 of the IROD)

Term Used in the IROD	Description
FMC Plant	This is used as a generic term throughout the IROD to describe the FMC Corporation Elemental Phosphorus Production Facility in Pocatello, Idaho.
FMC Facility	All areas owned by FMC. Sometimes used as *Facility* (see IROD Figure 3). Groundwater contamination on the Facility is not being segregated between the Resource Conservation and Recovery Act (RCRA) or the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) for the purpose of the remedy in this IRODA.
FMC Operable Unit (OU)	All areas owned by FMC that are addressed by CERCLA actions. The boundaries for the FMC Facility and the FMC OU are the same; however, the RCRA Ponds, although located within these concurrent boundaries, are not part of the FMC OU or CERCLA action. Groundwater beneath the FMC Facility is covered under this CERCLA action and therefore is part of the FMC OU. Sometimes referred as the *FMC Plant OU* (see IROD Figure 4).
Former Operations Area	Areas within the FMC Facility where any production-related operations occurred. This includes all the FMC-owned properties except the Northern Properties, Southern Undeveloped Area (SUA), and Western Undeveloped Area (WUA). The RCRA Ponds are located within the boundaries of the Former Operations Area but are not part of the CERCLA action. See IROD Figure 3.
Former Elemental Phosphorus (P_4) Production Area	Areas within the FMC Facility where primary elemental phosphorus production occurred, including the furnace building, secondary condenser, phosphorus dock, slag pit, and the former kiln scrubber ponds and calciners. See IROD Figure 5.
CERCLA Ponds	Areas within the FMC Facility where process wastes were managed in unlined surface impoundments and are addressed under this IRODA. See IROD Figure 5.
RCRA Ponds	Areas within the FMC Facility where process wastes were managed under RCRA in lined surface impoundments that have been capped. These ponds are managed under RCRA and are not being addressed under this Interim ROD Amendment. The RCRA Ponds are within the boundaries of the FMC OU and the Former Operations Area, however they are not considered part of the area addressed by CERCLA action. See IROD Figure 5.
Slag Pile	Area containing most of the above grade slag by-product from FMC Plant operations. See IROD Figure 5.
Northern Properties	Areas owned by FMC north of Highway 30 comprised of Parcels 1-6. These areas were not part of any elemental phosphorus processing operations. See IROD Figure 3.
Western Undeveloped Area (WUA)	Area west of the Former Operations Area within the FMC Facility. This area was not part of any elemental phosphorus processing operations. See IROD Figure 3.
Southern Undeveloped Area (SUA)	Area south of the Former Operations Area within the FMC Facility. This area was not part of any elemental phosphorus processing operations. See IROD Figure 3.

TABLE 2-2

EMF SITE GROUNDWATER COCs IDENTIFIED IN THE 1998 ROD
UPDATED COMPARATIVE VALUES AND FMC PLANT OU GROUNDWATER COCs
REMEDIAL DESIGN WORK PLAN
FMC Corporation, Pocatello, Idaho

TABLE 36 FROM THE 1998 ROD FOR THE EMF SITE - RISK BASED AND MAXIMUM CONCENTRATION OF CONTAMINANTS OF CONCERN IN GROUNDWATER					UPDATED GROUNDWATER COMPARATIVE VALUES, SUMMARY OF GROUNDWATER RESULTS[1] AND IDENTIFICATION OF FMC PLANT OU GROUNDWATER COCS			
Substance of Concern	Units	Maximum Detected Concentration	Risk Based Concentration	Maximum Contaminant Level (MCL)	Updated Comparative Value (CV)[2]	Percentage of Results for FMC Wells >= CV[3]	Maximum Detected Concentration (2000-2008)[4]	FMC Plant OU Groundwater COC
Antimony	mg/l	1.07	0.006	0.006	0.006	1.5%	0.0073 [5]	
Arsenic	mg/l	5.53	0.000048	0.05	0.01	66.4%	0.393	**X**
Beryllium	mg/l	0.083	0.000019	0.004	0.004	0.0%	No detected results	
Boron	mg/l	89	1.36	-	7.3	0.3%	6.24	
Cadmium	mg/l	3.9	0.008	0.005	0.005	0.2%	0.0013	
Chromium	mg/l	7.58	0.077	0.1	0.1	0.1%	0.0118	
Fluoride	mg/l	2,815	0.93	4	4	7.0%	193	**X**
Manganese	mg/l	91.2	0.077	-	0.05	44.4%	2.66	**X**
Mercury	mg/l	0.0043	0.0046	0.002	0.002	1.1%	0.00028	
Nickel	mg/l	3.46	0.299	0.1	0.73	0.0%	0.0451	
Nitrate	mg/l	660	25.03	10	10	18.5%	46.1	**X**
Radium-226	pCi/L	7.09	0.39	5*	5*	6.4% [6]	1.46 [7]	
Selenium	mg/l	19.73	0.07	0.05	0.05	4.9%	0.204	**X**
Thallium	mg/l	9.09	0.001	0.002	0.002	1.7%	0.0085 [8]	
Vanadium	mg/l	22.317	0.108	-	0.18	1.9%	0.182	**X**
Zinc	mg/l	28.9	3.92	-	71	0.0%	0.0209	
Tetrachloroethene	mg/l	0.035	0.001	0.005	0.005	3.9%	>0.001	
Trichloroethene	mg/l	0.028	0.002	0.005	0.005	0.8%	>0.001	
Gross Alpha [b]	pCi/L	1,690	-	15	15	4.0%	325 [9]	
Gross Beta [c]	pCi/L	1,355	-	4 mrem/yr	4 mrem/yr	NC [10]	960	

TABLE 2-2

EMF SITE GROUNDWATER COCs IDENTIFIED IN THE 1998 ROD
UPDATED COMPARATIVE VALUES AND FMC PLANT OU GROUNDWATER COCs
REMEDIAL DESIGN WORK PLAN
FMC Corporation, Pocatello, Idaho

(continued) (continued)

Substance of Concern	Units	Maximum Detected Concentration	Risk Based Concentration	Maximum Contaminant Level (MCL)	Updated Comparative Value (CV)[2]	Percentage of Results for FMC Wells >= CV[3]	Maximum Detected Concentration (2000-2008)[4]	FMC Plant OU Groundwater COC
Elemental phosphorus	mg/l	NA	NA	NA	0.00073	6.2%	0.258	**X**
Total cyanide	mg/l	NA	NA	NA	0.2	4.8%	0.43 [11]	

Key (*1998 ROD Table 36*):

*Combined Ra 226 and Ra 228

[a] RBCs for groundwater based on drinking water and watering homegrown produce. RBC value based on cancer risk of 10-6 or HQ=1

[b] Individual radionuclides potentially responsible for elevated gross alpha and gross beta levels are also COPCs. These include, but are not limited to Lead-210, Polonium-210, Potassium-40, Thorium-230, Uranium-234, and Uranium-238.

[c] Beta particle and photon activity based on consumption of 2 liters/day

Shaded chemicals are COCs identified in the FS (*1997 FS Reports for EMF Subareas*)

Notes (*Updated Information*) :

[1] The FMC Plant OU groundwater results are from monitoring locations: 100-series wells are 100 through 191 inclusive; the TW-series wells are TW-1 through TW-12 inclusive (including shallow, intermediate and deep); the selected 500-series wells are 500, 501, 502, 514, 515, 516, 517, 521, 522, 523, 524 and 525; and Batiste Spring and Swanson Road Spring (aka the Spring at Batiste Road).

[2] The Comparative Values (CVs) are taken from Table 4.2-1 "Groundwater Representative Concentrations and Comparative Values" in the GWCCR, June 2009 Final.

[3] The percentage of valid results greater than the CV are for all results through May 2008 for the wells listed in note 1.

[4] The maximum valid detected result based on monitoring from January 2000 through May 2008 for the wells listed in note 1.

[5] For the antimony results with a detection limit below the CV, only 1 of 41 results (2.4%) is greater than the CV. That single result >= CV was at northern Joint Fenceline Area well 110 and does not appear to be attributable to FMC Plant OU sources.

[6] Percentage is for combined Ra-226 and Ra-228 activity >= CV.

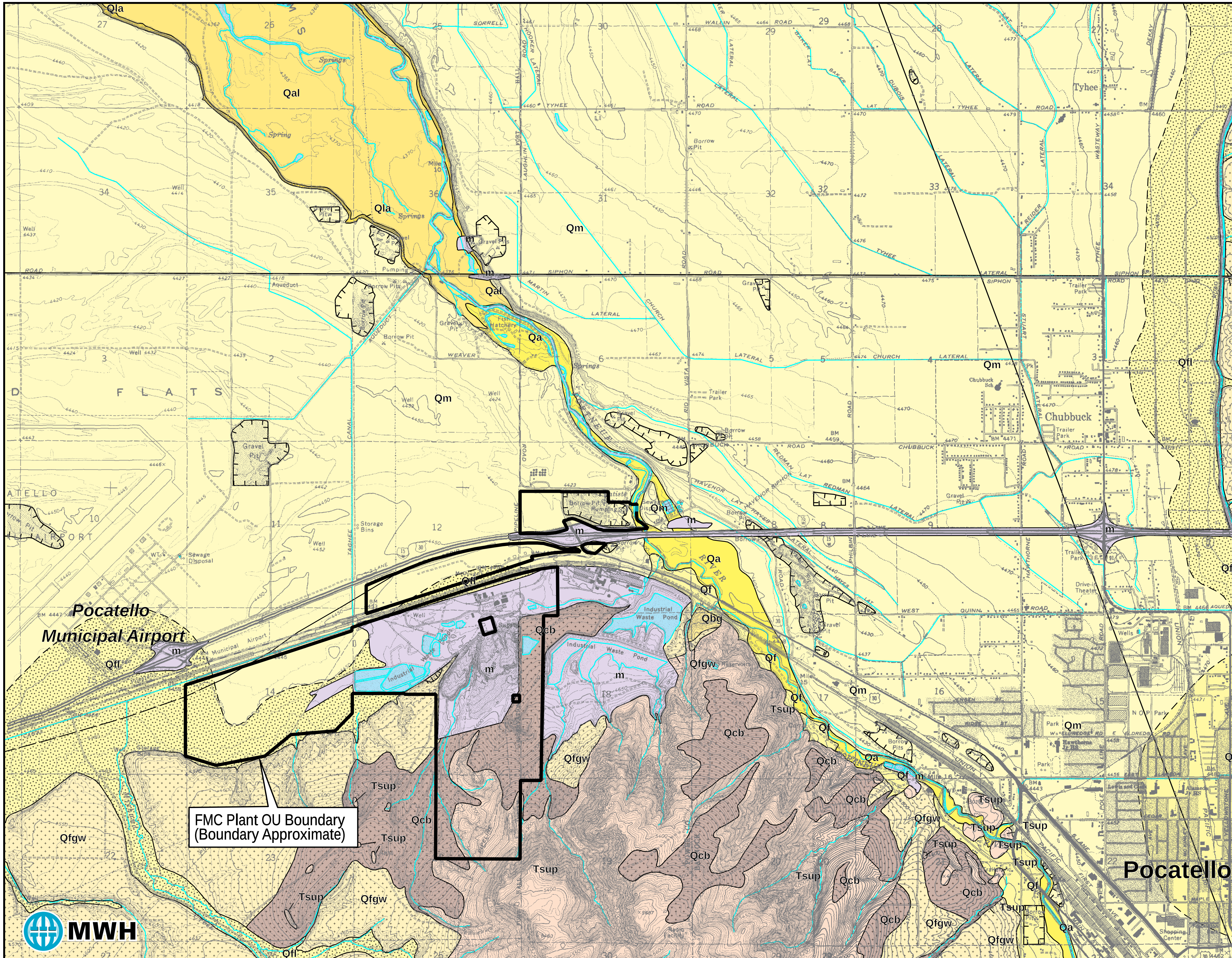
[7] Maximum value is maximum combined result for Ra-226 plus Ra-228; maximum Ra-226 result is 0.57 pCi/l.

[8] Only 2 of 21 results from 2000 were reported detected above the CV and zero of 36 results from 2001 were reported detected above the CV (including the same wells sampled during 2000), the sporatic detection of thallium above the CV but below the representative (background) levels is consistent with the findings of the EMF RI that thallium is not related to FMC Plant OU sources.

[9] As described in detail in the GWCCR, June 2009 Final, the only gross alpha results that exceed the CV are at Joint Fenceline Area wells 161 and 164 and representative (background) well 515 and are not related to FMC Plant OU sources.

[10] A percentage was not calculted as results are in pCi/l and not comparable to the CV in mrem/yr.

[11] For the 2000-2008 cyanide results, only 4 of 79 results (5%) are greater than the CV; no post-2001 results are >= CV.



DESCRIPTION OF MAP UNITS

- **m** — Made ground (historical)—Artificial deposits of disturbed, transported, and emplaced construction materials derived from various local sources. Primarily formed in the construction of highways, irrigation ditches, and industrial sites.
- **Qa** — Alluvium of lower Portneuf River and Pocatello Creek (Holocene) — Stratified and interfingering deposits of sand and gravel veneered by silty reworked loess.
- **Qal** — Alluvium and lacustrine deposits of the Portneuf River and Ross Fork delta (Holocene)- Laterally discontinuous beds of sand, silt, clay, muck, and peat.
- **Qf** — Alluvial-fan and debris-flow deposits (Holocene)—Muddy sand and gravel and beds of silty redeposited loess.
- **Qfl** — Alluvial-fan deposits composed mostly of reworked loess (Holocene)—Primarily bedded to massive silt that is redeposited loess.
- **Qm** — Michaud Gravel (late Pleistocene)—Bouldery gravel and sand; more sand in channeled-flow pathways and in distal parts of deposit where grain size decreases.
- **Qbg** — Gravel deposits of the Bonneville Flood, undifferentiated (late Pleistocene) Pebble gravel deposited in eddy bar of Bonneville Flood.
- **Qfgw** — Loess-mantled alluvial-fan gravel of Wisconsin age (late Pleistocene)—Crudely stratified muddy sand and pebble- to boulder-sized gravel mantled with loess.
- **Qfgo** — Loess-mantled alluvial-fan gravel of the ancesteral Pocatello Creek (early Pleistocene?) — Crudely stratified, muddy and sandy pebble-to cobble-sized gravel manteld with loess.
- **Qcb** — Loess-mantled bedrock colluvium (Pleistocene)—Wind-blown and redeposited loess that mantles, interfingers with, or is mixed with stony colluvium derived from local bedrock.
- **Tsup** — Rhyolite porphyry unit—Porphyritic rhyolite,

Source: Idaho Geological Survey, April 1997

N
W E
S

0 3000
Feet

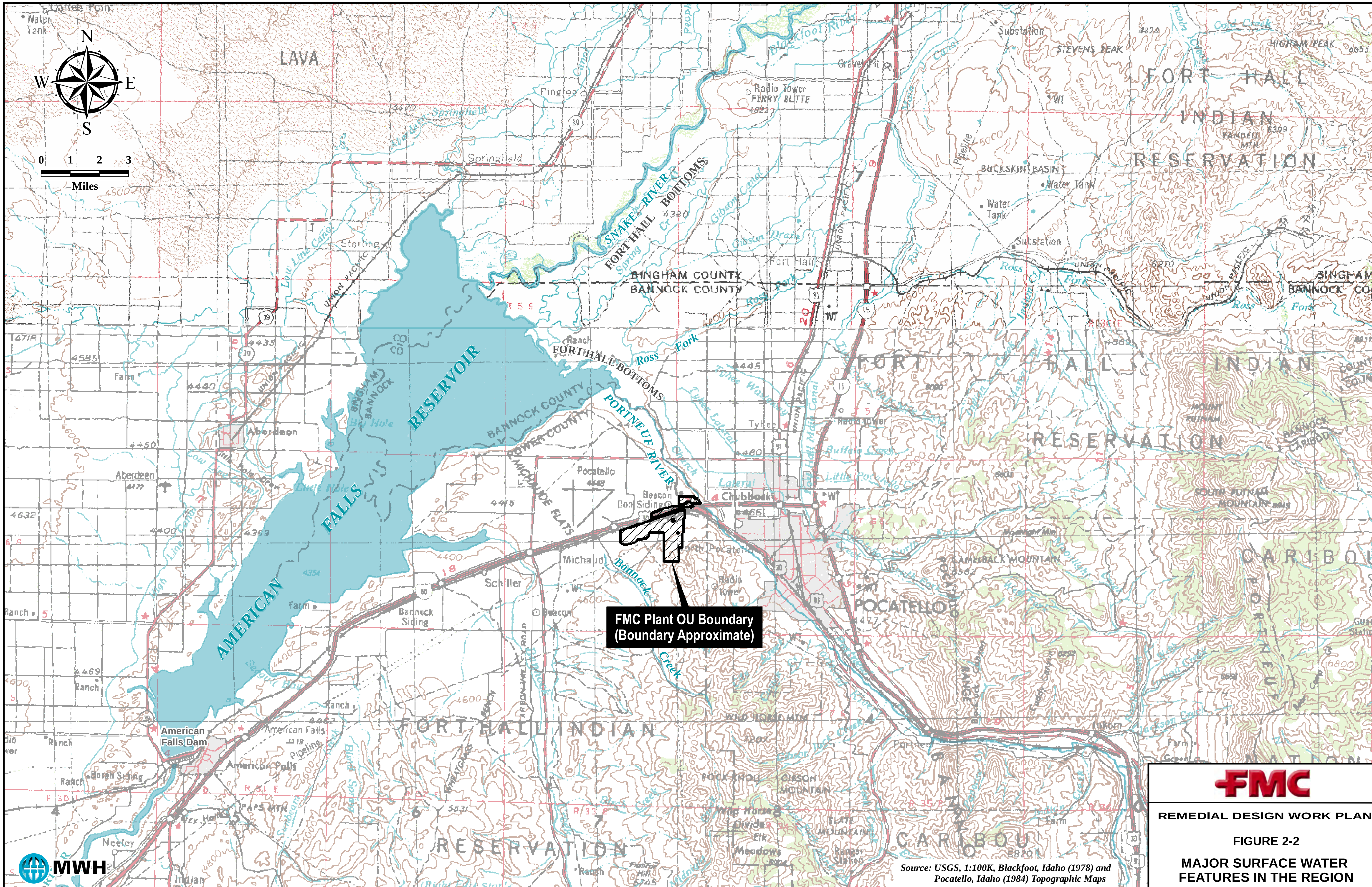
FMC

REMEDIAL DESIGN WORK PLAN

FIGURE 2-1

REGIONAL GEOLOGY AROUND THE FMC OU

FILE *Fig 2-1 Regional Geologic map_IGS_April 1997.ai* *2 July 2013*



FMC

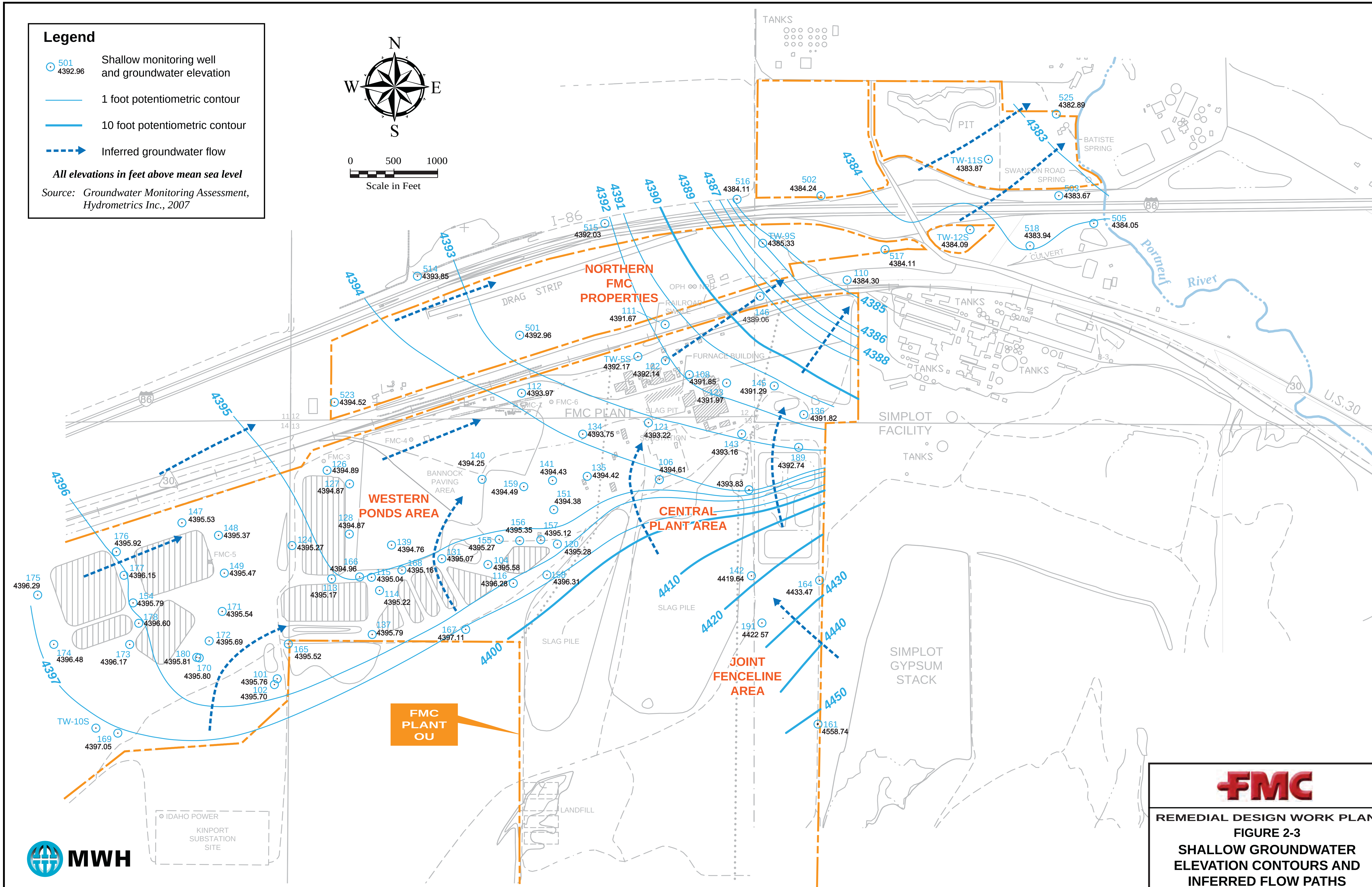
REMEDIAL DESIGN WORK PLAN

FIGURE 2-2

MAJOR SURFACE WATER FEATURES IN THE REGION

Source: USGS, 1:100K, Blackfoot, Idaho (1978) and Pocatello, Idaho (1984) Topographic Maps

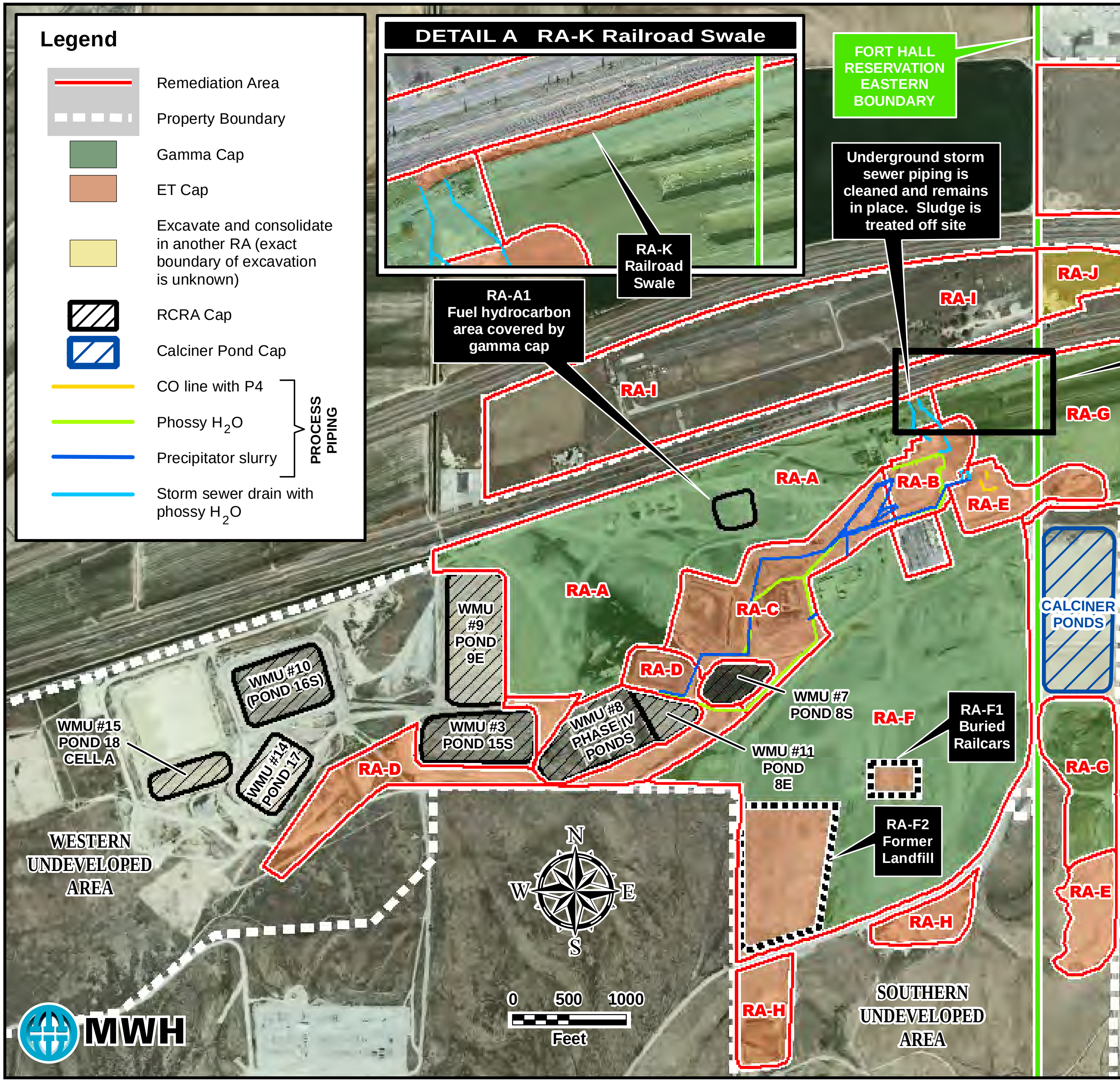
FILE: I:\projects\FMC\Idaho\REMEDIAL DESIGN WP_2013\FIGURES\Fig 2-2_Major Surface Water Features_July2013.mxd DATE: 3 July 2013



REMEDIAL DESIGN WORK PLAN
FIGURE 2-3
SHALLOW GROUNDWATER ELEVATION CONTOURS AND INFERRED FLOW PATHS

FILE Fig 2-3_Shallow GW Elev Cont and Flow Paths.ai 17 July 2013

FILE: I:\projects\FMCidaho\REMEDIAL DESIGN WP_2013\FIGURES\Fig 2-4_FMC_Soil Remedial Action.mxd DATE: 3 July 2013



REMEDIAL DESIGN WORK PLAN

FIGURE 2-4

SOIL REMEDIAL ACTION

FMC

REMEDIAL DESIGN WORK PLAN

FIGURE 2-5

GROUNDWATER REMEDIAL ACTION WATER MANAGEMENT OPTION A

DATE: 3 July 2013

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REMEDIAL DESIGN WORK PLAN

FIGURE 2-6

GROUNDWATER REMEDIAL ACTION WATER MANAGEMENT OPTION B

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DATE: 16 Dec 2013

3.0 SUMMARY OF COMPLETED AND ANTICIPATED DESIGN STUDIES

This section presents a summary of completed and anticipated studies that have been performed or are planned to support the design effort for the selected remedy at the FMC OU. The studies summarized in this section comprise the data/information required to advance the RD through successive stages of the design process (i.e., 30% through final design). The data obtained from the completed investigations in most cases are considered sufficient to support the RD process. However, additional data relevant to the design will be collected during anticipated studies and other data needs may be identified during the design process. The preliminary RD/RA schedule, which includes the anticipated design studies, is included in Section 6.0.

3.1 COMPLETED STUDIES RELEVANT TO THE RD

The completed design studies summarized below, which were components of the SFS and developed to evaluate remedial alternatives, provide relevant background for the design work. These summaries are not comprehensive and the cited reference documents should be referenced if more detailed information is required.

- Preliminary Evapotranspirative (ET) Cap Design – summary taken from Comparison of Conventional and Alternative Capping Systems for Use at the FMC Plant OU, June 2009 (Appendix D to the SFS Report)
- Preliminary Groundwater Extraction System Design – summary taken from Groundwater Model Report for the FMC Plant Operable Unit, July 2010 (Appendix E to the SFS Report)
- Preliminary Extracted Groundwater Management Options Design – summary taken from Section 7.5 of the SFS Report, July 2010

3.1.1 Preliminary ET Cap Design

In support of the SFS, the potential cover system remedial technologies being considered were evaluated against criteria to achieve the remedial action objectives (RAOs) for the areas identified for capping at the FMC Plant OU. These cap performance criteria provided a basis for comparing cover systems. Based on this analysis, an ET cap was identified as the most effective alternative for achieving RAOs at areas requiring prevention of exposure to P4-contaminated soils. The evaluation also included development of a conceptual design of the ET cap that was proposed as one of the capping options in the SFS. The conceptual design was based on the average climatic conditions of the site and the soil moisture storage properties of the borrow source to be used in the cover’s construction. The conceptual cover design was used to develop engineering cost estimates for installation of such covers at the FMC Plant OU, recognizing that a detailed design would be developed during the RD.

Measurements of water balance parameters were used to develop a conceptual model of water flow through cover systems. These are the primary parameters utilized in developing conceptual designs for caps to be installed in arid and semiarid environments. Water transport through a candidate cover design is based on fundamental physical processes that govern the flow of water in the vadose (unsaturated) zone.

Climate data were gathered from the Pocatello WSO Airport weather station (Station 107211). For purposes of the preliminary design, the maximum winter precipitation for the period of record (1939 to 2008) was used to provide an estimate of the worst-case amount of water storage that would be required. The maximum total precipitation for the winter (December, January, and February) months represents precipitation that would not be removed by evapotranspiration and thus would be required to be stored by the cover until plant growth and warmer temperatures began to remove water through evapotranspiration in the spring. The total maximum amount of precipitation for the months representing the winter period is 6.16 inches, compared with an average of 3.07 inches for this period. The maximum winter precipitation of 6.16 inches was used in the preliminary cover thickness calculations.

Five samples of potential borrow source material from the western borrow area were collected and submitted for geotechnical and hydrogeologic characterization to support the design of the RCRA pond cover systems. Geotechnical characterization included grain size analysis (sieve and hydrometer (ASTM D422), and Standard Proctor Compaction (per ASTM D698). Hydrogeologic characterization included saturated permeability testing (per ASTM D5084) at between 80% and 85% of the maximum dry density (i.e., Standard Proctor) and capillary moisture testing (ASTM D3152).

The samples were separated into the percentage of gravel, sand, silt, and clay and classified according to predominant soil type. The borrow materials were classified as either silt, calcitic silt, or clayey silt. The average maximum dry bulk density was 101.75 pounds per cubic foot (pcf) with optimum moisture content of 18%.

At the time of the design of the RCRA ponds, hydrogeological data had not been collected. As such, published literature values were used for determining the water storage capacity of the soils for use in performance modeling of the proposed caps. In the absence of site-specific data, the model used conservative values for characterizing the materials. Therefore, the RCRA pond caps' design represents an overly conservative assessment of required cover thicknesses. For example, the assumed hydraulic conductivity of the top soil layer (storage layer) was 9.35 x 10-4 cm/sec, whereas the permeability testing from the borrow source yielded an average hydraulic conductivity of 5x10-5 cm/sec for samples compacted to 85 percent standard Proctor and 6.6 x

10-5 cm/sec for samples compacted to 80 percent standard Proctor. This lower actual hydraulic conductivity would result in the cover having higher actual runoff and lower infiltration rates compared to those used in the RCRA cap modeling.

Capillary-moisture relationship testing was performed to determine the soil moisture storage capacity of the borrow material. Based on the test results, the difference in moisture content of the soil between saturation (approximated to be field capacity) and -15,000 cm of pressure (approximated to be wilting point) was determined. These provided an approximation of the total amount of water that can be stored in the cover. For the purpose of the preliminary design, the results for the samples remolded to 85% of modified Proctor were used, due to difficulties with achieving lower densities in the field. The results of the test yielded an average water storage capacity of 28.5 percent.

Based on this calculation, a storage layer with minimum thickness of 24 inches would be necessary to store the anticipated winter precipitation in the Pocatello area. Although a safety factor of 1.5 is commonly used for this calculation, this calculation conservatively assumes that all precipitation that falls to the surface would infiltrate and thus would need to be stored. In actuality, as described earlier, a portion of this precipitation would flow off the cover as surface drainage and a portion would evaporate/sublimate. Surface layers having lower saturated hydraulic conductivity, as is the case with the silt from the Western Borrow Area of the FMC Plant OU, will generate more runoff, less infiltration into the surface layers, and less percolation (Khire et al., 2000). In addition, this calculation also does not take into account the presence of a capillary break, which will add a factor of storage capacity to this upper layer.

A capillary break would be used for alternative covers at the FMC Plant OU for two reasons: 1) the availability of large amounts of variably sized crushed slag ideally suited as a capillary barrier material; and 2) capillary break enhances storage capacity of the finer textured storage layer (http://www.rtdf.org/public/phyto/minutes/031004/pdf/ benson-ses1.pdf). A study conducted by Khire et al. (2000) found that for a given soil thickness of 1 m the presence of a capillary break increased the storage capacity of soil by 3 inches. This effect may be greater for the FMC site due to the presence of non-plastic silts in the borrow area, which greatly enhances the effect of capillary barriers (http://www.rtdf.org/public/phyto/minutes/031004/pdf/benson-ses1.pdf).

Based on the water storage calculations, it was determined that a 24-inch soil storage layer is appropriate for the preliminary ET cover design. As described above, a capillary break will also be incorporated into the design to increase the storage capacity of the cover. A 1-foot thick layer of coarse crushed rock (slag or gravel) has been shown to be sufficient to serve as a capillary break (Khire et al., 2000). In addition to serving as a capillary break, the crushed slag will also serve as a biointrusion layer (Dwyer et al., 2007). It is anticipated that the covers would be constructed with a minimum of 3% slope to promote surface drainage while at the same time reducing the potential for erosion. The cover will be revegetated with native plant species with sufficient rooting depths and overlapping growing seasons to maximize evapotranspiration. Experience with the current caps on the RCRA ponds indicate that vegetation can be successfully established without the need for supplemental irrigation.

The preliminary design was developed for the purpose of evaluating the performance of the assembled alternatives in the SFS. Cover performance modeling and other work will be performed during the RD to develop a detailed ET cover design. Based on the results of the modeling, the cover design, specifically the thickness of the storage layer, may be modified to meet RAOs.

3.1.2 Preliminary Groundwater Extraction System Design

As described in detail in the Groundwater Model Report, the groundwater model was constructed and predictive simulations were performed in four general steps as follows:

1. The three-dimensional groundwater flow model was developed and refined during calibration to provide the underlying flow regime for contaminant fate and transport simulations;

2. The contaminant transport model was developed for the site-related groundwater constituents arsenic, total phosphorus / orthophosphate, and potassium, and refined during calibration (plume matching) to improve estimates of transport parameters;

3. The modeled groundwater remedial action extraction well configurations and pumping rates were developed and refined to meet appropriate capture and well drawdown criteria; and,

4. Predictive simulations were performed for the selected groundwater remedial action.

The objective of the selected groundwater remedial action is to contain contaminated groundwater at the FMC plant site northeastern boundary. Many well configurations (alignment and number of wells) and extraction rates were tested, until an optimal configuration was found that minimized extraction rates while still completely capturing on-site contaminated groundwater. The final well alignment consisted of five wells along the northern plant site boundary, with a total extraction rate of 530 gallons per minute (gpm). Containment was assessed by placing MODPATH particles within the footprint of the arsenic plume (largest plume) in the three uppermost layers and tracking them forward. Figures 2-5 and 2-6 present the preliminary extraction well alignment for containment of on-site contaminated groundwater for the selected groundwater remedial action. The groundwater model simulation included infiltration to the western undeveloped area of the FMC Plant Site property to simulate the disposal of treated, extracted groundwater to a percolation/evaporation pond upgradient (west) of the groundwater contamination.

3.1.3 Preliminary Extracted Groundwater Management Options Design

Option A

Based on analytical results from groundwater samples collected in monitoring wells in the vicinity of the groundwater extraction area (northeast plant boundary), the average concentrations of total phosphorus (orthophosphate) and arsenic in the combined groundwater extracted from these wells would be approximately 2.5 and 0.035 mg/L as measured in Well 110, Well 146, and TW-9S. Other less significant COCs including selenium, fluoride, and nitrate would average approximately 0.012, 0.30, and 6.65 mg/L. As a result of the low average COC concentrations in extracted groundwater, the water from the site should be permissible for direct pumping to a POTW for treatment, without any pretreatment. The current City of Pocatello POTW pollutant influent limits (Title 13, Chapter 13.20, and Local Limit 13.20.045) are shown in Table 3-1 and are compared to the probable average levels of COCs in the extracted groundwater based on historic analytical data.

These influent constituent concentrations are much below the average concentration of constituents in influent typically received by the POTW, so permitting this discharge to the POTW should be relatively straightforward. However, there are several hurdles to overcome in implementing this remedy, including a better understanding of: 1) whether the existing POTW treatment capacity could handle the proposed discharge and how long that treatment capacity would be available, 2) the difficulty of obtaining a permit from the City allowing discharge to the POTW, and 3) the integrity and capacity of the existing sewer line from FMC to the POTW. In response to a preliminary inquiry concerning the potential to discharge extracted groundwater to the City of Pocatello's waste water treatment plant, the City of Pocatello replied in a letter dated October 28, 2009, *"We are concerned about the potential effects of this discharge on our WWTP operations and Biosolids Land Application Program. In addition, the volume of remediated groundwater would use a large hydraulic capacity in our plant and severely limit our ability to serve our existing customers with their future needs without considerable capital outlay."* Additional discussions with the City of Pocatello to address these concerns have not yet occurred. Therefore, the viability of discharging extracted groundwater to the POTW remains uncertain.

Option B

Groundwater management option B would involve construction and operation of an on-site water treatment system, in which extracted groundwater would be treated and then discharged to an evaporation/infiltration basin located in the Western Undeveloped Area (WUA). The extracted groundwater would primarily be treated for elevated arsenic to the MCL of 0.010 mg/L. The groundwater would be treated by chemical precipitation, and then filtered to meet the remedial action requirements prior to discharge to the WUA evaporation/infiltration basin. Chemical precipitation (when combined with filtration) is capable of removing all COCs that would exceed the MCLs or other remedial action criteria in extracted groundwater. A precipitating agent (e.g., ferric chloride) would be required in order to achieve the arsenic (As) removal efficiencies required to meet the MCL target. Filtration would be necessary to remove the remaining small particulates prior to discharge to the evaporation/infiltration basin(s). Under this option, the extracted groundwater (net of evaporative loss) would be reintroduced to the shallow aquifer via the infiltration basin in the WUA.

3.2 ANTICIPATED STUDIES

The anticipated design studies include: 1) field studies to fill identified RD data gaps, 2) gamma cap performance demonstration, and 3) groundwater remedy extraction zone hydrogeologic study. The objectives, field methods and procedures, and schedules for these anticipated design studies will be included in work plans that will be submitted to EPA. The anticipated design studies will be performed concurrently with the RD (i.e., commencement of the RD will not be delayed due to the anticipated design studies); however, the data and results of the gamma cap and extraction zone hydrogeologic studies are needed prior to progressing to the Preliminary (30%) design.

3.2.1 Field Studies to Fill Data Gaps

In addition to the gamma cap performance demonstration and groundwater remedy extraction zone hydrogeologic study required pursuant to UAO Paragraph 30.d., field studies will be performed to obtain data needed to refine the RD. The design data gaps that will be filled with data from the field studies are summarized below:

- Obtain additional borrow soil geotechnical / material properties data and site-specific vegetation density data to refine evaluation and finalize design of the ET soil cover design;
- Develop a borrow source availability evaluation (material balance) to confirm availability of sufficient volume and quality of on-site soil for the ET and gamma cap remedial action elements;
- Obtain additional subsurface soil material and hydrologic data in the WUA area designated for the percolation ponds for groundwater management option B; and
- Perform a fiber-optic video inspection of the underground stormwater piping designated for cleaning during the remedial action to better estimate the volume of solids and method(s) for performing this element of the remedial action.

A Remedial Design Data Gap Work Plan has been prepared that details the sampling and analysis plan for collecting the supplemental data summarized above. The Work Plan includes the field methodologies for sample / data collection and provides a Quality Assurance Project Plan (QAPP) for obtaining the required data.

3.2.2 Gamma Cap Performance Evaluation

As specified in Section 10.2 of the IROD, gamma caps will be installed at Remediation Areas (RAs) A, A-1, F and G. These will provide protection with respect to both the gamma radiation and soil ingestion exposure pathways. An evapotranspirative (ET) cap is the selected remedy for other areas of the Site that exceed the incremental cancer risk remedial action objective (RAO) to future Site outdoor workers and also pose a threat to groundwater. Due to the additional soil thickness, an ET cap provides an equal or greater level of protection for gamma radiation and soil ingestion pathways as compared to the gamma cap. ET caps will be installed at RAs B, C, D, E, F-1, F-2, H and K.

UAO Section IX, Paragraph 30 d.2.bb. requires a “Gamma Cap Thickness Effectiveness Test” to be performed, with the following objectives:

1. To determine whether the one foot of native soil cap or “gamma” cap meets the external gamma radiation performance standard (and RAO) in the IROD, or whether more material is required; and
2. To develop construction quality assurance and quality control (QA/QC) methods to demonstrate achievement of the performance standard.

A Gamma Cap Performance Evaluation Work Plan has been prepared that details the sampling and analysis plan for collecting the supplemental data summarized above. The Work Plan includes the field methodologies for sample / data collection and provides a Quality Assurance Project Plan (QAPP) for obtaining the required data.

3.2.3 Groundwater Extraction Area Hydrogeologic Study

There is a need for more detailed hydrogeologic and water quality data within the groundwater remedy extraction area. That area was identified based on the groundwater model contained in Appendix E to the *SFS Report*. The needed data include expected total extraction flow, number and location of extraction wells and combined water quality. The combined water quality data will provide the basis for evaluating water management (treatment/disposal) options.

A groundwater Extraction Zone Hydrogeologic Study Work Plan has been prepared pursuant to UAO Section IX., Paragraph 30.d. (Performance Testing). The work plan describes the procedures for installing extraction wells and piezometers within the extraction area, aquifer characterization (pump) testing, and collection of groundwater samples for laboratory analyses. This information will allow further evaluation and, depending on the option selected, design of water management options A and B. Bulk water samples will be collected for potential bench-top / jar testing for the design the on-site water treatment process (option B). A subsequent work plan may be recommended for of water treatment process evaluation in the event that the bench-top / jar testing (if performed) indicates that a larger scale, on-site evaluation of the water treatment process is necessary to complete the remedial design.

3.3 INTERIM CERCLA GROUNDWATER MONITORING

FMC will continue to implement the Interim CERCLA Groundwater Monitoring Plan (Appendix G of the SFS Report; FMC, July 2010) until the Final Groundwater Monitoring Plan, as a component of the Remedial Action Work Plan, is approved by EPA as specified in UAO Section IX, Paragraph 30.c.7.hh. Although not directly related to the RD, the site-wide groundwater level monitoring data will be used for calibration of the groundwater flow model update that will be performed as described in the Extraction Zone Hydrogeologic Study Work Plan.

TABLE 3-1

EXTRACTED GROUNDWATER MANAGEMENT OPTION A
ESTIMATED AVERAGE CONCENTRATIONS VS. POTW INFLUENT CRITERIA

PARAMETER	WELL-110	WELL-146	TW-9S	Average Concentration of Constituent in Groundwater	Pocatello POTW Influent Standards
Sampling Event Date	4thQ2006 thru 2ndQ2008	4thQ2006 thru 2ndQ2008	4thQ2006 thru 2ndQ2008		
Field Measurments					
Depth to Water (Feet)	66.2	69.6	64.8	66.9	NA
pH (Field)	6.86	7.11	7.06	7.01	6.0-10.0
SC (UMHOS/CM)	1429	1294	1842	1521.7	NA
Redox (mV)	-100	-100	-100	-100.0	NA
Turbidity (NTU)	0.4	0.35	8	2.9	NA
Water Temperature (C)	17.1	16.9	14.4	16.1	NA
General WQP (mg/L)					
Potassium	25.4	46.3	58.4	43.4	NA
Sulfate	215	128	161	168.0	NA
Chloride	89.8	132	187	136.3	NA
Fluoride	0.44	0.38	0.10	0.30	32.0
Ammonia	0.15	0.15	0.2	0.17	NA
Nitrate	3.8	6.13	9.95	6.63	NA
Orthophosphate/ Total Phosphorus	3.09	1.33	3.21	2.54	7.0
Metals (mg/L)					
Arsenic	0.048	0.029	0.027	0.03	0.06
Cadmium	ND	ND	ND	0.00	0.2
Copper[1]	0.0015	<0.025	0.0011	0.00	
Cyanide[1]	NA		NA		0.2
Flouride[1]	0.44	0.5	0.07	0.34	32.0
Lead[1]	<0.003	<0.003	<0.003	0.00	0.3
Mercury[1]	<0.0002	<0.0002	<0.0002	<0.0002	0.0006
Nickel[1]	<0.04	<0.04	<0.04	<0.04	1
Silver[1]	<0.005	<0.005	<0.005	<0.005	0.6
Selenium	0.029	0.003	0.005	0.012	NA
Zinc[1]	0.00036	0.0024	0.00037	0.001	1.2

[1] - Results from November 2001 Special Groundwater sampling event.
NA-Not Analyzed
ND- Not Detected

4.0 REMEDY WORK ELEMENTS, OBJECTIVES, AND PERFORMANCE STANDARDS

This section describes the selected remedy work elements and the associated issues, goals, and objectives that will be considered during the RD. The purpose of this section is to link the RAOs and performance standards to each work element so that that the design team has a clear understanding of what each design component is intended to achieve.

The performance standards discussed below are defined in the IROD, and were developed to define when the RAOs of the selected remedy have been achieved. The performance standards include both general and specific standards applicable to the selected remedy work elements and associated work components. The elements of the selected remedy for the FMC OU include the following:

Soil Remedy Design and Construction Elements:

- Implementation of an FMC OU-wide storm water runoff management plan, including FMC OU-wide grading and the collection of storm water in retention basins.
- Placement of evapotraspirative (ET) caps over the following remedial areas (RAs): RA-B, RA-C, RA-D, RA-E, RA-F1, RA-F2, RA-H and RA-K as shown on Figure 2-4.
- Placement of soil covers (“gamma caps”) over the following RAs: RA-A, RA-A1, RA-F and RA-G as shown on Figure 2-4.
- Implementation of a remedy management system to integrate the existing RCRA Pond caps with the development of new caps, access roads, the groundwater extraction system and utility lines.
- Excavation of the upper six (6) inches of soil from RA-J.
- Cleaning of the reinforced concrete underground storm water piping in RA-A to remove potential residual P4 and soil/materials potentially containing metal and radiological constituents.
- Installation of additional engineering controls to further limit facility access as appropriate.

Soil Remedy Operation, Monitoring and Maintenance Elements:

- Implementation and monitoring of appropriate institutional controls to all or part of the site to prohibit activities that may disturb the remedies, including access controls and / or land use covenants or easements placing restrictions on property use (including groundwater use) in addition to those institutional controls already in place.
- Implementation of a gas monitoring program at the FMC OU CERCLA capped ponds and subsurface areas where elemental phosphorus is present.
- Implementation of an operation and maintenance plan for the implemented remedial action.

Groundwater Remedy Design and Construction Elements:

- Installation of a groundwater extraction system to provide hydraulic containment of the shallow aquifer. Treatment of the extracted groundwater will be by one of two options: option A, involving discharge to the City of Pocatello POTW, or option B, involving on-site treatment and discharge to an on-site percolation / evaporation basin(s) located in the western undeveloped portion of the FMC Plant Site.

Groundwater Remedy Operation, Monitoring and Maintenance Elements:

- Implementation of a long-term groundwater monitoring program to evaluate the effectiveness of the soil and groundwater remedial actions, based on the current Interim CERCLA groundwater monitoring program.
- Implementation of an operation and maintenance plan for the implemented remedial action.

Achievement of the performance standards will be demonstrated throughout the RD process in the Remedial Design Reports, during RA construction in accordance with the Construction Quality Assurance Plan (CQAP), and by verification measurements / testing pursuant to the Performance Standards Verification Plan(s) (PSVPs). The Remedial Design Reports, CQAP and PSVP are described further in Section 5.0. Table 4-1 provides a summary of the remedy work elements and “maps” those elements to the RD deliverables. Descriptions, objectives, and associated RD considerations for the remedial work elements and associated work components are presented below.

4.1 SOIL REMEDY DESIGN AND CONSTRUCTION ELEMENTS

The soil remedial action RAOs are presented in Section 2.4.1 and the soil cleanup levels contained in the IROD are presented on Table 4-2.

4.1.1 Site-Wide Stormwater Management and Grading Plans

Site-wide stormwater runoff management will be critical to minimize cap erosion and ponding/infiltration at areas where leachable COCs remain in the soil/fill. Stormwater will be addressed by site-wide grade planning, integration into cap design, and collection of stormwater to minimize degradation of the caps and maintain a zero discharge of stormwater from the site to surface waters. One or more stormwater retention basins likely will be needed for stormwater management. The site-wide grading plan must also accommodate the integration of caps, maintenance roads, existing easements and infrastructure and existing monitoring systems as further described in Section 4.1.4 below.

Objective: The objectives of the site-wide stormwater management and grading plans are to 1) establish the elevation contours for the subgrade to receive the ET and gamma caps, 2) design a site-wide stormwater capture, conveyance and detention system that minimizes erosion and diverts water from the planned ET and gamma covers and existing capped areas, and 3) integrate the stormwater management system and grading plans with the existing and planned caps, access roads, infrastructure and monitoring systems.

Performance Standard: The site-wide stormwater management and grading plans establish the subgrade and stormwater management controls such that the ET and gamma caps meet their respective performance standards and maintain the zero stormwater discharge status of the FMC plant site.

4.1.2 Evapotranspirative (ET) Caps

The ET cap involves constructing a soil cover of native soil and vegetation that provides sufficient water storage and ET capacity to store and remove precipitation, thereby minimizing or eliminating infiltration. ET cover systems also typically include a capillary break layer comprised of coarse material (e.g., cobbles) that limits the infiltration into the underlying fill and/or soil materials. The ET caps will be installed on RAs that are identified as posing a potential threat to groundwater due to release and migration of COCs from surface/subsurface soil/fill to groundwater. Installation of ET caps on the specified RAs also constitutes the source control remedy element of the groundwater Remedial Action. After grading to establish the appropriate subgrade slopes and stormwater drainage/collection, ET caps will be installed at the following RAs:

RA-B: This area encompasses the former furnace building, phosphorus loading dock, secondary condenser and slag pit, and encompasses the P4-impacted capillary fringe soils downgradient of these RUs. Surface and/or subsurface fill within this remedial area contains P4 (subsurface), phossy solids, precipitator solids, slag, ore, concrete, asphalt, and silica. Underground piping containing COCs (potentially including P4) is also present in RA-B.

RA-C: This area encompasses the former phossy/precipitator slurry ponds, the piping corridor leading from RA-B to the former ponds, and the Pond 8S recovery process. Surface and/or subsurface fill within this area contains P4 (subsurface), phossy solids, precipitator solids, slag, ore, ferrophos, concrete and asphalt. Underground piping containing COCs (potentially including P4) is also present in RA-C.

RA-D: This area encompasses the western portion of the former phossy/precipitator slurry ponds including Pond 9S. Surface and/or subsurface fill within this area contains phossy solids, precipitator solids, slag and ore, but no significant quantity of P4 is present. RA-D is not known to contain P4 other than presumably in underground piping.

RA-E: This area encompasses the former ore kilns, kiln scrubber ponds, calciners, calciner pond solids stockpiles, silica stockpiles, and calcined ore stockpiles. No P4 is present, but surface/subsurface fill contains slag, ore, silica, and kiln pond solids (subsurface). A short segment of underground piping containing COCs (potentially including P4) is present in also present in this RA.

RA-H: This area contains the active plant landfill and the construction/demolition debris landfill. Surface and subsurface fill within this area contains solid waste including plant trash, Andersen filter media (AFM), asbestos, empty containers, concrete, carbon, and furnace feed materials (ore, silica, coke).

RA-K (the Railroad Swale): This area is located along the northeastern border of the FMC Plant Site and was used for stormwater retention. The Railroad Swale also received an intermittent flow of phossy water, known to contain low levels of P4 and phossy solids.

RA-F1 (Buried Railcars): This area is located in approximately the center of the slag pile and contains 21 buried railcars. The railcars were covered with 80 to 120 feet of slag as placement of slag on the pile progressed to the south.

RA-F2 (Former Plant Landfill): This area is located within the southwestern corner of the slag pile. These wastes, as described in the *SRI Report*, are covered by 50 to 140 feet of slag.

Objective*:* The objectives of the ET caps are to 1) prevent exposure via all viable pathways (external gamma radiation, incidental soil ingestion, dermal absorption, and fugitive dust inhalation) to soils and solids contaminated with COCs that would result in an unacceptable risk to human health under current or reasonably anticipated future land use; 2) reduce the release and migration of COCs to the groundwater from facility sources that may result in concentrations in groundwater exceeding risk-based concentrations (RBCs) or chemical-specific ARARs, specifically Maximum Contaminant Levels (MCLs), or reduce to site-specific background concentrations if those are higher, and 3) for the RAs with known or suspected P4 in the subsurface, prevent the direct exposure to elemental phosphorus under conditions that may spontaneously combust, posing a fire hazard or resultant air emissions that represent a significant risk to human health and the environment, and minimize generation and prevent exposure to phosphine and other gases at levels that represent a significant risk to human health and the environment.

Performance Standard*:* The performance standard for this element of work is the successful implementation of the final design.

4.1.3 Gamma Caps

The soil cover or "gamma" cap involves placement of a native soil over fill or soil within specified RAs. As described in Section 3.2.2, a gamma cap performance evaluation will be conducted to finalize the design of the gamma cap. After grading to establish the appropriate subgrade slopes to minimize potential run-on/run-off erosion damage, gamma caps will be installed at the following RAs:

RA-A: The northern plant boundary, which abuts Highway 30, forms the northern boundary of this area. RA-A is covered with non-leachable fill including primarily slag, coke, silica, concrete, asphalt, and native soil.

RA-A1: This area was investigated during the SRI and found to contain fuel PAHs above the soil SSLs. Since the PAHs are a direct contact threat, use of a soil (gamma) cover over this area meets the RAOs.

RA-F: This area contains the slag pile and bullrock pile and former equipment maintenance/laydown areas. Surface and subsurface fill within this area consists predominantly of slag and bull rock (rejected oversized ore).

RA-G: This area contains the ore stockpiles, silica stockpile, IWW pond and ditch, and dry process waste piles. Surface and subsurface fill within this area include various plant solid materials including ore, baghouse dust, coke, carbon, calciner solids, and slag.

Objective*:* The objective of the gamma caps is to prevent exposure via all viable pathways (external gamma radiation, incidental soil ingestion, dermal absorption, and fugitive dust inhalation) to soils and solids contaminated with COCs that would result in an unacceptable risk to human health under current and reasonably anticipated future land use.

Performance Standard*:* The performance standard for this element of work is the successful implementation of the final design, which will be based on the Gamma Cap Performance Evaluation described in Section 3.2.2. Achievement of the RAO and soil cleanup level for radium-226 will be demonstrated by verification measurements pursuant to the Performance Standards Verification Plan.

4.1.4 Integration of Caps

The site currently has 11 ponds that were capped and closed pursuant to EPA-approved RCRA closure plans. These ponds (known as the RCRA Ponds) are currently being managed under EPA-approved RCRA post-closure plans. There are also five ponds (known as the Calciner Ponds) that were remediated (capped) and are currently being managed under a Voluntary Consent Order with the Idaho Department of Environmental Quality (IDEQ). The Remedial Action requires construction of caps that will intersect with one or more of the caps that are already in place. In addition, there are locations where the Remedial Action gamma and ET caps will intersect. Therefore, careful consideration will be required during the Remedial Design to ensure that:

- Intersection of caps will maintain the integrity and performance of both caps;
- Cap grading design will adequately control and provide for management of stormwater runoff;
- Access roads (e.g., roads to RCRA ponds, power substations, etc.) are maintained and integrated into the cap design, as appropriate;
- Existing easements and infrastructure (e.g., active power lines, access to the Don substation, etc.) are integrated into the cap design; and,
- Monitoring wells, pond leachate collection systems, and other monitoring and/or maintenance systems are integrated into the cap design and remain functional (or a functional replacement is included in the remedial design and approved by EPA).

In addition to integration of the RCRA pond caps and monitoring systems, as stated in Section 4.2 of the IROD, the solid waste management units (SWMUs) at the FMC OU that are not RCRA-regulated hazardous waste units are subject to both RCRA corrective action requirements and to CERCLA remedial action requirements. The selected remedy is designed to meet both sets of requirements for those units.

Objective: The objective of the cap integration element of the soil remedy is to provide for integration of the ET, gamma and existing caps, access roads, infrastructure and monitoring systems.

Performance Standard: The cap integration element does not have a performance standard apart from assuring that the ET and gamma caps meet their respective performance standards and the existing caps continue to meet their respective post-closure / post-remedial action requirements.

4.1.5 Excavation and Consolidation

The excavation of surface soil at RA-J will be accomplished by removal of the upper 6 inches of fill/soil materials that will expose the underlying native soils, which do not contain significant quantities of COCs. Confirmation sampling of the underlying native soil in excavated areas will be performed to demonstrate that the RAOs are met. Excavated material from RA-J will be further characterized to determine if the excavated soil, through the mechanical mixing that would occur during scraping, can be used as surface capping material in constructing gamma or ET caps at other RAs. If unacceptable for that use, the material will be placed under one of the gamma or ET caps as subgrade material.

***Objective**:* The objective of the removal of surface soil from RA-J is to prevent exposure via all viable pathways (external gamma radiation, incidental soil ingestion, dermal absorption, and fugitive dust inhalation) to soils contaminated with COCs that would result in an unacceptable risk to human health under current or reasonably anticipated future land use.

***Performance Standard**:* The performance standard for this element of work is the successful implementation of the final design and demonstration that the soil cleanup levels have been achieved by confirmation soil sampling pursuant to the Performance Standards Verification Plan.

4.1.6 Underground Storm Water Piping

The underground storm sewer piping in RA-A will be cleaned to remove accumulated sediment and potential P4 residues. These 16-inch, reinforced concrete sewer pipes will be cleaned to remove sediment (soil/materials potentially containing metal and radiological constituents) and potential residual P4. The cleanout sediments and any P4 residue will be disposed of off-site following characterization and, depending on the characterization, will either be disposed in an appropriate landfill or incinerated in compliance with the UAO and applicable regulatory requirements. After cleaning, these storm sewer pipes will remain in place for continued stormwater management.

***Objective**:* The objectives of the removal of accumulated sediments and potential residual P4 from the storm sewer piping are to prevent the direct exposure to elemental phosphorus under conditions that may cause it to spontaneously combust, and to eliminate the potential for re-deposition of the accumulated sediments beyond the point at which the storm sewer piping discharges to the railroad swale (RA-K).

***Performance Standard**:* The performance standard for this element of work is the successful implementation of the final design as demonstrated by confirmation sampling.

4.1.7 Engineering Controls

FMC will implement engineering (access) controls at the FMC Plant OU, as appropriate for the needed control, that will include access controls consisting of fencing, entrance gate controls, site entrance logs, warning signs, and/or required training.

Objective*:* In conjunction with the Soil Remedial Action elements and institutional controls program, the objectives of the engineering controls are to 1) prevent exposure via all viable pathways (external gamma radiation, incidental soil ingestion, dermal absorption, and fugitive dust inhalation) to soils and solids contaminated with COCs that would result in an unacceptable risk to human health assuming current or reasonably anticipated future land use, and 2) prevent the direct exposure to elemental phosphorus under conditions that may cause it to spontaneously combust, posing a fire hazard or resultant air emissions that represent a significant risk to human health and the environment.

Performance Standard: The performance standard for this element of work is implementation of the engineering controls plan.

4.2 SOIL REMEDY MONITORING ELEMENTS

4.2.1 Institutional Controls Program

FMC will implement legally enforceable institutional controls with respect to all or part of the FMC Plant OU, as appropriate for the needed control, that will include any or all of the following in addition to those institutional controls already in place:

a. Prevent any future ingestion of or exposure to contaminated groundwater (i.e., deed restrictions or restrictive covenants including prohibitions on extraction and consumption of impacted groundwater).
b. Restrictions on the types of activities and/or development (e.g., limited to commercial or industrial);
c. Prohibition of intrusive activities, construction and/or excavation at RAs designated for gamma or ET caps; and,
d. A soil/fill management plan that would be incorporated into deed restrictions to ensure that disturbance, management, and/or disposition of site-impacted soil/fill is controlled.

Objective*:* In conjunction with the Soil and Groundwater Remedial Action elements, the objectives of the institutional controls program are to 1) prevent exposure via all viable pathways (external gamma radiation, incidental soil ingestion, dermal absorption, and fugitive dust inhalation) to soils and solids contaminated with COCs that would result in an unacceptable risk to human health assuming current or reasonably anticipated future land use, 2) prevent the direct exposure to elemental phosphorus under conditions that may cause it to spontaneously combust, posing a fire hazard or resultant air emissions that represent a significant risk to human health and the environment, and 3) prevent potential ingestion of groundwater containing COCs having concentrations exceeding RBCs or MCLs (chemical-specific ARARs), or site-specific background concentrations if those are higher.

***Performance Standard**:* The performance standard for this element of work is implementation of the Institutional Controls Implementation and Assurance Plan (ICIAP) that will include the elements described above.

4.2.2 Gas Monitoring Program

A phosphine monitoring program will be implemented at RAs B, C, D, F1 and K, where elemental phosphorus is present in the subsurface, to identify any phosphine releases to ambient air or soil chemistry disturbances.

***Objective**:* The objectives of the gas monitoring program are to 1) identify potential phosphine releases to ambient air through the caps and 2) identify potential changes in the basic soil properties (physical and chemical) within the cap materials that would threaten the cap integrity or vegetative cover.

***Performance Standard**:* Specific performance standards for the gas monitoring program will be finalized and documented in the Performance Standards Verification Plan.

4.2.3 Operation, Monitoring and Maintenance Program

The cap operation and maintenance element of work includes visual observation and measurements at the capped RAs, maintenance of the caps as necessary, and evaluation and reporting of the results of the monitoring and any maintenance.

***Objective**:* The objective of the cap monitoring and maintenance of the capped RAs is to assure the caps continue to perform as designed and installed.

***Performance Standard**:* Specific performance standards for the cap monitoring program depend on the nature of the fill / soil beneath the cap and the type of cap (gamma or ET) and the final design for each of those caps / RAs. The performance standard for cap monitoring and maintenance will be finalized and documented in the Remedial Action Work Plan. The cap monitoring will include, as appropriate, the following:

- Vegetation monitoring on the surface of the capped areas;
- Erosion monitoring (periodic and after certain storm events);
- Stormwater / precipitation drainage system monitoring;

- Security monitoring (fences, signage, etc.); and
- Settlement monitoring.

4.3 GROUNDWATER REMEDY DESIGN AND CONSTRUCTION ELEMENTS

The groundwater remedial action RAOs are presented in Section 2.4.1 and the groundwater cleanup levels set forth in the IROD are presented on Table 4-3.

4.3.1 Groundwater Extraction System

The groundwater extraction system will consist of a network of extraction wells located in the northeastern corner of the former FMC Plant Site to capture impacted shallow groundwater before it can migrate downgradient beyond the FMC Plant Site boundary. Groundwater modeling indicates that five extraction wells will be sufficient for hydraulic capture (containment) of the remaining plume before it leaves the FMC Plant OU. The extracted groundwater will be treated by one of two management options: option A, under which the groundwater would be discharged to the City of Pocatello POTW, or option B, under which the groundwater would be treated on-site and then placed in one or more percolation / evaporation basins located in the western undeveloped area (WUA) of the FMC Plant Site.

As stated in the IROD, EPA recognizes that operation of the extraction system will not likely achieve the groundwater quality ARARs throughout the FMC Plant OU within a reasonable timeframe (the groundwater model indicates that it will require >100 years to restore groundwater quality below the arsenic MCL within the FMC Plant Site). During implementation of the groundwater extraction remedy, the aquifer system will have been stressed and additional site-specific data will be collected to determine if the groundwater restoration RAO can be achieved within a reasonable timeframe. The data and information obtained during implementation of the groundwater extraction system may indicate a need for modification of the system or operation of the system that is substantively different than the implemented groundwater remedial action (per the RAWP) and operation of the system (per the OM&M plan) that presumably would be documented in an Explanation of Significant Difference (ESD), IRODA amendment and/or final ROD. The data and information obtained during implementation of the groundwater extraction system may also indicate a need for a Technical Impracticability (TI) or other waiver for a portion of the groundwater plume that would also be documented in an Explanation of Significant Difference (ESD), IRODA amendment and/or final ROD. Institutional controls will remain in place to control groundwater use until RBCs and MCLs (or site-specific background levels where those are higher) for groundwater COCs are achieved at the FMC Plant OU.

Objective*:* The objectives of the extraction well system are to 1) restore groundwater that has been impacted by site sources to meet RBCs or MCLs for the COCs, or site-specific background levels where those are higher, wherever practicable and within a timeframe that is reasonable given the particular circumstances of the site, and 2) reduce the migration of COCs in groundwater to surface water that result in concentrations exceeding risk-based concentrations (RBCs) or chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs), including water quality criteria (WQC) pursuant to the Clean Water Act.

Performance Standards*:* There are two performance standards for the extraction well system. The first is to demonstrate hydraulic control of groundwater at the northeastern boundary of the FMC Plant Site. The groundwater model indicates that five extraction wells with a combined pumping rate of 530 gallons per minute (gpm) will achieve hydraulic control. The actual number, locations and pumping rate will be established during system design, start-up, operation and performance monitoring. The second performance standard, to be met after the required annual average pumping rate has been met and sustained, is extraction of groundwater containing COCs sufficient to meet RBCs and MCLs (or site-specific background levels where those are higher) as measured at the appropriate monitoring locations at the FMC Plant OU and Off-Plant OU, as determined by EPA.

4.3.2 Institutional Controls Program

FMC will implement legally enforceable institutional controls with respect to all or part of the FMC Plant OU, as appropriate for the needed control, that will include any or all of the following in addition to those institutional controls already in place:

a. Prevent any future ingestion of or exposure to contaminated groundwater (i.e., deed restrictions or restrictive covenants including prohibitions on extraction and consumption of impacted groundwater).
b. Restrictions on the types of activities and/or development (e.g., limited to commercial or industrial);
c. Prohibition of intrusive activities, construction and/or excavation at RAs designated for gamma or ET caps; and,
d. A soil/fill management plan that would be incorporated into deed restrictions to ensure that disturbance, management, and/or disposition of site-impacted soil/fill are controlled.

Objective*:* In conjunction with the Soil and Groundwater Remedial Action elements, the objectives of the institutional controls program are to 1) prevent exposure via all viable pathways (external gamma radiation, incidental soil ingestion, dermal absorption, and fugitive dust inhalation) to soils and solids contaminated with COCs that would result in an unacceptable risk to human health assuming current or reasonably anticipated future land use, 2) prevent the direct exposure to elemental phosphorus under conditions that may cause it to spontaneously combust, posing a fire hazard or resultant air emissions that represent a significant risk to human health and the environment, and 3) prevent potential ingestion of groundwater containing COCs having concentrations exceeding RBCs or MCLs (chemical-specific ARARs), or site-specific background concentrations if those are higher.

***Performance Standard**:* The performance standard for this element of work is implementation of the Institutional Controls Implementation and Assurance Plan (ICIAP) that will include the elements described above.

4.4 GROUNDWATER REMEDY OPERATION, MONITORING AND MAINTENANCE ELEMENTS

4.4.1 Groundwater Monitoring

The groundwater monitoring element of work includes sampling and analysis of groundwater from selected wells and the evaluation and reporting of monitoring data.

***Objective**:* The objective of the groundwater monitoring is to collect sufficient data of known, defined quality to evaluate the performance of the source control measures (ET cap element of the Soil Remedial Action) and the groundwater extraction system in 1) reducing the release and migration of COCs to the groundwater from facility sources that may result in concentrations in groundwater exceeding risk-based concentrations (RBCs) or chemical-specific ARARs, specifically Maximum Contaminant Levels (MCLs), or reduce to site-specific background concentrations if those are higher, and 2) restoring groundwater that has been impacted by site sources to meet RBCs or MCLs for the COCs, or site-specific background levels where those are higher, wherever practicable and within a timeframe that is reasonable given the particular circumstances of the site.

***Performance Standard**:* The performance standards for the groundwater monitoring element of work are as follows:

1. Groundwater monitoring, sampling, analysis and reporting will continue pursuant to FMC's Interim CERCLA Groundwater Monitoring Plan (MWH, 2010c) until the Final CERCLA Groundwater Monitoring Plan, as a component of the Remedial Action Plan, is approved by EPA.

2. Consistent with the Interim CERCLA Groundwater Monitoring Plan, the final CERCLA groundwater monitoring program will be coordinated with FMC's RCRA and Calciner Pond remedial action groundwater monitoring programs. The Final CERCLA Groundwater Monitoring Plan also will specify methods for evaluation of potential changes and/or trends in site-related groundwater constituents and groundwater conditions on an FMC Plant OU-wide basis.

3. Once installation of the groundwater extraction system has been completed and the annual average pumping rate has been achieved, the Final CERCLA Groundwater

Monitoring Plan will specify the appropriate monitoring locations at the FMC Plant OU and Off-Plant OU, as determined by EPA, to measure progress toward achieving the Groundwater Extraction System objective and performance standards specified in Section 4.3.1 above.

4.4.2 Operation, Monitoring and Maintenance Program

The groundwater remedy operation and maintenance (O&M) element of work includes development of an operation and maintenance manual for the groundwater extraction system (e.g., groundwater extraction wells, pumps, piping and instrumentation and controls) and the water management system. For water management option A (discharge to the POTW), the O&M Plan would likely be closely aligned with the requirements of the discharge permit including sampling and analysis to demonstrate permit compliance. For water management option B (on-site treatment and discharge to one or more percolation / evaporation basins located in the WUA) the O&M Plan would include detailed operational and maintenance procedures for the treatment system process, piping and percolation pond(s).

***Objective**:* The objective of the groundwater remedy operation and maintenance is to assure the groundwater extraction and management systems continue to perform as designed and installed.

***Performance Standard**:* Specific performance standards for the groundwater remedy O&M program will depend on the final design of the groundwater extraction and water management systems. The performance standards will be finalized and documented in the Remedial Action Work Plan.

TABLE 4-1. Remedy Work Elements Mapped to Remedial Design Deliverables

Remedy Work Elements (Section 4)	Remedial Design Deliverables (Section 5)
Soil Remedy Design and Construction • Implementation of an FMC OU-wide storm water runoff management plan, including FMC OU-wide grading and the collection of storm water in retention basins. • Placement of evapotraspirative (ET) caps over the following remedial areas (RAs): RA-B, RA-C, RA-D, RA-E, RA-F1, RA-F2, RA-H and RA-K. • Placement of soil covers ("gamma caps") over the following RAs: RA-A, RA-A1, RA-F and RA-G. • Implementation of a remedy management system to integrate the existing RCRA Pond caps with the development of new caps, access roads, the groundwater extraction system and utility lines. • Excavation of the upper six (6) inches of soil from RA-J. • Cleaning of the reinforced concrete underground storm water piping in RA-A. • Installation of additional engineering controls to further limit facility access as appropriate.	**Soil Remedial Design and Construction** • Soil Remedy Preliminary (30%) Design Submittal and Engineering Design – Section 5.3.2.1 and Section 5.3.2.2 • Pre-Final (90/95%) and Final (100%) Engineering Design Submittals – Section 5.3.3.1 • Remedial Action Work Plan (Soil Remedy) – Section 5.6
Soil Remedy Operation, Monitoring and Maintenance (OM&M) • Implementation and monitoring of appropriate institutional controls to all or part of the site to prohibit activities that may disturb the remedies, including access controls in addition to those access controls already in place. • Implementation of a gas monitoring program at the FMC OU CERCLA capped ponds and subsurface areas where elemental phosphorus is present. • Implementation of an operation and maintenance plan for the implemented remedial action.	**Soil Remedy OM&M** • Operations, Monitoring and Maintenance Plan (Soil Remedy) – Section 5.4.5

TABLE 4-1. Remedy Work Elements Mapped to Remedial Design Deliverables

Remedy Work Elements (Section 4)	Remedial Design Deliverables (Section 5)
Groundwater Remedy Design and Construction • Installation of a groundwater extraction system to provide hydraulic containment of the shallow aquifer. Treatment of the extracted groundwater will be by one of two options: option A, involving discharge to the City of Pocatello POTW, or option B, involving on-site treatment and discharge to an on-site percolation / evaporation basin(s) located in the western undeveloped portion of the FMC Plant Site.	**Groundwater Remedy Design and Construction** • Groundwater Remedy Preliminary (30%) Design Submittal and Engineering Design – Section 5.3.4.1 and Section 5.3.4.2 • Groundwater Remedy Intermediate (60%) Design Submittal – Section 5.3.5 • Pre-Final (90/95%) and Final (100%) Engineering Design Submittals – Section 5.3.6.1 • Remedial Action Work Plan (Groundwater Remedy) – Section 5.6
Groundwater Remedy OM&M • Implementation of an operation and maintenance plan for the implemented remedial action.	**Groundwater Remedy OM&M** • Operations, Monitoring and Maintenance Plan (Groundwater Remedy) – Section 5.4.5
• Implementation of a long-term groundwater monitoring program to evaluate the effectiveness of the remedial actions.	• Final CERCLA Groundwater Monitoring Plan (Submitted with Remedial Action Work Plan (Groundwater Remedy) – Section 5.6
Institutional Controls • Implementation and monitoring of appropriate institutional controls to all or part of the site to prohibit activities that may disturb the remedies, including land use covenants or easements placing restrictions on property use (including groundwater use) in addition to those institutional controls already in place.	**Institutional Controls** • Institutional Controls Implementation and Assurance Plan (ICIAP) - Section 5.4.4

TABLE 4-2

CONTAMINANTS OF CONCERN IN SOIL AND CLEANUP LEVELS FOR RISK DRIVERS FOR THE FMC OU (Table 9 from the IROD)

Contaminants of Concern	Units	Cleanup Levels Industrial[1]
Antimony	mg/kg	
Arsenic	mg/kg	150
Beryllium	mg/kg	
Boron	mg/kg	
Cadmium	mg/kg	39
Fluoride	mg/kg	49,000
Gross alpha	pCi/g [a]	
Gross beta	pCi/g [a]	
Lead-210	pCi/g	67
Manganese	mg/kg	
Mercury	mg/kg	
Nickel	mg/kg	
Phosphorus (elemental)[c]	mg/kg	-
Polonium-210	pCi/g	
Potassium-40	pCi/g	
Radium-226	pCi/g [a]	3.8
Radon	pCi/g [a,b]	
Selenium	mg/kg	
Silver	mg/kg	
Thallium	mg/kg	
Thorium-230	pCi/g	
Uranium-238	mg/kg	
Vanadium	mg/kg	
Zinc	mg/kg	

[a] Individual radionuclides potentially responsible for elevated gross alpha and beta levels are also COCs.

[b] Retained as a COC mainly for evaluation of potential radon infiltration into buildings under alternate future commercial or industrial uses of the site.

[c] There are currently no cleanup levels for phosphorus or elemental phosphorus in soils.

[1] Cleanup levels are provided for COCs associated with worker risk at the former operations area or Northern Properties. The cleanup level cited is the lower cleanup level between the outdoor / commercial / industrial worker and construction worker preliminary remediation goal (PRG) from the SFS Work Plan.

TABLE 4-3

CONTAMINANTS OF CONCERN IN GROUNDWATER AND CLEANUP LEVELS FOR THE FMC OU (Table 8 from the IROD)

Contaminants of Concern	Units	Maximum Detected Concentration	Risk-Based Concentration[a]	Federal Maximum Contaminant Level (MCL)	Cleanup Level
Antimony	mg/l	1.07	0.006	0.006	0.006
Arsenic	mg/l	2.66	0.000048	0.01[e]	0.01
Beryllium	mg/l	0.083	0.000019	0.004	0.004
Boron	mg/l	89	1.36	-	1.36
Cadmium	mg/l	3.9	0.008	0.005	0.005
Chromium	mg/l	7.58	0.077	0.1	0.1
Fluoride	mg/l	193	0.93	4	4
Manganese	mg/l	91.2	0.077	-	0.077
Mercury	mg/l	0.0043	0.0046	0.002	0.002
Nickel	mg/l	3.46	0.299	0.1	0.1
Nitrate	mg/l	466	25.03	10	10
Phosphorus[d]	mg/l	697	TBD	-	TBD
Phosphorus (elemental)	mg/l	0.258	0.00073	N/A	0.00073
Radium-226	pCi/l	7.09	0.39	5*	5
Selenium	mg/l	19.73	0.07	0.05	0.05
Thallium	mg/l	9.09	0.001	0.002	0.002
Vanadium	mg/l	0.45	0.108	-	0.108
Zinc	mg/l	28.9	3.92	-	3.92
Tetrachloroethene	mg/l	0.035	0.001	0.005	0.005
Trichloroethene	mg/l	0.028	0.002	0.005	0.005
Gross Alpha[b]	pCi/l	1,690	-	15	15
Gross Beta[c]	pCi/l	1,355	-	4 mrem/yr	4 mrem/yr

*Combined Ra 226 and Ra 228.

[a] RBCs for groundwater based on drinking water and watering homegrown produce. RBC value based on cancer risk of 10^{-6} or HQ=1.

[b] Individual radionuclides potentially responsible for elevated gross alpha and gross beta levels are also COCs. These include but are not limited to lead-210, polonium-210, potassium-40, thorium-230, uranium-234, and uranium-238.

[c] Beta particle and photon activity based on consumption of 2 liters/day.

[d] RBC for phosphorus will be defined in a future decision document.

[e] MCL was changed from 0.050 mg/l to 0.010 mg/l in 2006.

5.0 REMEDIAL DESIGN APPROACH AND DELIVERABLES

5.1 GENERAL APPROACH

The FMC OU RD tasks will be sequenced to reflect the RA construction sequence and timing to obtain the additional design data and information described in Section 3.2. The goal is to integrate the RD and RA such that the overall implementation of the remedy is high quality, remains on schedule, and is as streamlined and cost efficient as possible, while meeting all UAO requirements. The elements of the RD/RA that will drive the sequence and schedule are summarized below.

5.1.1 Soil Remedy

The preliminary site-wide grading and stormwater management system design will progress during implementation of the gamma cap performance evaluation and data gap investigations discussed in Section 3.2, which will generate information allowing the design basis for the gamma and ET caps to be finalized. The site-wide grading and stormwater management system design will then be refined based on the gamma and ET cap designs. The site-wide grading plan will be integrated with the layout of adjacent areas that are currently capped. The design of the site-wide grading, stormwater management and gamma and ET caps is expected to be relatively straightforward, allowing the soil remedy RD to progress from the 30% design directly to the 90/95% design. Design of these elements of the soil remedial action is not dependent on which groundwater treatment option is selected, i.e., off-site or on-site, and can proceed independently of the groundwater remedy design.

5.1.2 Groundwater Remedy

The design of the groundwater extraction system will be refined following completion of the groundwater extraction area hydrogeologic study described in Section 3.2. In parallel with the hydrogeologic study, the preliminary level design of the extracted water management options will be advanced toward the 30% design. The results of the hydrogeologic study, particularly more detailed information regarding the total groundwater extraction rate and average water quality, will be critical for finalizing the design of the groundwater remedy. Following any bench-top / jar testing to further evaluate the process for treating extracted groundwater on-site (option B), a subsequent work plan may be prepared for larger-scale and on-site evaluation of the water treatment process if recommended and necessary to complete the remedial design. Taking into account the timing for determining the viability and design of groundwater management options A and B, FMC's current assumption is that an Intermediate (60%) RD will be necessary for the groundwater remedy. In contrast and as stated earlier, the soil remedy RD can and will proceed independently of the potential additional resources and time required to prepare a 60%

design for the groundwater remedy before proceeding to the 90/95% and final design. Not only is the groundwater remedy design likely to be completed after the soil remedy design, implementation of the groundwater remedy if option B is selected (on-site groundwater treatment) would commence after the soil cap construction begins. This is because the percolation basin component of the on-site groundwater remedy (created from excavating soil cap material from a borrow area in the WUA) cannot begin operation until a sufficient volume of the soil needed for cap construction is removed from that borrow area to create one or more percolation basins.

5.2 REMEDIAL DESIGN APPROACH

As described above, the FMC OU RD will consist of two separate design efforts that align with 1) the soil remedial action and 2) the groundwater extraction and water management system. The earthwork and water treatment design efforts will be conducted separately largely due to the different nature of the two main work elements, unique professional disciplines required to prepare the designs, and the straightforward nature of the soil RD compared to the potential need to perform additional design studies and develop a 60% design for the extracted groundwater management system component of the groundwater RD. By separating the designs, the soil remedial action can proceed even if the groundwater RD is not complete. Although the soil and groundwater remedy designs will be performed separately, the overall RD effort will be coordinated throughout the design process to ensure that the designs are complementary, and that the implemented remedy efficiently and effectively meets the performance standards and overall UAO requirements.

Based on the RD/RA considerations described in Section 5.1, the RD will be sequenced as follows:

- All components of soil remedy designs will progress to the preliminary (30%) RD.
- Following submittal and resolution of any EPA comments on the soil remedy preliminary design, the soil remedy design will progress to the pre-final and final design stages. Concurrently with the soil remedy design progressing to the preliminary RD, but on a longer schedule due to the longer duration of the Hydrogeologic Study, the groundwater remedial design, likely including both groundwater management options A and B, will progress to the preliminary (30%) RD.
- Depending on the timing of determining the design and viability of groundwater management options A and B, FMC may determine that a 60% Intermediate RD is necessary for the groundwater remedy.
- Following submittal and EPA comments on the groundwater remedy preliminary design, the design will progress to the 60% (if recommended), pre-final and final design stages.

5.3 REMEDIAL DESIGN DELIVERABLES

This section describes the plans and design submittals that will be prepared to support implementation of the selected remedy at the FMC OU as specified in Paragraph 30 of the UAO. All the plans and design documents described below will be submitted for EPA review and approval. Additional deliverables may be proposed as the design progresses, which similarly will be subject to EPA review and approval.

EPA guidance documents will be applied in developing work plans, sampling plans, monitoring plans, and other documents. EPA guidance documents to be used for these purposes include the following:

- *EPA Superfund Remedial Design and Remedial Action Guidance (Office of Solid Waste and Emergency Response [OSWER] Directive 9355.0-4A, June 1986)* and other EPA RD/RA guidance.
- *EPA QA/R-5, EPA Requirements for Quality Assurance Project Plans.*
- *EPA QA/G-5, EPA Guidance for Quality Assurance Project Plans.*
- *EPA QA/G-4, Data Quality Objectives Process for Hazardous Waste Site Investigations.*

The RD deliverables for the soil and groundwater remedial (i.e., the Design Submittals) are described in Section 5.3, the RD supporting documents (or “other named plans”) are described in Sections 5.4, the anticipated design drawings and content are described in Section 5.5, and the Remedial Action Work Plan is described in Section 5.6. The other named plans will be completed before commencing the RA. The design documents will be sequenced to align with the anticipated chronological order (or phases) of the RA construction. For example, the design for site-wide grading that will occur early during the RA will be developed first, followed by the design for the caps.

5.3.1 Health and Safety Plan

FMC maintains a Site-Wide Health and Safety Plan (SWHASP) in accordance with the Occupational Safety and Health Administration (OSHA) requirements outlined in 29 CFR Parts 1920 and 1926. MWH has prepared a site-specific Health and Safety Plan (HASP) that is consistent with the requirements of the FMC Site-Wide Health and Safety Plan and the requirements of 29 CFR Parts 1920 and 1926. Addenda will be prepared as necessary during the RD process to address task-specific health and safety topics. In addition, the RD subcontractors will be responsible for maintaining their own health and safety programs/plans.

5.3.2 Soil Remedy Engineering Design Packages

The objectives of the FMC OU RD are to produce engineering plans and technical specifications that 1) meet the RAOs and performance standards defined in the IROD and the overall requirements of the UAO, and 2) are suitable for procuring construction contractors to implement the Selected Remedy. The design process will further define the scope of work and the general planning and construction methods to be used. All plans and specifications will be developed in accordance with *Superfund Remedial Design and Remedial Action Guidance* (EPA, 1986), standard engineering practices, and relevant guidelines. Examples of the standard engineering practices and relevant guidelines that will be referenced and as appropriate incorporated in the design include the following:

- ASTM International (formerly known as the American Society for Testing and Materials).
- ASME Codes, Standards and Publications (American Society of Mechanical Engineers).
- ANSI (American National Standards Institute).
- National Electrical Safety Code (NESC).

Progressive design packages will be prepared for review as described below. The successive design for the soil remedial action is anticipated to progress to an approximate level of 30% (preliminary), 90/95% (pre-final), and then 100% (final).

Each design submittal will include a Basis of Design Report narrative, with supporting documentation included as appendices (e.g., design drawings, specifications, calculations, etc.). The specific deliverables to be prepared and their respective content are discussed below.

5.3.2.1 Soil Remedy Preliminary (30%) Design Submittal

The UAO requires that the Soil Remedy Preliminary (30%) Design will be prepared and submitted to EPA for review and approval 45 days after EPA approval of the Final Remedial Design Work Plan, or, if no Intermediate (60%) Design will be developed, 45 days after receipt of EPA's approval of the performance testing evaluation report. For the soil remedy, an Intermediate Design is not included in the Remedial Design Work Plan and thus the Soil Remedy Preliminary (30%) Design will be prepared and submitted for EPA review and approval no later than 45 days after receipt of EPA's approval of both the Gamma Cap Performance Evaluation Report and the Remedial Design Data Gap Report. FMC submitted both of these work plans to EPA on July 15, 2013 for review and approval.

5.3.2.2 Soil Remedy Preliminary Engineering Design

The preliminary design establishes the design basis and allows for accurate scoping and execution of the design effort based on an agreed-upon design concept. The intent of the submittal is to provide enough information related to all RA major work elements in order to gain EPA approval regarding the general approach before proceeding with developing the detailed design. The preliminary design phase is a critical component in the engineering process and is the phase when all significant questions and concerns are addressed and resolved in order to avoid untimely and costly changes later in the design process. Once the preliminary design is accepted, this would constitute a concept design freeze so that future efforts are focused on developing the design details required for competitive bidding and construction of the final approved project.

The preliminary (30%) engineering design submittal will include the following, at a minimum:

- Design analysis, including assumptions and parameters, design restrictions, design calculations, process performance criteria, appropriate unit processes for the treatment train, and expected removal or treatment efficiencies for both the process and waste (concentration and volume);
- Preliminary drawings and specifications (as discussed below in Section 5.5);
- Preliminary description of any access requirements or proposed easements;
- A description of how the Remedial Action will be implemented in a manner that minimizes environmental impacts, consistent with EPA's *Principles for Greener Cleanups,* OSWER (Aug. 2009) and Region 10’s Clean and Green Policy (Aug. 2009); and
- A preliminary soil RA schedule.

5.3.2.3 Soil Remedy - Preliminary Supporting Documents (“Other Named Plans”)

The preliminary design phase is a critical component in the remedy implementation process and is the phase when all significant questions and concerns are addressed and resolved, to avoid untimely and costly changes later in the design process. Once the preliminary plans are accepted future efforts are focused on developing the detailed plans required for implementation the final approved selected remedy. Preliminary drafts of the supporting documents described in Section 5.4 will be submitted concurrently with the Preliminary (30%) RD for the soil remedy.

Within 120 days after receipt of EPA’s comments on the Preliminary RD package, the Pre-Final RD Package will be submitted for EPA review and approval.

5.3.3 Soil Remedy Pre-Final (90/95%) and Final (100%) Design Submittals

5.3.3.1 Pre-Final (90/95%) and Final (100%) Engineering Design Submittals

A Pre-Final Design will be submitted when the design is 95% complete, and the Final Design will be submitted when the design effort is 100% complete. The Pre-Final Design will fully address EPA comments on the 30% design submittal (and 60% design submittal, if determined to be necessary). The Final Design will fully address comments made to the Pre-Final Design and will include all reproducible drawings and specifications suitable for bid advertisement. The Pre-Final Design submittal will include those elements listed for the Preliminary Design (and Intermediate Design, if required), as well as the following in accordance with the UAO:

- A complete set of construction drawings and specifications that are:
  - certified by a Professional Engineer registered in the State;
  - suitable for bid advertisement; and
  - follow the Construction Specifications Institute's Master Format 2012;
- Survey and engineering drawings showing existing FMC OU elements, conditions, borders, and easements;
- A specification for photographic documentation of the RA;
- A description of the process FMC will follow for selecting the construction contractor(s).

5.3.3.2 Soil Remedy - Draft and Final Supporting Documents ("Other Named Plans")

Concurrent with the Pre-final RD submittal, draft final versions of the supporting documents described in Section 5.4 will be submitted for EPA review and approval.

Within 21 days of receipt of any EPA comments on the Pre-final RD package, including any comments on the draft final supporting documents, the Final (100%) RD will be submitted for EPA approval.

5.3.4 Groundwater Remedy Engineering Design Packages

The objectives of the FMC OU RD are to produce engineering plans and technical specifications that 1) meet the RAOs and performance standards defined in the IROD and the overall requirements of the UAO, and 2) are suitable for procuring construction contractors to implement the Selected Remedy. The design process will further define the scope of work and the general methods to be used. All plans and specifications will be developed in accordance with *Superfund Remedial Design and Remedial Action Guidance* (EPA, 1986), standard engineering practices, and relevant guidelines. Examples of the standard engineering practices and relevant guidelines that will be referenced and as appropriate incorporated during the design include:

- ASTM International (formerly known as the American Society for Testing and Materials).
- ASME Codes, Standards and Publications (American Society of Mechanical Engineers).
- ANSI (American National Standards Institute).
- National Electrical Safety Code (NESC).

Progressive design packages will be prepared for review as described below. The successive designs for the groundwater remedial action is anticipated to progress to an approximate level of 30% (preliminary), 60% (intermediate), 90/95% (pre-final), and then 100% (final). The likely inclusion of an intermediate design for groundwater reflects additional complexity in the design scope for the groundwater remedy as well as uncertainty regarding which groundwater management option (POTW or onsite treatment and percolation) will be implemented. The

Intermediate RD for the groundwater remedy will: 1) be a continuation and expansion of the preliminary design; 2) address all of EPA's comments regarding the Preliminary RD; and 3) include the same elements as are required for the Preliminary RD.

Each design submittal will include a Basis of Design Report narrative, with supporting documentation included as appendices (e.g., design drawings, specifications, cost estimates, calculations, etc.). The specific deliverables to be prepared and their respective content are discussed below.

5.3.4.1 Groundwater Remedy Preliminary (30%) Design Submittal

The UAO requires that the Groundwater Remedy Preliminary (30%) Design be prepared and submitted to EPA for review and approval 45 days after EPA approval of the Final Remedial Design Work Plan, or, if no Intermediate Design, 45 days after receipt of EPA's approval of the performance testing evaluation report. The results of the Groundwater Extraction Zone Hydrogeologic Study are necessary to progress to the 30% RD and an Intermediate (60%) design is anticipated for the groundwater remedy. Therefore, FMC requests that EPA clarify the schedule in the UAO to acknowledge the planned sequencing of the groundwater RD. Specifically, the schedule in Appendix C should read:

- Preliminary (30%) RD: 45 days after EPA approval of the Final RDWP, or if no Intermediate Design, 45 days after receipt of EPA's approval of the Performance Testing Evaluation Report, whichever is later
- Intermediate (60%) RD (if required): 90 days after EPA comments on the Preliminary RD

5.3.4.2 Groundwater Remedy Preliminary Engineering Design

The preliminary design establishes the design basis and allows for accurate scoping and execution of the design effort based on an agreed-upon conceptual design. The intent of the submittal is to provide enough information related to all RA major work elements to gain EPA agreement with the approach before proceeding with developing the intermediate design. The preliminary design phase for the groundwater remedy will likely include both water management options A and B, and questions may remain regarding the viability of the options; therefore, acceptance of the preliminary design will not freeze which groundwater remedial option will be implemented.

The preliminary (30%) engineering design submittal will include the following, at a minimum:

- Design analysis, including assumptions and parameters, design restrictions, design calculations, process performance criteria, appropriate unit processes for the treatment train, and expected removal or treatment efficiencies for both the process and waste (concentration and volume);

- Preliminary drawings and specifications (refer to Section 5.5);
- Preliminary description of any access requirements or proposed easements;
- A description of how the Remedial Action will be implemented in a manner that minimizes environmental impacts, consistent with EPA's *Principles for Greener Cleanups*, OSWER (Aug. 2009) and Region 10's Clean and Green Policy (Aug. 2009); and
- A preliminary groundwater RA schedule.

5.3.4.3 Preliminary Supporting Documents ("Other Named Plans")

The preliminary design phase is a critical component in the remedy implementation process and is the phase when all significant questions and concerns are addressed and resolved to avoid untimely and costly changes later in the design process. Once the preliminary plans are accepted future efforts are focused on developing the detailed plans required for implementation of the selected remedy. Preliminary drafts of the supporting documents described in Section 5.4 will be submitted concurrently with the Preliminary (30%) RD for the groundwater remedy, with the exception of the Institutional Control Implementation and Assurance Plan that will be submitted with the Preliminary RD for the soil remedy.

During the RD, groundwater monitoring, sampling, analysis and reporting will continue pursuant to FMC's Interim CERCLA Groundwater Monitoring Plan (MWH, 2010c) until EPA approves the Final CERCLA Groundwater Monitoring Plan. The Final CERCLA Groundwater Monitoring Plan will be included as a component of or a companion document to the Operation, Monitoring and Maintenance Plan for the groundwater remedy.

5.3.5 Groundwater Remedy Intermediate (60%) Design Submittal

Within 90 days after receipt of EPA comments on the Preliminary RD, the likely Intermediate (60%) design package will be submitted for EPA review and comment. The groundwater management option selected for the RA will be identified in the 60% design. The intermediate design phase will be a critical component in the engineering process for the groundwater remedy. It is the phase when all significant questions and concerns are addressed and resolved regarding the approach for the groundwater remedy, to avoid untimely and costly changes later in the design process. Once the intermediate design is accepted, this would constitute a concept design freeze so that future efforts are focused on developing the design details required for competitive bidding and construction of the final approved project. The 60% design submittal will be a continuation and expansion of the 30% design submittal and will include the same elements as contained in the preliminary design. These elements will include the following:

- Written response to EPA's preliminary design review comments. The responses will indicate if a design change was made as a result of the comment.
- Updated Basis of Design Report.
- Intermediate design drawings.

Revision of the Supporting Documents ("Other Named Plans") is not anticipated at the Intermediate Design step. However, based on the extent of comments received on the preliminary draft plans, FMC may prepare and submit to EPA intermediate drafts of these supporting documents.

5.3.6 Groundwater Remedy Pre-Final (90/95%) and Final (100%) Design Submittals

5.3.6.1 Pre-Final (90/95%) and Final (100%) Engineering Design Submittals

A Pre-Final Design will be submitted when the groundwater remedy design is 95% complete, and the Final Design will be submitted when the design effort is 100% complete. The Pre-Final Design will fully address EPA comments on the 30% design submittal (and 60% design submittal, if determined to be necessary). The Final Design will fully address EPA comments made to the Pre-Final Design and will include all reproducible drawings and specifications suitable for bid advertisement. The Pre-Final Design submittal will include those elements listed for the Preliminary Design (and Intermediate Design, if required), and the following elements in accordance with the UAO:

- A complete set of construction drawings and specifications that are:
  - certified by a Professional Engineer registered in the State;
  - suitable for bid advertisement; and
  - consistent with the Construction Specifications Institute's Master Format 2012;
- Survey and engineering drawings showing existing FMC OU elements, conditions, boundaries, and easements;
- A specification for photographic documentation of the RA;
- A description of the processes FMC will follow for selecting the construction contractor(s).

The design and construction of all new wells and modification and decommissioning of existing wells associated with the remedial action will meet the standards contained in the Idaho Department of Water Resources' (IDWR) Well Construction Standards Rules, IDAPA 37.03.09.

5.3.6.2 Other Final Supporting Documents ("Other Named Plans")

Concurrent with the Pre-final RD submittal, draft final versions of the supporting documents described in Section 5.4 will be submitted for EPA review and approval.

Within 21 days of receipt of any EPA comments on the Pre-final RD package, including any comments on the draft final supporting documents, the Final (100%) RD will be submitted for EPA approval.

5.4 SUPPORTING DOCUMENTS ("OTHER NAMED PLANS")

5.4.1 Construction Quality Assurance/Quality Control Plan (CQAP)

Consistent with Section XI (Quality Assurance, Sampling, and Data Analysis) of the UAO, the CQAP will describe the planned and systemic activities that provide confidence that the RA construction will satisfy all plans, specifications, and related requirements, including quality objectives. The purpose of the CQAP is to describe the activities that will be conducted to verify that RA construction has satisfied all plans, specifications, and related requirements, including quality objectives. The CQA/QCP will:

- Identify, and describe the responsibilities of, the organizations and personnel implementing the quality assurance/quality control ("QA/QC");
- Describe verification activities, such as inspections, sampling, testing, monitoring, and production controls, under the QA/QC;
- Describe industry standards and technical specifications used in implementing the QA/QC;
- Describe procedures for tracking construction deficiencies from identification through corrective action; and,
- Describe procedures for documenting all QA/QC activities.

5.4.2 Emergency Response Plan ("ERP")

Consistent with Section XXI (Emergency Response) of the UAO, the ERP will describe procedures to be used in the event of an accident or emergency at the FMC OU (for example, power outages, slope failure, etc). The ERP will include the following:

- Name of the person or entity responsible for responding in the event of an emergency incident;
- Plan and date(s) for meeting(s) with all appropriate authorities under the circumstances, including emergency response personnel and hospitals if relevant;
- Spill Prevention, Control, and Countermeasures (SPCC) Plan, as required
- Notification activities in accordance with Paragraph 57 of the UAO in the event of a release of hazardous substances requiring reporting under Section 103 of CERCLA, 42 U.S.C. § 9603, or Section 304 of the Emergency Planning and Community Right-to-know Act ("EPCRA"), 42 U.S.C. § 11004; and

- A description of all necessary actions to ensure compliance with Section XXI (Emergency Response) of the UAO in the event of an occurrence during the performance of the Work that causes or threatens a release of waste material from the FMC OU that constitutes an emergency or may present an immediate threat to public health or welfare or the environment.

5.4.3 Field Sampling Plans and Quality Assurance Project Plans

The field sampling plans (FSPs) supplement the quality assurance project plans (QAPPs) and address all sample collection activities. Rather than a single QAPP and FSP, the individual work plans specified in Section 3.2 will each include a QAPP and FSP specific to the sampling / data acquisition in that plan. Similarly, the EPA-approved Interim CERCLA Groundwater Monitoring Plan that will continue to be implemented during the RD contains the QAPP and FSP for the CERCLA groundwater monitoring program.

The FSPs will be written so that a field sampling team unfamiliar with the project would be able to gather the samples and field information required. The FSPs will be prepared consistent with *Guidance for Conducting Remedial Investigations and Feasibility Studies*, EPA/540/G-89/004 (EPA, 1988), and in accordance with Section XI (Quality Assurance, Sampling, and Data Analysis) of the UAO.

5.4.4 Institutional Controls Implementation and Assurance Plan (“ICIAP”)

The ICIAP will specify how the institutional controls (ICs) specified in the IROD and required under the UAO will be implemented. The ICIAP will include but not be limited to the following:

- A description of the pathways for potential human exposure to Waste Material that may remain during and/or after completion of construction of the Remedial Action;
- A description of the areas where human activities should be restricted, including legal descriptions for such areas, sample maps, and a plan for preparing final survey maps (e.g., survey of capped areas);
- A list of properties where Proprietary Controls (or Institutional Controls [ICs]) are needed;
- A description of the proposed ICs and their purpose;
- A description of the proposed duration of each IC and an explanation for such duration;
- A schedule for implementing each IC;
- A schedule for completing title work;
- Draft enforceable Proprietary Controls to implement the proposed land or resource use restrictions;

- A description of the authority of each affected property owner to implement each Proprietary Control, including title insurance commitments or other title evidence acceptable to EPA for proposed Proprietary Controls;
- A description of all prior liens and encumbrances existing on any real property that may affect the Proprietary Controls or the protectiveness of the remedy, and a plan for the release or subordination of any such liens and encumbrances (unless EPA waives the release or subordination of such liens or encumbrances);
- A plan for monitoring, maintaining, reporting on, and ensuring the continued efficacy of the ICs and a contingency plan in the event ICs are ineffective; and
- A schedule for annual certifications regarding whether the ICs remain in place, regarding whether the ICs have been complied with, and regarding enforcement of the Institutional Controls.

FMC will submit the ICIAP with the soil remedy preliminary RD. The schedule for EPA comments, resolution of comments and finalization of the ICIAP is not directly linked to the schedule for other remedial design deliverables and likely will be on a schedule that is independent of the groundwater and later soil remedial design submittals.

5.4.5 Operation, Monitoring and Maintenance (OM&M) Plans

The OM&M Plans will describe the long-term operation and maintenance of the RA. The O&M Plan will provide for all operation and maintenance activities required for the Remedial Action to achieve Performance Standards, and all activities required to maintain the effectiveness of the Remedial Action after Performance Standards are met. The O&M Plan will include the following:

- Description of and schedule for each operation task and maintenance task;
- Description of and schedule for periodic inspections of equipment and components;
- Description of O&M requirements;
- Description of instrumentation and monitoring;
- Sample checklists and periodic reports;
- Description and analysis of potential operating problems, including common and/or anticipated remedies;
- Description of routine monitoring and laboratory testing;
- Description of required data collection, laboratory tests and their interpretation;
- Schedule of monitoring frequency and procedures;
- Description of verification sampling procedures, if Performance Standards are exceeded during routine monitoring;
- Description of alternative operations and maintenance in case of systems failure, including: (1) alternative procedures to prevent the release or threatened release of Waste

Material that may endanger public health and the environment or exceed Performance Standards; (2) analysis of vulnerability and additional resource requirements should a failure occur; and, (3) notification and reporting requirements should O&M systems fail or be in danger of imminent failure;

- Description of corrective measures to be implemented in the event that Performance Standards are exceeded, and a schedule for implementing those corrective measures;
- Description of monitoring equipment and monitoring components, including identifying information, maintenance requirements and schedule, and replacement requirements and schedule; and
- Description of records and reports that will be generated during O&M, such as daily operating logs, laboratory records, records of operating costs, reports regarding emergencies, personnel and maintenance records; and provisions for preparation and submission of monthly and annual O&M summary reports to EPA.

5.4.6 Performance Standards Verification Plans ("PSVP")

The PSVP will describe the activities to verify that all performance standards are achieved, and a schedule for performing these activities. The PSVP will include the following elements:

- A description of each of the performance standards specified by the IROD and UAO;
- A description of FMC's plans for determining and ensuring that each performance standard is met; and
- A description of the activities that FMC will perform to determine whether performance standards have been met.

5.4.7 Transportation and Off-Site Disposal Plans ("TODP")

The TODP will describe the measures FMC will take to ensure compliance with Paragraph 35 (Off-Site Shipments of Waste Material) of the UAO. The TODP will include the following:

- Proposed locations and routes for off-site shipment of waste material;
- Identification of communities affected by shipment of waste material; and
- Description of plans to minimize impacts on affected communities.

5.5 ANTICIPATED REMEDIAL DESIGN DRAWINGS AND CONTENT

It is anticipated that the design effort will comprise the following drawings:

5.5.1 General

The general design sheets will show site location, access, general location of existing and proposed facilities, site boundaries, and the survey control points, standard symbols and abbreviations used in subsequent drawings. Anticipated drawings include the following:

1. Cover Sheet
2. Index of Drawings
3. General Notes & Acronyms
4. Site Location, Principal Site Features and Survey Control
5. Remedial Components (RA boundaries)
6. General Design Details

5.5.2 Site-Wide Grading Plan

The site-wide grading plan will identify the final elevation contours designed for the overall site. The grading plan will incorporate the design for the gamma and ET caps, storm water management systems and integration of the remedial action caps with the existing capped areas of the site. Anticipated drawings include the following:

1. Final Subgrade Elevation Plans
2. Final Subgrade Elevation Sections
3. Cut and Fill Plans
4. Cut and Fill Sections

5.5.3 Stormwater Management Systems

Earthwork will be carried out in such a manner that 1) surface water runoff will continue to be contained entirely on-site during RA construction and 2) the post-remedial action stormwater system configuration is consistent with the following drawings and plans:

1. Site Drainage Plan
2. Diversion Ditch Plan and Profile
3. Diversion Ditch Sections
4. Diversion Ditch Details
5. Storm Water Retention Basin Plan
6. Storm Water Retention Basin Sections
7. Staking Point Plans

5.5.4 Soil Borrow Area

As currently envisioned, borrow material for the gamma and ET cap construction will be obtained primarily from the WUA. The surficial soil removed from RA-J may also be usable for cap construction. It is possible that additional borrow materials will be required from other areas of the FMC OU. If necessary, borrow plans will be developed for those areas as well. The availability of suitable quantities of material required for cap construction will be evaluated as planned during the Data Gap investigation described in Section 3.2.1. Drawings will be prepared showing the identified borrow area(s) (plan view and sections) as well as a borrow excavation plan indicating extent of cuts throughout the borrow area.

5.5.5 Gamma Caps

The following drawings will be developed for the gamma caps:

1. Final gamma cap elevation plans
2. Final gamma cap elevation sections
3. Typical gamma cap design details
4. Staking point plans

5.5.6 ET Caps

The following drawings will be developed for the gamma caps:

1. Final ET cap elevation plans
2. Final ET cap elevation sections
3. Typical ET cap design details
4. Staking point plans

5.5.7 Engineering Controls

The following drawings will be developed to support engineering controls:

1. Fencing layout and setout drawings
2. Fencing and placard design details

5.5.8 Groundwater Extraction System

The groundwater extraction system design will include the following drawings (arranged by discipline):

General. The General design drawings provide the standards used in the development of the drawing set, including location, access, standard symbols, and abbreviations used. The General drawings also will provide complete hydraulic information for the WTP (from plant influent to effluent discharge), and a process flow schematic with necessary equipment references. Anticipated drawings include the following:

- Cover Sheet
- Location Map, Vicinity Map, and Index of Drawings
- Standard Symbols
- Standard Abbreviations

Extraction Wells and Piezometers. Anticipated drawings include the following:

- Extraction Well and Piezometer Location Plan
- Extraction Well and Piezometer Construction Details
- Pump, Pipe, Instrumentation and Control Details

5.5.9 Extracted Groundwater Management System

General. The General design drawings provide the standards used in the development of the drawing set, including location, access, standard symbols, and abbreviations used. The General drawings also will provide complete hydraulic information for the water treatment system (from plant influent to effluent discharge), and a process flow schematic with necessary equipment references. Anticipated drawings include the following:

- Cover Sheet
- Location Map, Vicinity Map, and Index of Drawings
- Standard Symbols
- Standard Abbreviations

Civil. The Civil design drawings will provide survey control data and a piping plan for connecting the extraction wells to either 1) the existing sewer line to the Pocatello POTW (option A), or 2) the water treatment system and from that system to the percolation pond(s) in the WUA (option B). Anticipated drawings include the following:

- General Notes and Symbols
- Site Control Data
- Site Key Plan
- Piping Alignment Plan

Process Mechanical. The Process Mechanical design drawings will have fully developed piping schedules and equipment schedules for all of the process piping and equipment for the water treatment system. The design drawing package also will contain plans for each of the unit processes. Anticipated drawings include the following:

- Piping Schedule
- Equipment Schedule
- Mechanical Plans and Sections
- Mechanical Design Details
- Chemical Storage and Delivery Systems

The design for both water management options A and B will include the following drawings as appropriate:

Electrical. The Electrical design drawings will include a single line diagram for all major electrical equipment, and also will include power/lighting plans for the new WTP building. Anticipated drawings include the following:

- Load Schedules
- Switch board layout, MCC Control Schematics
- Conduit and cable routing
- Electrical details
- High voltage and low-voltage single lines
- Yard Power and Lighting Plan
- Single Line Diagram

Instrumentation and Controls. The Instrumentation and Control design drawings will include the following:

- Piping and Instrumentation Diagrams
- Communication block diagrams
- Standard Details

If water management option A is not viable, the option B design will be further developed to include the additional drawings described below:

Structural. The structural design drawings will include the following:

- Slab plans and sections
- Reinforcing steel details
- Structural steel building plan and sections

5.6 REMEDIAL ACTION WORK PLAN

The work plan for the performance of the Remedial Action at the FMC OU ("Remedial Action Work Plan" or "RAWP") will be prepared and submitted to EPA consistent with the UAO schedule and content requirements. The Remedial Action Work Plan will provide for construction and implementation of the remedy consistent with UAO requirements, Other Named Plans and RD drawings as approved by EPA. Concurrent with submittal of the RAWP, FMC will submit to EPA a Health and Safety Plan for the field activities specified in the RAWP. That Health and Safety Plan will conform with applicable Occupational Safety and Health Administration and EPA requirements including, but not limited to, those specified in 29 C.F.R. §1910.120.

The Remedial Action Work Plan will include the following:

- A schedule for completion of the Remedial Action
- The method for selection of the contractor
- A schedule for developing and submitting other required Remedial Action plans
- The Final CERCLA Groundwater Monitoring Plan
- Methods for satisfying access requirements
- The methodology for implementing the Operation and Maintenance Plan
- The methodology for implementing the Emergency Response Plan
- A tentative formulation of the Remedial Action project team
- The Construction Quality Control Plan (by the construction contractor)
- The Performance Standards Verification Plan
- Procedures and plans for the decontamination of equipment and the disposal of contaminated materials

The RAWP also will include the methodology for implementing the CQAP and a schedule for implementing all Remedial Action tasks identified in the final design submission.

The Final CERCLA Groundwater Monitoring Plan will be submitted concurrently with the RAWP and will provide for the following:

- The EPA guidance *Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems* (EPA 600/R-08/003; EPA 2008) will be used to evaluate the effectiveness of the groundwater extraction system. An evaluation of the groundwater monitoring network will be conducted to confirm that it is adequate to monitor the FMC OU.
- Consistent with the Interim CERCLA Groundwater Monitoring Plan, implementation of the Final CERCLA Groundwater Monitoring Plan will be coordinated with FMC's RCRA and Calciner Pond groundwater monitoring programs. The Final CERCLA Groundwater Monitoring Plan also will specify the methods for evaluating potential changes and/or trends in FMC facility-related groundwater constituents and groundwater conditions on an FMC facility-wide basis.
- Once installation of the groundwater extraction system has been completed and the designed annual average pumping rate has been achieved, an addendum to the plan will specify the appropriate monitoring locations at the FMC OU and Off-Plant OU, as determined by EPA, to measure progress toward achieving the Performance Standards for the groundwater extraction and treatment system, including the types of statistical tools to be used to evaluate the groundwater data and the system's effectiveness.

5.7 DELIVERABLE FORMAT AND DISTRIBUTION

An electronic copy and four bound copies of each deliverable will be submitted to EPA, and an electronic copy and two bound copies each will be provided to the Idaho Department of Environmental Quality (IDEQ) and the Tribes as prescribed by Paragraph 58 of the UAO, unless that requirement is modified by the EPA Remedial Project Manager (RPM). For the design submittals that include drawings, a half-size (11 inch by 17 inch) drawing set will be included with each copy. In addition, EPA will be provided with one full-size set of drawings at each stage (i.e., preliminary, intermediate (if required), pre-final/final) of the design. Example design drawings are included in Appendix B and an example earthwork specification is included in Appendix C.

6.0 REMEDIAL DESIGN / REMEDIAL ACTION SCHEDULE AND APPROACH FOR REMEDIAL ACTION

6.1 RD/RA SCHEDULE

The anticipated RD schedule through initiation of remedial action construction is shown on Table 6-1 (soil remedy schedule) and Table 6-2 (groundwater remedy schedule). These tables have been updated since the draft RDWP (August 2013) and baseline schedule contained therein was prepared and submitted to EPA. The updated tables represent the third revision (Rev 3.0) of the schedule; revisions 1.0 and 2.0 of the schedule were submitted with the UAO monthly reports for August and September 2013 respectively. Please note that these schedules have been prepared at the pre-design stage, and therefore should be considered preliminary; any further changes will be included in monthly reports as the RD progresses.

Additionally, as the project progresses, the priorities of various key tasks will be revisited and, if necessary, the schedule will be revised to assure that the critical path tasks are being given the highest priority. Specifically, the site-wide grading and storm water management plans, required precursors to cap construction, will be submitted for EPA review and approval in advance of the balance of the soil remedy design engineering deliverables to allow these critical path tasks to progress in advance of the cap design and to commence grading field work during the 2014 construction season.

The following are additional notes regarding the schedules depicted on Tables 6-1 and 6-2:

- The schedule begins with submittal of this RDWP on August 12, 2013. This is in advance of the deadline established by the UAO, which requires submittal of the RDWP within 45 days of EPA's approval of FMC's Supervising Contractor. EPA provided that approval on July 10, 2013, meaning that the RDWP was not required to be submitted until August 26, 2013.
- The "Construction Season" for the FMC OU is April to October.
- The schedule was developed using working days, where five days represents one week and 20 days represents one month.
- The schedule has been revised to reflect EPA approval of 1) the Gamma Cap Performance Evaluation Work Plan and 2) the Remedial Design Data Gap Work Plan that allowed field work during 2013 and is anticipated to be completed during the week of November 11, 2013. FMC acknowledges that EPA could require or FMC could

propose further data collection in addition to these studies to support the RD. However, the schedule does not anticipate any such additional studies.

- The schedule for field implementation of the Extraction Zone Hydrogeologic (EZH) Study Work Plan has been shifted to begin on or about March 15, 2014 due to the extended EPA review of the draft EZH Work Plan, FMC's requested / EPA approved 45 day period to respond to EPA comments, and to perform the work with reasonable weather conditions (i.e., not during December – February).

- Information obtained from the gamma cap performance evaluation, data gap investigation and groundwater extraction area hydrogeological study are critical-path data needs and will be required prior to completing the preliminary designs. As such, the schedule for submittal of the Preliminary RD for the groundwater remedy is shown as being submitted 45 days after EPA's approval of the Groundwater Extraction Zone Hydrogeologic Performance Test Work Plan, rather than 45 days after EPA's approval of this RDWP, which the UAO would appear to require for the groundwater Preliminary RD as an Intermediate Design is anticipated. FMC requests that EPA clarify the schedule in the UAO to adjust for this apparent inconsistency. Specifically, the schedule in Appendix C should read:

    - Preliminary (30%) RD: 45 days after EPA approval of the Final RDWP, or if no Intermediate Design, 45 days after receipt of EPA's approval of the Performance Testing Evaluation Report, whichever is later

    - Intermediate (60%) RD (if required): 90 days after EPA comments on the Preliminary RD

- Pursuant to the EPA comments on the draft RDWP (August 2013) EPA review periods for future deliverables are included on the schedule as 60 days (44 working days) for each deliverable with the exception of the ICIAP.

- The bid packages for the RA are anticipated to be sent out at the 90/95% design stage, because the designs are expected to be complete enough at the pre-final stage to allow the procurement process to begin in advance of EPA approval of the final RD and the RAWP.

- The schedule included as Appendix C to the UAO requires awarding the RA contract 45 days after approval of the RAWP. The schedules included in Tables 6-1 and 6-2 assume the RAWP is approved concurrently with EPA approval of the Final RD.

- The schedule included as Appendix C to the UAO also requires construction to start 45 days after award of the Contract. Note that the implementation schedule may require adjustment should the RAWP be approved in the second half, end of or outside the construction season.

6.2 GENERAL APPROACH FOR REMEDIAL ACTION

As discussed in Section 1.2.1, the RD/RA will be a design-bid-build project delivery. The EPA-approved RD documents described in Section 5.0 will be used to solicit competitive bids from qualified remediation contractors. The selected RA contractor will be hired by FMC and will be required to conform to the EPA-approved Final RDs and the RAWPs. In accordance with the UAO, the RAWP will describe how each Element/Component of the Selected Remedy will be addressed during the RAs, identify tasks necessary for completing the RAs, and provide an overall management strategy for completion of all such tasks. The RAWPs also will include a project schedule for each major activity and submission of deliverables to be generated during the RAs.

The RA contractor will participate in a preconstruction conference prior to each construction season as well as in regular meetings with EPA to discuss the RA construction as it progresses. The RA contractor will provide full and complete access to EPA (or its designated representatives) for periodic inspections intended to assure that the RAs are proceeding or have been completed in substantial compliance with the approved Final RD and RAWP. The RA contractor will be required to take necessary steps to correct deficiencies and/or bring the construction into compliance with the approved Final RD and RAWP.

Pursuant to Paragraph 55 of the UAO, during implementation of the RD/RA, FMC will submit monthly reports to EPA on the 15th day of the month following the reporting period. The monthly reports at a minimum will contain the following information:

- A description of the actions that have been taken to comply with the UAO during the previous month;
- A summary of all results of sampling and tests and all other data received or generated by FMC or its contractors or agents;
- Identification of all plans, reports, and other deliverables required by the UAO that have been completed and submitted; a description of all actions, including but not limited to data collection and implementation of work plans, that are scheduled for the next two months; and other information relating to the progress of construction, including but not limited to critical path diagrams, Gantt charts and Pert charts;

- Information regarding percentage of completion, unresolved delays encountered or anticipated that may affect the future schedule for implementation of the RD/RA, and a description of efforts made to mitigate those delays or anticipated delays; and
- Any modifications to the work plans or other schedules that FMC has proposed to EPA or that have been approved by EPA.

TABLE 6-1. Soil Remedial Design / Remedial Action Preliminary Schedule (Rev 3.0)

RD Deliverable/Work Element	Schedule per UAO	Baseline[1] Planned	Revised Plan	Actual
Remedial Design Work Plan				
Submit Remedial Design Work Plan (RDWP)	W/in 45 days EPA approval SC			**8/12/2013**
EPA Comments on RDWP	**NS**	9/13/2013		**10/28/2013**
Submit Final RDWP	14 days or as specified by EPA	9/27/2013		**11/11/2013**
EPA Approval RDWP	**NS**	10/14/2013	12/2/2013	
Performance Testing (PT) Work Plans - Soil Remedy				
RD Data Gap (DG) Acquisition Work Plan	W/in 60 days EPA approval SC			**7/15/2013**
Gamma Cap (GC) Performance Evaluation Work Plan	W/in 60 days EPA approval SC			**7/15/2013**
EPA approval of GC WP	**NS**	8/16/2013		**9/5/2013**
EPA approval of DG WP	**NS**	8/16/2013		**10/22/2013**
Execute PTs to Support Soil Remedial Design				
PT Field Work	Per DG/GC Work Plans	8/26 to 9/27/2013	9/16/ to 11/13/2013	
Submit GC / DG PT Reports	Per DG/GC Work Plans	10/25/2013	11/25 **/** 12/30/2013	
EPA Comments on GC / DG PT Reports	**NS**	11/22/2013	1/27 **/** 2/28/2014	
Submit Final GC / DG PT Reports	14 days or as specified by EPA	11/29/2013	2/3 **/** 3/7/2014	
EPA approval GC / DG PT Reports	**NS**	12/16/2014	2/17 **/** 3/20/2014	
Remedial Design - Soil Remedy				
Submit Soil Remedy - 30% Design Package	45 days after EPA approval of GC/DG PT reports	1/27/2014	5/5/2014	
EPA Comments on 30% RD Package	**NS**	3/6/2014	7/4/2014	
Submit Soil Remedy Pre-Final (90/95%) RD Package	120 days after receipt of EPA comments on 30% RD	5/1/2014	8/29/2014	
EPA Comments on Pre-Final RD Package	**NS**	5/29/2014	10/30/2014	
Submit Soil Remedy Final RD Package	21 days after receipt of EPA comments on Pre-final RD	6/26/2014	11/27/2014	
Remedial Action Work Plan - Soil Remedy				
Submit Draft RAWP Soil Remedy	Concurrent with Pre-Final RD	5/1/2014	8/29/2014	
EPA Comments on RAWP Soil Remedy	**NS**	5/29/2014	10/30/2014	
Submit Final RAWP Soil Remedy	Concurrent with Final RD	6/26/2014	11/27/2014	
Remedial Contractor Procurement				
Bid Package Preparation - Soil Remedy	**NS**	5/5/2014	11/3/2014	
Evaluate Bids / Recommendation	**NS**	6/26/2014	12/5/2014	
EPA Approval Soil Remedy Final RD and RAWP	**NS**	7/7/2014	12/8/2014	
Soil Remedial Action				
Award RA Contract	45 days after EPA approval RAWP	7/10/2014	12/11/2014	
Pre-Construction Inspection and Meeting	30 days after Award RA Contract	7/17/2014	12/18/2014	
Start of Soil Remedy Construction	15 days after Pre-Con Meeting	7/28/2014	4/1/2015	
Institutional Control Program				
Institutional Control Implementation and Assurance Plan	Submit with 30% RD for Soil RA	1/27/2014	5/5/2014	
EPA Comments on ICIAP	**NS**	4/28/2014	6/30/2014	
Submit Final ICIAP	14 days or as specified by EPA	5/12/2014	7/14/2014	
EPA Approval ICIAP	**NS**	6/11/2014	8/4/2014	
Implement ICIAP	Per ICIAP	———	———	

1 Baseline schedule is the Planned schedule from Table 6-1 of the draft RDWP, August 2013.

NS means no schedule (timeframe) specified in UAO.

TABLE 6-2. Groundwater Remedial Design / Remedial Action Preliminary Schedule (Rev 3.0)

RD Deliverable/Work Element	Schedule per UAO	Baseline[1] Planned	Revised Plan	Actual
Remedial Design Work Plan				
Submit Remedial Design Work Plan	W/in 45 days EPA approval SC			**8/12/2013**
EPA Comments on RDWP	**NS**	9/13/2013		**10/28/2013**
Submit Final RDWP	14 days or as specified by EPA	9/27/2013		**11/11/2013**
EPA Approval RDWP	**NS**	10/14/2013	12/2/2013	
Performance Testing (PT) Work Plans - Groundwater Remedy				
Groundwater Extraction Zone Hydrogeologic (EZH) Work Plan	W/in 60 days EPA approval SC			**7/15/2013**
EPA Comments on GW EZH Work Plan	**NS**	8/16/2013		**9/16/2013**
Submit Final Groundwater EZH Work Plan	14 days or as specified by EPA	Not included	11/29/2013	
EPA approval of Groundwater EZH Work Plan	**NS**	8/16/2013	12/20/2013	
Execute PTs to support Groundwater (GW) Remedial Design				
PT Field Work	Per GW EZH Work Plan	8/26 to 11/8/2013	3/15 to 5/22/2014	
Submit GW EZH Report	Per GW EZH Work Plan	1/10/2014	7/24/2014	
EPA Comments on GW EZH Report	**NS**	2/7/2014	9/24/2014	
Submit Final GW EZH Report	14 days or as specified by EPA	2/14/2014	10/1/2014	
EPA approval GW EZH Report	**NS**	2/28/2014	10/29/2014	
Remedial Design - Groundwater Remedy				
Submit Groundwater Remedy - 30% Design Package	45 days after EPA approval of GW EZH Report	3/24/2014	12/12/2014	
EPA Comments on 30% RD Package	**NS**	4/21/2014	2/12/2015	
Submit Groundwater Remedy - 60% Design Package	90 days after EPA comments on 30% RD	7/21/2014	4/9/2015	
EPA Comments on 60% RD Package	**NS**	8/22/2014	6/10/2015	
Submit Pre-Final (90/95%) Groundwater RD Package	90 days after receipt of EPA comments on 60% RD	10/24/2014	8/5/2015	
EPA Comments on Pre-Final RD Package	**NS**	11/24/2014	10/6/2015	
Submit Groundwater Remedy Final RD Package	21 days after receipt of EPA comments on Pre-final RD	12/15/2014	11/3/2015	
Remedial Action Work Plan - Groundwater Remedy				
Submit Draft RAWP Groundwater Remedy	Concurrent with Pre-Final RD	10/24/2014	8/5/2015	
EPA Comments on RAWP	**NS**	11/24/2014	10/6/2015	
Submit Groundwater Remedy Final RAWP	Concurrent with Final RD	12/15/2014	11/3/2015	
Remedial Contractor Procurement				
Bid Package Preparation Groundwater Remedy	**NS**	10/30/2014	11/10/2015	
Evaluate Bids / Recommendation	**NS**	12/19/2014	12/15/2015	
EPA Approval Groundwater Remedy Final RD and RAWP	**NS**	1/15/2015	12/3/2015	
Groundwater Remedial Action				
Award RA Contract - Groundwater	45 days after EPA approval RAWP	3/1/2015	1/19/2015	
Pre-Construction Inspection and Meeting	30 days after Award RA Contract	3/31/2015	2/17/2016	
Start of Construction	15 days after Pre-Con Meeting	4/14/2015	3/2/2016	

1 Baseline schedule is the Planned schedule from Table 6-2 of the draft RDWP, August 2013.

NS means no schedule (timeframe) specified in UAO.

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APPENDIX A

REMEDIAL DESIGN QUALITY ASSURANCE / QUALITY CONTROL

APPENDIX A
REMEDIAL DESIGN QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance and quality control (QA/QC) procedures will be implemented throughout the design process to ensure that the final design is technically sound, cost-effective, biddable and constructible, and that the design meets the remedial action goals for the site. This section describes the QA/QC roles and responsibilities and QA/QC mechanisms that will be employed during the RD process.

1.0 QA/QC ROLES AND RESPONSIBILITIES

Figure 1-3 of the RD Work Plan depicts the anticipated RD team organization and lines of authority. The roles and responsibilities of the team members are discussed below.

1.1 Environmental Protection Agency – EPA

EPA, as the lead agency governing the FMC OU remediation, is responsible for final approval of the RD. At its discretion, EPA will review each design submittal described in Section 5.0 for overall content, quality, and compliance with the requirements of the UAO.

1.2 FMC Corporation

As the responsible party for complying with the UAO and implementing the Selected Remedy, FMC will provide EPA with a technically sound RD that complies with the UAO. All RD deliverables will receive internal review and approval by FMC prior to submittal to the EPA.

1.3 MWH Project Director

The MWH Project Director (Marc Bowman) is responsible for assuring that sufficient resources, including budget, staff, expertise, and time are dedicated to QA/QC for the FMC OU RD. The MWH Project Manager is ultimately responsible for confirming that the MWH QA/QC policies and procedures are followed. The MWH RD Manager will communicate all QA/QC issues and results to FMC. Additional information regarding the roles and qualifications of the MWH Project Director is included in Section 1.3.3 of the RD Work Plan.

1.4 MWH RD Manager

The MWH RD Manager, Rob Hartman, is responsible for assuring that all RD deliverables meet MWH and industry standards. The MWH RD Manager will communicate all QA/QC issues and results to FMC. Additional information regarding the roles and qualifications of the MWH RD Manager is included in Section 1.3.3 of the RD Work Plan.

1.5 MWH Engineering Manager

The MWH Engineering Manager, Chad Tomlinson, P.E., is responsible for overseeing the QA/QC related to the soil remedial action design. The MWH Engineering Manager is responsible for confirming that the design team is qualified, the appropriate QA/QC mechanisms are implemented, and for communicating QA/QC issues and results to the MWH RD Manager. The MWH Engineering Manager is ultimately responsible for having each design drawing and design report stamped by an appropriate discipline engineer. Additional information regarding the roles and qualifications of the MWH Engineering Manager is included in Section 1.3.3 of the RD Work Plan.

1.6 Groundwater Extraction System Manager

The MWH Groundwater Extraction System Manager, Jesse Stewart, is responsible for overseeing the QA/QC related to the groundwater extraction system design. The MWH Groundwater Extraction System Manager is responsible for confirming that the design team is qualified, the appropriate QA/QC mechanisms are implemented, and for communicating QA/QC issues and results to the MWH RD Manager. Additional information regarding the roles and qualifications of the MWH Engineering Manager is included in Section 1.3.3 of the RD Work Plan.

1.7 Program QA/QC Leader

Mike Gronseth, P.E. of MWH will be assigned as the Project Reviewer for the earthwork and design effort, and will be responsible for implementing QA/QC throughout the design process. The Project Reviewer role is to coordinate and facilitate the QA/QC mechanisms described below. The Project Reviewer will communicate QA/QC issues and results to the MWH Engineering Manager.

1.8 Discipline and Inter-Discipline Checkers

Discipline Checkers are subject-matter experts assigned to review individual components of a design (e.g., geotechnical, civil). The role of the Discipline Checker is to verify adherence to appropriate design criteria and governing code requirements. Inter-Discipline Checkers perform a cross-check between each of the various design components to confirm compatibility and completeness. The discipline checks will be documented on standard MWH calculation forms that are used to document design analyses and calculations, and include provision for documentation of checking and review. The appropriate form to be used will be selected by the type of analysis that is conducted. For design products such as drawings and specifications, the checking history and personnel will be provided in appropriate locations on these documents.

1.9 Constructability, Biddability, and Operability Reviewers

An individual(s) with significant construction and procurement experience will review the design to confirm it can reasonably be constructed and that the relevant information is available to obtain realistic construction bids. An individual with O&M experience will review the design documents to evaluate the ease with which the completed project can be operated and maintained. The overall goals of the constructability, biddability, and operability reviews are to confirm that the design can be efficiently constructed with minimal cost and schedule growth, and to assure safe and efficient operations by the end user.

1.10 Cost and Schedule Reviewers

MWH professionals with significant and relevant construction experience will review the RD cost estimates and schedules for accuracy and reasonableness.

2.0 QA/QC MECHANISMS

The following mechanisms will be used to assure that the remedial design is completed in a high quality manner:

- Criteria Committee Meetings
- Design checks at each design phase
- Operability reviews
- Constructability reviews
- Biddability reviews
- Technical Manager meetings
- Subcontractor reviews

Each quality check mechanism is summarized below.

2.1 Criteria Committee Meetings

Criteria Committee Meetings (CCMs) are internal project review meetings with both the project team and outside experts to obtain input from experienced individuals at critical junctures in the project. The CCM members are selected from the most current list of MWH technical experts, and include MWH staff members from outside the Project Team that are experienced in similar projects. The first CCM will be held early in the design phase to set appropriate criteria and direction for the work. A second CCM will be held at the 60% design stage to provide continued input throughout the project. Meeting participants and CCM members will remain consistent between meetings to provide important continuity in quality review throughout the early and middle stages of the design. The objectives of the meetings are to critically review the project scope and direction, criteria, budget, and schedule. Minutes of the CCMs will be sent to each participant.

2.2 Design Checks

Design checks are crucial to the overall success of the remedial design process and will consist of the following:

- A design check will be performed at every phase of the design process, with the level of effort increasing as the design progresses.
- The design checks will be performed by a senior person within the appropriate discipline.
- The Project Reviewer will verify that all components of the design have been checked. In some cases, particularly in the early phases of design, the Project Reviewer also may conduct the checks.
- **30 Percent Design Check:** Checking will include the following:
  - Review the design criteria and assumptions.
  - Check and approve all calculations.
  - Review the Basis of Design Report and associated planning documents.
  - Check and approve drawings.
  - Review the specifications outline.
  - Review construction cost estimate and schedule.
  - Perform a Constructability and Operability Review as discussed later in this section.
- **60 Percent Design Check:** If FMC determines that an Intermediate Design is required for the groundwater remedy, checking will include the following:
  - Review the technical specifications.
  - Check and approve all calculations and equipment data sheets.
  - Check and approve drawings.
  - Review the construction cost estimate and schedule.
  - Review the Construction Quality Assurance Plan.
  - Review the Basis of Design Report.
  - Perform a Constructability and Operability Review as discussed later in this section.
- **90/95 Percent Design Check:** Checking will include the following:
  - Perform Discipline Checks. This is accomplished by having a senior person within each discipline review the calculations, specifications, and drawings for that aspect of the design.
  - Perform Inter-discipline Check. After the comments from the Discipline Checkers have been incorporated, a complete set of drawings, specifications, calculations, and previous review comments are given to a single, qualified individual who is familiar with the project. The Project Reviewer often serves this role. The Project Reviewer

conducts a detailed item-by-item check of all the documents.

    - Review the detailed construction cost estimate and schedule.
    - Perform a Biddability Review as described later in this section.
    - Review updated sections of the Basis of Design Report.

- **<u>100 Percent (Final) Design Check</u>:** Checking will include the following:

    - Verify that design changes are technically sound and do not compromise the integrity of the project or create a potential safety hazard. If necessary, have the Criteria Committee members evaluate the effects of modifications (see Section 2.1).
    - Verify that changes have been incorporated into the drawings, specifications, design analysis, and cost estimate.
    - Conduct final check and approve the drawings.

2.3 Constructability Reviews

A constructability review will be conducted after completing the 30% (and 60%, if required) Design phase to evaluate the ease and efficiency with which the design can be built. The goals of the review are to confirm that the design documents are sufficient to ensure a safe, cost-effective, quality construction and to investigate opportunities for cost reduction and construction schedule improvements. The review focuses on determining the following:

- Can the work be executed as shown?
- Are there conflicts between the specifications and drawings?
- Can the project be completed within the time frame allotted?

Constructability reviews allow for evaluation of the design for accuracy and completeness and provide an opportunity to eliminate impractical and inefficient requirements as well as deficiencies in the contract documents. Involvement of experienced construction personnel ensures that their knowledge can guide the designers to deliver the best possible project at the best value. Projects designed with constructability in mind can result in lower contract prices and minimization of risks. Attention to constructability also facilitates timely completion of the project while minimizing potential contractor claims.

2.4 Operability Reviews

An operability review will be conducted after completing the 30% (and 60%, if required) Design phase. The review determines if the facilities associated with the Selected Remedy can be operated and maintained with a reasonable level of effort, and without creating a health and safety hazard for the operators or the general public. For the FMC OU selected remedy, these reviews would include the groundwater extraction system pumping and conveyance systems (for water management option A) and would also include the treatment process and percolation pond(s) (for water management option B). The review will be performed by a professional or professionals with experience in the startup and/or operation of similar facilities.

2.5 Biddability Reviews

At the 90/95% Design stage, the drawings and specifications will be reviewed to assess the ease with which a construction contractor can bid the job. The purpose of the biddability review is to define the degree to which the design documents can be understood, readily bid, administered, and enforced during project construction. Objectives of the biddability review are to identify and correct any significant design errors, omissions, and ambiguities in the construction bid package so that prospective bidders can respond in an informed manner and with realistic cost proposals. In this review, the design is analyzed for consistency with the bid documents, and the bid and design documents are assessed to confirm they are clear, comprehensive, and manageable. The review also assesses whether the schedule in the contract documents is reasonable for the work to be completed.

2.6 Technical Manager Meetings

The Technical Manager meetings described in Section 1.2 of the RD Work Plan will include reviews of QA/QC activities and results to date. These meetings also will be used to discuss particular design elements and any problems encountered during the design preparation so that brainstorming among the group participants can occur and resolutions can be made to advance the design process. The planned next steps in the RD will be discussed during these meetings. EPA input will be solicited for concurrence that the ongoing and planned QA/QC processes and solutions for design problems are adequate.

2.7 Subcontractor Reviews

It is anticipated that subcontractor review of select portions of the design will be solicited at various stages of the RD process. These may include additional constructability and biddability reviews from construction contractors or technical review by specialty firms (e.g., geotechnical or water treatment engineering firms).

APPENDIX B

EXAMPLE DESIGN DRAWINGS

GENERAL:

1. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING IMPROVEMENTS WHICH ARE TO REMAIN IN PLACE FROM DAMAGE. ALL IMPROVEMENTS DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE EXPEDITIOUSLY REPAIRED OR RECONSTRUCTED AT THE CONTRACTOR'S EXPENSE WITHOUT ADDITIONAL COMPENSATION.
2. ALL BUILDING COORDINATES ARE TO OUTSIDE CORNER OF COLUMN OR BUILDING.
3. CONTRACTOR SHALL RESTORE ALL SURVEY MONUMENTS THAT ARE DAMAGED OR DESTROYED DURING CONSTRUCTION.

UTILITIES:

1. PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR SHALL LOCATE ALL EXISTING UTILITIES IN AND AROUND THE AREAS OF NEW CONSTRUCTION. THE CONTRACTOR SHALL POTHOLE FOR EXISTING UTILITIES PRIOR TO SUBMITTAL OF SHOP DRAWINGS, FOR POINTS OF CONNECTIONS.
2. THE CONTRACTOR SHALL PROTECT ALL REMAINING EXISTING UTILITIES.
3. LOCATIONS OF UNDERGROUND UTILITIES SHOWN ON THE DRAWINGS WERE OBTAINED FROM AVAILABLE RECORDS. THE CONTRACTOR SHALL VERIFY ALL LOCATIONS AND ELEVATIONS AND SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT UTILITY LINES WHETHER SHOWN OR NOT SHOWN.
4. PRIOR TO ANY CONNECTION TO AN EXISTING UTILITY, THE CONTRACTOR SHALL COORDINATE WITH THE UTILITY OWNER.
5. PRIOR TO ANY EXCAVATION IN THE VICINITY OF ANY EXISTING UNDERGROUND FACILITIES, INCLUDING ALL WATER, SEWER, STORM DRAIN, GAS, PETROLEUM PRODUCTS, OR OTHER PIPELINES; ALL BURIED ELECTRIC POWER, COMMUNICATIONS, OR TELEVISION CABLES; ALL TRAFFIC SIGNAL AND STREET LIGHTING FACILITIES; AND ALL ROADWAY, STATE HIGHWAY, AND RAILROAD RIGHTS-OF-WAY, THE CONTRACTOR. SHALL NOTIFY THE RESPECTIVE AUTHORITIES REPRESENTING THE OWNERS OR AGENCIES RESPONSIBLE FOR SUCH FACILITIES NOT LESS THAN 3 DAYS NOR MORE THAN 7 DAYS PRIOR TO EXCAVATION SO THAT A REPRESENTATIVE OF SAID OWNERS OR AGENCIES CAN BE PRESENT DURING SUCH WORK IF THEY SO DESIRE. IN THE CASE OF THE UNDERGROUND UTILITY SERVICE ALERT CENTER, THIS NOTICE WILL GIVE THEM TIME TO MARK THE LOCATION OF THE UTILITIES. THE CONTRACTOR SHALL ALSO NOTIFY THE REGIONAL OR LOCAL UNDERGROUND SERVICE ALERT COMPANY AT LEAST 3 DAYS, BUT NO MORE THAN 7 DAYS, PRIOR TO SUCH EXCAVATION.

PIPING:

1. THE CONTRACTOR SHALL COMPLY WITH THE STATE DEPARTMENT OF HEALTH SERVICES CRITERIA FOR THE SEPARATION OF WATER MAINS AND SANITARY SEWERS.
2. THE CONTRACTOR SHALL PROVIDE A MINIMUM OF 36 INCHES OF COVER ON ALL PIPELINES UNLESS OTHERWISE SHOWN OR DIRECTED.
3. STRAIGHT SLOPES SHALL BE MAINTAINED BETWEEN INVERT ELEVATIONS SHOWN OR SPECIFIED.
4. THE CONTRACTOR SHALL ADJUST ALL VALVE BOXES, PULL BOXES AND MANHOLES TO FINISHED GRADE UNLESS OTHERWISE SHOWN OR SPECIFIED. MANHOLES IN OPEN FIELDS SHALL BE SET ONE FOOT ABOVE GRADE. APPROXIMATE RIM ELEVATIONS ARE SHOWN ON DRAWINGS.

EROSION CONTROL:

1. THE CONTRACTOR SHALL SUBMIT AN EROSION CONTROL PLAN FOR WORK PRIOR TO THE START OF CONSTRUCTION.
   a. ALL SLOPES SHALL BE PROTECTED FROM EROSION ...G ROUGH GRADING OPERATIONS AND THEREAFTER, UNTIL IN...ALLA... OF FINAL GROUNDCOVER.
   b. ALL SLOPE PROTECTION SWALES SHALL ... CONSTRUCTE... AT THE SAME TIME AS BANKS ARE GRADED.
   c. THE CONTRACTOR IS RESPONSI... ...ENTAT... AND MAINTENANCE OF EROSION CONTROL M... ...CO...AINED WITHIN THE CONTRACT SPECIFICATIONS OR AS REQU... ...E CITY, DISTRICT, OR OTHER REGULATORY AUTHORITY. THE C... ...R SHALL ALSO PROVIDE ANY ADDITIONAL EROSION CONTROL ... (E.G. HYDROSEEDING, MULCHING OF STRAW, SAND ... ...VERS... DITCHES, ETC.) DICTATED BY FIELD CONDITIONS ... EROSION OR THE INTRODUCTION OF DIRT, MUD, OR DEBRIS ...ISTING PUBLIC STREETS, WATERWAYS, OR ONTO ADJACENT ...ERTIES DURING ANY PHASE OF CONSTRUCTION OPERATIONS.

ACRONYMS:

AC	ASPHALT CONCRETE
AMSL	ABOVE MEAN SEA LEVEL
BH	BORE HOLE
CH	CORE HOLE
CGS	CLEARING, GRUBBING, STRIPPING
CMP	CORRUGATED METAL PIPE
CND	CONDUIT
CONT	CONTINUOUS
CPT	CORRUGATED POLYETHYLENE TUBING
℄	CENTER LINE
CY	CUBIC YARD
DI	DUCTILE IRON
DIA	DIAMETER
DS	DOWNSTREAM
EL	ELEVATION
ENV	ENVIRONMENTAL
EOP	EDGE OF PAVEMENT
EQUIV	EQUIVALENT
GB	GRADE BREAK
HOR	HORIZONTAL
HDPE	HIGH DENSITY P...
HWL	HIGH WATER LINE
ID	INSIDE DIAMETER
INV	...ERT
LCRS	...LECTI... AND RECOV... SYSTEM
LLDPE	LINEA... ...OLYETHY...ENE
LF	...EAL FOOT
LWL	LO... WATER LINE
MAX	MAXIM...
	I/1000T... OF AN INCH
	MINIMUM
...W	MONITORING WELL
MH	MANHOLE
MSL	MEAN SEA LEVEL
NFWE	NO FREE WATER ENCOUNTERED
NO	NUMBER
NOM	NOMINAL
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
PC	POINT OF CURVE
PCC	POINT OF COMPOUND CURVE
PI	POINT OF INTERSECTION
PRC	POINT OF RETURN CURVE
PT	POINT OF TANGENCY
PVC	POINT OF VERTICAL TANGENT
PVC	POLYVINYL CHLORIDE
PSI	POUNDS PER SQUARE INCH
PVC	POINT OF VERTICAL CURVE
PVC	POLYVINYL CHLORIDE
RCP	REINFORCED CONCRETE PIPE

ACRONYMS (CONT'D):

REQ'D	REQUIRED
R.O.W.	RIGHT OF WAY
SCH	SCH...
SDR	...TANDARD DIMENSIONAL RATIO
SDR	STANDARD DIMENSION RATIO
SPE...	SPECIFICA...S
...S	STAIN...SS STEEL
STA	...TION
TOC	... CONCRET...
TP	
TYP	TYP...
US	UP...TREAM
FS	UNITED STATES DEPARTMENT OF THE INTERIOR FOREST SERVICE
VERT	VERTICAL
V...E	VERY LOW DENSITY POLYETHYLENE

IMPERIAL UNITS:

" OR IN	INCHES
OZ	OUNCES
F	FAHRENHEIT
' OR FT	FEET
MI	MILES
YD	YARD
SQ MI	SQUARE MILES
AC	ACRE
AC-FT	ACRE-FEET
° OR DEGREES	DEGREES
4.9%	SLOPE GRADE

ISSUE/REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW AND COMMENT	DM	PC	07/29/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	PC	FA	

DRAWING REFERENCE(S):

DESIGNED BY	C. STRACHAN	07/15/10
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APPROVED BY	P. CROUSE	07/29/11
PROJECT MANAGER	V. DRAIN	07/29/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

FMC Corporation

PROJECT LOCATION: FMC OU, Idaho

PROJECT: REMEDIAL DESIGN FOR FMC OU INFRASTRUCTURE

TITLE: GENERAL NOTES AND ACRONYMS

SHEET: 1-7 REVISION: E

FILE NAME: 1008679D051

MWH

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LEGEND:

- 5280 — APPROXIMATE EXISTING GROUND SURFACE CONTOURS AND ELEVATION, FEET
- APPROXIMATE LIMITS OF CLEARING AND GRUBBING
- CIVIL TOWNSHIP OR EQUIVALENT BOUNDARY
- CONTROL LINE AND/OR ROAD CENTERLINE
- COUNTY OR EQUIVALENT BOUNDARY
- CREEK
- 5275 — DESIGN CONTOUR AND ELEVATION, FEET
- DIRT ROAD
- E — ELECTRIC
- W — EXISTING POTABLE WATER PIPELINE
- RW — EXISTING RAW WATER PIPELINE
- X — FENCE
- WILDERNESS BOUNDARY
- INCORPORATED CITY OR EQUIVALENT BOUNDARY
- INVENTORIED ROADLESS AREA
- LATE SUCCESSIONAL RESERVE (LSR)
- NATURAL DRAINAGE
- NEW PIPELINE
- OHP — OVERHEAD POWER
- PATENTED MINE CLAIM BOUNDARY
- PAVED ROAD
- W — POTABLE WATER PIPELINE
- PRIMARY HIGHWAY
- BANK FULL WATER SURFACE BASED ON 2 YEAR FLOW MODELED WITH HEC–RAS
- SS — SANITARY SEWER
- SECTION LINE
- ST — STORM SEWER
- SURFACE WATER FLOW DIRECTION
- TRAIL
- UGE — UNDERGROUND ELECTRIC
- USFS RIPARIAN AND WETLAND DELINEATION
- WATERSHED BOUNDARY

MISCELLANEOUS SYMBOLS:

- ALIQUOT SECTION CORNER
- ARTESIAN WELL
- BENCH MARK
- CORNER MARKER POST
- 5332.785 — HORIZONTAL AND VERTICAL SURVEY CONTROL POINT AND ELEVATION
- LIGHT POLE
- MANHOLE
- MINE ADIT
- POWER POLE
- SECTION CORNER/CONTR... ...ENT
- 22 — SECTION NUMBER

MISCELLANEOUS SYMBOLS (CONT'D):

- BRIDGE
- 141 — COUNTY HIGHWAY
- CULVERT
- 3:1 — CUT SLOPE, H:V (HORIZONTAL TO VERTICAL)
- 1/1 — DETAIL IDENTIFICATION; DRAWING No. WHERE DETAIL IS SHOWN
- 1/- — DETAIL IDENTIFICATION; DETAIL SHOWN ON SAME SHEET AS ORIGINALLY IDENTIFIED
- EXISTING VEGETATION
- 3:1 — FILL SLOPE, H:V (HORIZONTAL TO VERT...
- 3156.4 / 3148.1 — FINAL DESIGN ELEVATION; APPROXIMA... GROUND SU... ELEVATION
- HO...ZONTAL TANK
- Mi 2
- 1% — PERCE... SLOPE
- PROFILE OR ... SECTION IDEN...CATION; ...ING NO. WHERE ...OFILE/SECTION IS SHOWN
- 119 — STATE HIGHWAY
- 2 / 1 — SLOPE RATIO
- STRUCTURE
- 50 — U.S. HIGHWAY
- VERTICAL TANK

INVESTIGATION LOCATION SYMBOLS:

- HISTORICAL INVESTIGATION LOCATIONS (BY OTHERS)
- TP1-1BB — BATT TIP
- CPT-1 — CONE PEN...METER TEST PROBE
- CH-3 — COR... HOLE
- SG-1-WP — DRIVEN WELL ...INT
- SP... — ...TECHNIC... ...G EXP...ATION
- HB-1 — ...GER
- TP2-9L — LY...
- P-1 (HC-1975) — PERME...
- RC-6-PW-12 — PORE WA...ER SAMPLER
- P-1 — ...RTAL DRAINAGE
- SP-3 — SEEP
- STAFF GAUGE
- RC-7 — SURFACE WATER
- TP-5 — TEST PIT
- 1S/1I/1D — WELL (S = SHALLOW, I= INTERMEDIATE D = DEEP)

ISSUE/REV	DESCRIPTION	TECH	ENG	DATE
B	ISSUED FOR AGENCY REVIEW AND COMMENT	DM	PC	07/29/11
A	ISSUED FOR CLIENT REVIEW AND COMMENT	PC	FA	

DRAWING REFERENCE(S):

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CHECKED BY	D. RODRIGUEZ	07/15/10
APPROVED BY	P. CROUSE	07/29/11
PROJECT MANAGER	V. DRAIN	07/29/11
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

FMC Corporation

PROJECT LOCATION: FMC OU, Idaho

PROJECT: REMEDIAL DESIGN FOR FMC OU INFRASTRUCTURE

TITLE: MASTER LEGEND

MWH

SHEET: 1-6 REVISION: E

FILE NAME: 1008679D037

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APPENDIX C

EXAMPLE EARTHWORK SPECIFICATIONS

SECTION 02200 – EARTHWORK

PART 1 -- GENERAL

1.1 SUMMARY

A. The CONTRACTOR shall perform earthwork as indicated and required for construction of the WORK, complete and in place, in accordance with the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

A. Samples:

1. The CONTRACTOR shall submit samples of materials proposed for the WORK in conformance with the requirements of Section 01300 – Contractor Submittals.

2. Sample sizes shall be as determined by the testing laboratory.

PART 2 -- PRODUCTS

2.1 FILL AND BACKFILL MATERIAL REQUIREMENTS

A. General:

1. Fill, backfill, and embankment materials shall be selected or shall be processed and clean fine earth, rock, gravel, or sand, free from grass, roots, brush, other vegetation and organic matter.

2. Fill and backfill materials that are to be placed within 6 inches of any structure or pipe shall be free of rocks or unbroken masses of earth materials having a maximum dimension larger than 3 inches.

B. Suitable Materials:

1. Materials not defined below as unsuitable will be considered as suitable materials and may be used in fills, backfilling, and embankment construction, subject to the indicated requirements.

2. If acceptable to the ENGINEER, some of the material listed as unsuitable may be used when thoroughly mixed with suitable material to form a stable composite.

3. Mixing or blending of materials to obtain a suitable composite is the CONTRACTOR's option but is subject to the approval of the ENGINEER.

4. The CONTRACTOR shall submit certification to the ENGINEER that the chloride concentration in imported materials within the pipe zone does not exceed 100 ppm, when tested in accordance with the requirements of AASHTO T291-94 – Standard Method of Test for determining Water-Soluble Chloride Ion Content in Soil.

5. Suitable materials may be obtained from on-Site excavations, may be processed on-Site materials, or may be imported.

6. If imported materials are required by this Section or are required in order to meet the quantity requirements of the WORK, the CONTRACTOR shall provide the imported materials as part of the WORK,unless a unit price item is included for imported materials in the Bidding Schedule.

C. The following types of materials are defined:

Soil Class	Soil Type[1]	Description of Material Classification	Acceptable Areas
Class I[3,4]	GW	Well-graded gravels and gravel-sand mixtures with little or no fines. 50 percent or more retained in the No. 4 sieve.	As per Drawings
	GP	Poorly graded gravels and gravel-sand mixtures with little or no fines. 50 percent or more retained on the No. 4 sieve. More than 95 percent retained in the No. 200 sieve.	As per Drawings
	SW	Well graded sands and gravelly sands with little or no fines. More than 50 percent passing the No. 4 sieve and more than 95 percent retained on the No. 200 sieve.	As per Drawings
	SP	Poorly graded sands and gravelly sands with little or no fines. More than 50 percent passing the No. 4 sieve and more than 95 percent retained on the No. 200 sieve.	As per Drawings
Class II	GM	Silty gravels, gravelly-sand-silt mixtures. 50 percent or more retained on the No. 4 sieve. Less than 88 percent retained on the No. 200 sieve.	As per Drawings
	GC	Clayey gravels, gravelly-sand-silt mixtures. 50 percent or more retained on the No. 4 sieve. Less than 88 percent retained on the No. 200 sieve.	As per Drawings
	SM	Silty sands, sand-silt mixtures. More than 50 percent passing the No. 4 sieve. Less than 88 percent retained on the No. 200 sieve.	As per Drawings
	SC	Clayey sands, sand-clay mixtures. More than 50 percent passing the No. 4 sieve. Less than 88 percent retained on the No. 200 sieve.	As per Drawings
Class III	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands. Liquid limit 50 percent or less. 50 percent or more passing the No. 200 sieve.	As per Drawings

Soil Class	Soil Type[1]	Description of Material Classification	Acceptable Areas
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays. Liquid limit 50 percent or less. 50 percent or more passing the No. 200 sieve.	As per Drawings
	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts. Liquid limit greater than 50 percent. 50 percent or more passing the No. 200 sieve.	None – Material is unsuitable
	CH	Inorganic clays of high plasticity, fat clays. Liquid limit greater than 50 percent. 50 percent or more passing the No. 200 sieve.	None – Material is unsuitable
Class IV	OL	Organic silts and organic silty clays of low plasticity. Liquid limit of 50 percent or less. 50 percent or more passing the No. 200 sieve.	None – Material is unsuitable
	OH	Organic clays of medium to high plasticity. Liquid limit greater than 50 percent. 50 percent or more passing the No. 200 sieve.	None – Material is unsuitable
	PT	Peat, muck, and other highly organic soils.	None – Material is unsuitable
Class V	Base Course	Aggregates that consist of hard, durable particles or fragments of crushed stone. Free of lumps or balls of clay. Meeting the following gradation, and Attterberg limits. Liquid Limit ASTM D4318-10 – 25 (max) Plastic Limit ASTM D4318-10 – Nonplastic	As per Drawings

Sieve Size	% by Mass Passing Designated Sieve (ASTM D422)		
	Grade A	Grade B	Grade C
2	100		
1.5	97-100	100	
1		97-100	100
3/4			97-100

<table>
<tr><th>Soil Class</th><th>Soil Type[1]</th><th>Description of Material Classification</th><th>Acceptable Areas</th></tr>
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<tr><td>3/8</td><td></td><td>56-70(7)</td><td>67-79(6)</td></tr>
<tr><td>#4</td><td>40-60(8)*</td><td>39-53(6)</td><td>47-59(7)</td></tr>
<tr><td>#40</td><td></td><td>12-21(4)</td><td>12-21(4)</td></tr>
<tr><td>#200</td><td>0-12(4)</td><td>4-8(3)</td><td>4-8(3)</td></tr>
</table>
*- Allowable deviation
</td><td></td></tr>
<tr><td>Class VI</td><td>Wearing Course</td><td>
Aggregates that consist of hard, durable particles or fragments of crushed stone. Free of lumps or balls of clay. Meeting the following gradation, and Attterberg limits.
Liquid Limit ASTM D4318: 35 (max)
Plastic Limit ASTM D4318: Nonplastic
<table>
<tr><td>Sieve Size</td><td colspan="2">% by Mass Passing Designated Sieve (ASTM D422)</td></tr>
<tr><td></td><td>Grade A</td><td>Grade B</td></tr>
<tr><td>1.5</td><td>100</td><td></td></tr>
<tr><td>1</td><td>97-100</td><td>100</td></tr>
<tr><td>3/4</td><td>76-89(6)*</td><td>97-100</td></tr>
<tr><td>3/8</td><td>56-68(6)</td><td>70-80(6)</td></tr>
<tr><td>#4</td><td>43-53(7)*</td><td>51-63(7)</td></tr>
<tr><td>#16</td><td>23-32(6)</td><td>28-39(6)</td></tr>
<tr><td>#40</td><td>15-23(5)</td><td>19-27(5)</td></tr>
<tr><td>#200</td><td>10-16(4)</td><td>10-16(4)</td></tr>
</table>
*- Allowable deviation
</td><td>As per Drawings</td></tr>
<tr><td>Class VII</td><td>Topsoil</td><td>Stockpiled topsoil material from the Site obtained by removing soil. Removal of topsoil shall be done after the area has been stripped and grubbed of vegetation.</td><td>As per drawings</td></tr>
</table>

Soil Class	Soil Type[1]	Description of Material Classification	Acceptable Areas
NOTES: 1. Refers to ASTM D 2487 classifications for Classes I, II, III, IV, and V. 2. In accordance with ASTM D 2487, less than 5 percent passes the No. 200 sieve. 3. In accordance with ASTM D 2487, more than 12 percent passing the No. 200 sieve. Soils with 5 to 12 percent passing the No. 200 sieve fall in borderline classification such as GP-GC. If borderline classifications are proposed, approval shall be subject to the CONTRACTOR demonstrating its ability to control moisture content and achieve the required compaction. If the borderline classification is predominately an unsuitable material, the composite material shall be considered unsuitable.			

2.2 MATERIALS TESTING

A. Samples:

1. Soils testing of samples submitted by the CONTRACTOR will be performed by a testing laboratory of the OWNER's choice and at the CONTRACTOR's expense.

2. The ENGINEER may direct the CONTRACTOR to supply samples for testing of any material used in the WORK.

B. Particle size analysis of soils and aggregates will be performed using ASTM D 422 - Standard Test Method for Particle-Size Analysis of Soils.

C. Determination of sand equivalent value will be performed using ASTM D 2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

D. Unified Soil Classification System:

1. References in this Section to soil classification types and standards shall have the meanings and definitions indicated in ASTM D 2487.

2. The CONTRACTOR shall be bound by applicable provisions of ASTM D 2487 in the interpretation of soil classifications.

2.3 IDENTIFICATION TAPE

A. Unless otherwise indicated, identification tape shall be placed above buried pipelines that are not comprised of magnetic components at least in part. Curlverts are exempt from this requirement.

B. Identification tape shall be 6-inches wide, yellow in color, composed of polyethylene, and provided with an integral metallic wire.

C. Tape shall be labeled with CAUTION – BURIED UTILITIES.

PART 3 -- EXECUTION

3.1 EXCAVATION AND BACKFILLING - GENERAL

A. General:

1. Except when specifically provided to the contrary, excavation shall include the removal of materials, including obstructions, that would interfere with the proper execution and completion of the WORK.

2. The removal of such materials shall conform to the lines and grades indicated or ordered.

3. Unless otherwise indicated, the entire Site shall be stripped of vegetation and debris and shall be grubbed, and such material shall be removed from the Site prior to performing any excavation or placing any fill.

4. The CONTRACTOR shall furnish, place, and maintain supports and shoring that may be required for the sides of excavations.

5. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable state safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926).

6. The CONTRACTOR shall provide quantity surveys where so required to verify quantities for Unit Price Contracts.

7. Surveys shall be performed prior to beginning WORK and upon completion by a surveyor licensed in the state where the Site is located.

B. Removal and Exclusion of Water:

1. The CONTRACTOR shall remove and exclude water, including stormwater, groundwater, irrigation water, and wastewater, from excavations.

2. Dewatering wells, wellpoints, sump pumps, or other means shall be used to remove water and continuously maintain groundwater at a level at least 2 feet below the bottom of excavations before the excavation WORK begins at each location.

3. Water shall be removed and excluded until backfilling is complete and field soils testing has been completed.

3.2 OVER-EXCAVATION

A. Indicated:

1. Where areas are indicated to be over-excavated, excavation shall be to the depth indicated, and backfill shall be installed to the grade indicated.

B. Not Indicated:

1. When ordered to over-excavate areas deeper and/or wider than required by the Contract Documents, the CONTRACTOR shall over-excavate to the dimensions ordered and backfill to the indicated grade.

C. Neither Indicated nor Ordered:

1. Any over-excavation carried below the grade that is neither ordered or indicated shall be backfilled and compacted to the required grade with the indicated material as part of the WORK

3.3 EXCAVATION IN LAWN AREAS

A. Where excavation occurs in lawn areas, the sod shall be carefully removed, dampened, and stockpiled in order to preserve it for replacement.

B. Excavated material may be placed on the lawn, provided that a drop cloth or other suitable method is employed to protect the lawn from damage, but the lawn shall not remain covered for more than 72 hours.

C. Immediately after completion of backfilling and testing, the sod shall be replaced and lightly rolled in a manner as to restore the lawn as near as possible to its original condition.

D. The CONTRACTOR shall provide new sod if the stockpiled sod has not been replaced within 72 hours.

3.4 EXCAVATION IN VICINITY OF TREES

A. Except where trees are indicated to be removed, trees shall be protected from injury during construction operations.

B. Trees shall be supported during excavation by any means previously reviewed and accepted by the ENGINEER.

3.5 ROCK EXCAVATION

A. Rock excavation shall include removal and disposal of the following items:

1. rock material in ledges, bedding deposits, and un-stratified masses that cannot be removed using conventional equipment as defined herein and which require systematic drilling and blasting for removal;

2. concrete or masonry structures that have been abandoned; and,

3. conglomerate deposits that are so firmly cemented that they possess the characteristics of solid rock and cannot be removed using conventional equipment as herein defined and require systematic drilling and blasting for removal.

B. Scope and Payment:

1. Rock excavation shall be performed by the CONTRACTOR, provided that if the quantity of rock excavation is affected by any change in the scope of the WORK an appropriate adjustment of the Contract Price will be made under a separate Bid Item if such Bid Item has been established.

2. Otherwise, payment will be made in accordance with a negotiated price.

C. Explosives and Blasting: Blasting will not be permitted.

3.6 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. The CONTRACTOR shall be responsible for the removal and stockpiling of any excess excavated material according to Section 01552 – Staging and Stockpile Areas.

B. Material shall be disposed of at an approved on-Site disposal area or off-Site at a location arranged by the CONTRACTOR in accordance with laws and regulations regarding the disposal of such material.

3.7 STRUCTURE, ROADWAY, AND EMBANKMENT EXCAVATION AND BACKFILL

A. Excavation Beneath Structures and Embankments:

1. Except where indicated otherwise for a particular structure or where ordered by the ENGINEER, excavation shall be carried to an elevation 6 inches below the bottom of the footing or slab and brought back to grade with compacted materials acceptable for placement beneath structures.

2. The area where a fill or embankment is to be constructed shall be cleared of vegetation, roots, and foreign material.

3. Where indicated or ordered, areas beneath structures or fills shall be over-excavated.

4. The subgrade areas beneath embankments shall be excavated to remove all deleterious native material and where such subgrade is sloped, the native material shall be benched.

5. When such over-excavation is indicated, both the over-excavation and the subsequent backfill to the required grade shall be performed by the CONTRACTOR.

6. After the required excavation or over-excavation for fills and embankments has been completed, the exposed surface shall be scarified to a depth of 6 inches, brought to optimum moisture content, and rolled with heavy compaction equipment to obtain 95 percent of maximum density as determined by ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3).

B. Excavation Beneath Paved Areas:

1. Excavation under areas to be paved shall extend to the bottom of the aggregate base or subbase, if such base is called for; otherwise it shall extend to the paving thickness.

2. After the required excavation has been completed, the top 12 inches of exposed surface shall be scarified, brought to optimum moisture content, and rolled with heavy compaction equipment to obtain 95 percent of maximum density.

3. The finished subgrade shall be even, self-draining, and in conformance with the slope of the finished pavement.

4. Areas that could accumulate standing water shall be regraded to provide a self-draining subgrade.

C. Notification of ENGINEER:

1. The CONTRACTOR shall notify the ENGINEER at least 3 Days in advance of completion of any structure or roadway excavation and shall allow the ENGINEER a review period of at least one day before the exposed foundation is scarified and compacted or is covered with backfill or with any construction materials.

D. Compaction of Fill, Backfill, and Embankment Materials:

1. Each layer of backfill materials as defined herein, where the material is graded such that 10 percent or more passes a No. 4 sieve, shall be mechanically compacted to the indicated percentage of density.

2. Equipment that is consistently capable of achieving the required degree of compaction shall be used, and each layer shall be compacted over its entire area while the material is at the required moisture content.

3. Each layer of coarse granular backfill materials with less than 10 percent passing the No. 4 sieve shall be compacted by means of at least 2 passes from a vibratory compactor that is capable of obtaining the required density in 2 passes.

E. Flooding, ponding, and jetting shall not be used for backfill around structures, backfill around reservoir walls, for final backfill materials, or aggregate base materials.

F. Heavy Equipment:

1. Equipment weighing more than 10,000 pounds shall not be used closer to walls than a horizontal distance equal to the vertical depth of the fill above undisturbed soil at that time.

2. Hand-operated power compaction equipment shall be used where the use of heavier equipment is impractical or restricted due to weight limitations.

G. Layering:

1. Embankment and fill material shall be placed and spread evenly in approximately horizontal layers.

2. Each layer shall be moistened and aerated as necessary.

3. Unless otherwise approved by the ENGINEER, no layer shall exceed 6 inches of compacted thickness.

4. The embankment and fill shall be compacted in conformance with Paragraph K, below.

H. Embankments and Fills:

1. When an embankment or fill is to be constructed and compacted against hillsides or fill slopes steeper than 4:1, the slopes of the hillsides or fills shall be horizontally benched in order to key the embankment or fill to the underlying ground.

2. A minimum of 12 inches perpendicular to the slope of the hillside or fill shall be removed and re-compacted as the embankment or fill is brought up in layers.

3. Material thus cut shall be re-compacted along with the new material.

4. Hillside or fill slopes 4:1 or flatter shall be prepared in accordance with Paragraph A, above.

I. Compaction Requirements:

1. The following compaction requirements shall be in accordance with ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3) where the material is graded such that 10 percent or more passes a No. 4 sieve and in accordance with ASTM D 4253 - Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table, and D 4254 - Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density, where the material is coarse granular backfill materials with less than 10 percent passing the No. 4 sieve:

Location or Use of Fill or Backfill	Percentage of Maximum Dry Density	Percentage of Relative Density
Embankments and fills not identified otherwise	90	55
Embankments and fills beneath road areas or structures	95	70
Backfill beneath structures and hydraulic structures	95	70
Topsoil	80	NA
Base and wearing course	95	NA

2. All compaction shall be at plus or minus 2% of optimum moisture content as determined by ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3).

3.8 PIPELINE AND UTILITY TRENCH EXCAVATION AND BACKFILL

A. Exploratory Excavations:

1. The CONTRACTOR shall excavate and expose buried points of connection to existing utilities as indicated on the Drawings.

2. Excavation shall be performed prior to the preparation of Shop Drawings for connections and before the fabrication and installation of the pipe

3. The data obtained from exploratory excavations shall be used in preparing the Shop Drawings.

4. Data, including dates, locations excavated, and dimensioned sketches, shall be submitted to the ENGINEER within one week of excavation.

5. Damage to utilities from excavation activities shall be repaired by the CONTRACTOR at their expense.

B. General:

1. Unless otherwise indicated or ordered, excavation for pipelines and utilities shall be open-cut trenches with minimum widths as indicated.

2. Backfill shall not be dropped directly upon any structure or pipe.

3. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength to withstand the loads imposed.

4. Backfill around water-retaining structures shall not be placed until the structures have been tested, and the structures shall be full of water while backfill is being placed.

C. Trench Bottom:

1. Except where pipe bedding is required, the bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe.

2. Excavations for pipe bells and welding shall be made as required.

3. Where pipe bedding is required, the bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe bedding.

D. Open Trenches:

1. The maximum amount of open trench permitted in any one location shall be 500 feet or the length necessary to accommodate the amount of pipe installed in a single Day, whichever is greater.

2. Trenches shall be fully backfilled at the end of each Day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each Day.

3. These requirements for backfilling or use of steel plate will be waived in cases where the trench is located further than 100 feet from any traveled roadway or occupied structure; in such cases, however, barricades and warning signs meeting appropriate safety requirements shall be provided and maintained.

E. Embankments, Fills and Structural Backfills:

1. Where pipelines are to be installed in embankments, fills, or structure backfills, the fill shall be constructed to a level at least one foot above the top of the pipe before the trench is excavated.

2. Upon completion of the embankment or structural backfill, a trench conforming to the appropriate detail may be excavated and the pipe may be installed.

F. Trench Shield

1. If a moveable trench shield is used during excavation operations, the trench width shall be wider than the shield such that the shield is free to be lifted and then moved horizontally without binding against the trench sidewalls and causing sloughing or caving of the trench walls.

2. If the trench walls cave or slough, the trench shall be excavated as an open excavation with sloped sidewalls or with trench shoring, as indicated and as required by the pipe structural design.

3. If a moveable trench shield is used during excavation, pipe installation, and backfill operations, the shield shall be moved by lifting the shield free of the trench bottom or backfill and then moving the shield horizontally.

4. The CONTRACTOR shall not drag trench shields along the trench causing damage or displacement to the trench sidewalls, the pipe, or the bedding and backfill.

G. Placing and Spreading of Backfill Materials:

1. Each layer of coarse granular backfill materials with less than 10 percent passing the No. 4 sieve shall be compacted by means of at least 2 passes from a vibratory compactor that is capable of achieving the required density in 2 passes and that is acceptable to the ENGINEER.

2. Where such materials are used for pipe zone backfill, vibratory compaction shall be used at vertical intervals of the lesser of:

    a. one-half the diameter of the pipe; or

    b. 24 inches, measured in the uncompacted state.

3. In addition, these materials shall be subjected to vibratory compaction at the springline of the pipe and the top of the pipe zone backfill, regardless of whether that dimension is less than 24 inches or not.

4. Each layer of backfill material with greater than 10 percent passing the No. 4 sieve shall be compacted using mechanical compactors suitable for the WORK.

5. The material shall be placed and compacted under the haunch of the pipe and up each side evenly so as not to move the pipe during the placement of the backfill.

6. The material shall be placed in lifts that will not exceed 6 inches when compacted to the required density.

7. During spreading, each layer shall be thoroughly mixed as necessary in order to promote uniformity of material in each layer.

H. Mechanical Compaction:

1. Backfill around and over pipelines that is mechanically compacted shall be compacted using light, hand-operated vibratory compactors and rollers that do not damage the pipe.

2. After completion of at least 2 feet of compacted backfill over the top of pipeline, compaction equipment weighing no more than 8,000 pounds may be used to complete the trench backfill.

I. Pre-Placement Conditions:

1. Immediately prior to placement of backfill materials, the bottoms and sidewalls of trenches and structure excavations shall have any loose, sloughing, or caving soil and rock materials removed.

2. Trench sidewalls shall consist of excavated surfaces that are in a relatively undisturbed condition before placement of backfill materials.

J. Pipe And Utility Trench Backfill:

1. Pipe Zone Backfill

a. Definitions

1) The pipe zone is defined as that portion of the vertical trench cross-section lying between a plane below the bottom surface of the pipe and a plane at a point above the top surface of the pipe as indicated.

2) The bedding is defined as that portion of pipe zone backfill material between the trench subgrade and the bottom of the pipe.

3) The embedment is defined as that portion of the pipe zone backfill material between the bedding and a level line as indicated.

b. Final Trim

1) After compacting the bedding, the CONTRACTOR shall perform a final trim using a stringline for establishing grade, such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe.

2) Excavation for pipe bells and welding shall be made as required.

c. The pipe zone shall be backfilled with the indicated backfill material.

d. Pipe zone backfill materials shall be manually spread evenly around the pipe, maintaining the same height on both sides of the pipe such that when compacted the pipe zone backfill will provide uniform bearing and side support.

e. The CONTRACTOR shall exercise care in order to prevent damage to the pipeline coating, cathodic bonds, and the pipe itself during the installation and backfill operations.

2. Trench Zone Backfill

a. After the pipe zone backfill has been placed, backfilling of the trench zone may proceed.

b. The trench zone is defined as that portion of the vertical trench cross-section lying as indicated between a plane above the top surface of the pipe and a plane at a point 18 inches below the finished surface grade, or if the trench is under pavement, 18 inches below the roadway subgrade.

3. Final Backfill

    a. Final backfill is defined as backfill in the trench cross-sectional area within 18 inches of finished grade, or if the trench is under pavement, backfill within 18 inches of the roadway subgrade.

K. Except for drainrock materials being placed in over-excavated areas or trenches, backfill shall be placed after water is removed from the excavation and the trench sidewalls and bottom have been dried to a moisture content suitable for compaction.

L. Layering:

1. Backfill materials shall be placed and spread evenly in layers.

2. When compaction is achieved using mechanical equipment, the layers shall be evenly spread such that when compacted each layer shall not exceed 6 inches in thickness.

M. Identification Tape

1. Install identification tape as indicated.

2. Terminate the tape in a precast concrete box either adjacent to or part of the valve box, manhole, vault, or other structure into which the non-metallic pipe enters or at the end of the non-metallic pipeline.

3. The termination box shall be covered with a cast iron lid.

4. The box shall be located at grade in paved areas or 6 inches above grade in unpaved areas.

N. Trench Shield:

1. If a moveable trench shield is used during backfill operations, the shield shall be lifted to a location above each layer of backfill material prior to compaction of the layer.

2. The CONTRACTOR shall not displace the pipe or backfill while the shield is being moved.

O. Compaction Requirements:

1. The following compaction requirements shall be in accordance with ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3) where the material is graded such that 10 percent or more passes a No. 4 sieve, and in accordance with ASTM D 4253 - Standard Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table, and D 4254 - Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density where the material is coarse granular backfill materials with less than 10 percent passing the No. 4 sieve.

Location or Use of Fill or Backfill	Percentage of Maximum Dry Density	Percentage of Relative Density
Pipe embedment backfill for flexible pipe.	95	70
Pipe bedding and over-excavated zones under bedding for flexible pipe,.	95	70
Pipe embedment backfill for steel yard piping	---	70
Pipe zone backfill portion above embedment for flexible pipe	95	70

2. All compaction shall be at plus or minus 2% of optimum moisture content as determined by ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3)

3.9 FIELD TESTING

A. General:

1. Field soils testing will be performed by a testing laboratory of the OWNER's choice at the OWNER's expense, except as indicated below.

B. Density:

1. Where soil material is required to be compacted to a percentage of maximum density, the maximum density at optimum moisture content will be determined in accordance with ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3).

2. Where cohesionless, free draining soil material is required to be compacted to a percentage of relative density, the calculation of relative density will be determined in accordance with ASTM D 4253 and D 4254.

3. Field density in-place tests will be performed in accordance with ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method, ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place By Nuclear Methods (Shallow Depth), or by such other means acceptable to the ENGINEER.

C. Remediation:

1. In case the test of the fill or backfill shows non-compliance with the required density, the CONTRACTOR shall accomplish such remedy as may be required to ensure compliance.

2. Subsequent testing to show compliance shall be by a testing laboratory selected by the OWNER and paid by the CONTRACTOR.

D. CONTRACTOR's Responsibilities:

1. The CONTRACTOR shall provide test trenches and excavations, including excavation, trench support and groundwater removal for the OWNER's field soils testing operations.

2. The trenches and excavations shall be provided at the locations and to the depths as required by the OWNER.

- END OF SECTION -

APPENDIX D

EPA AND AGENCY COMMENTS ON THE

REMEDIAL DESIGN WORK PLAN (AUGUST 2013)

AND FMC RESPONSES/REVISIONS

FMC Responses to EPA Comments, dated October 25 and received October 28, 2013, and IDEQ C and SBT Comments, dated October 2013, on the Remedial Design Work Plan submitted August 12, 2013
November 11, 2013

TECHNICAL REVIEW COMMENTS ON THE REMEDIAL DESIGN WORK PLAN FOR THE FMC OU DATED AUGUST 2013

October 25, 2013

General Comments

1. Sections 4.1 through 4.4 discuss the remedy elements while Section 6 presents the project schedule. Including the following items in the plan would facilitate the understanding of the deliverables and schedule for the project:

   - In Section 4, include a list of anticipated deliverables under each remedy element and include a summary table that shows which remedy elements (if any) will be combined into a single set of project documents.

   - In Section 6, modify the existing Table 6-1 or create a new table that includes the anticipated schedule for the deliverables associated with each remedy element.

   FMC Response: As suggested by the comment, a new Table 4-1 has been added to the Work Plan that "maps" the remedy elements to the planned deliverables. Note that current Tables 4-1 and 4-2 have been renumbered as appropriate. As shown on the new Table 4-1, the majority of the elements will be combined in the remedy design and engineering design submittals and Remedial Action Work Plans for the soil and groundwater remedies. Adding the same list of deliverables that are now contained in Table 4-1 repetitively in the text for the remedy elements would be highly redundant and does not appear to add substantive value to the Work Plan.

   Modifying the existing Tables 6-1 and 6-2 to include the remedy elements would require redundant listing of the elements and make those tables cumbersome. A new table that adds schedule dates from Tables 1 and 2 to the new Table 4-1 (remedy elements mapped to the planned deliverables) was considered; however, such a table does not add any new information. As Tables 6-1 and 6-2 have been, and will likely continue to be, updated in monthly reports, propagating dates that are subject to revision into an additional table(s) would likely be more confusing than limiting dates to the schedules laid out in Tables 6-1 and 6-2.

Specific Comments

1. 2.1.5 Hydrology and Hydrogeologic Setting, page 2-3
   A statement was provided in the text that reads "*Between I-86 and American Falls Reservoir, the Michaud Flats aquifer system discharges 200 cubic feet per second (cfs) of groundwater to the Portneuf River*". No reference was provided on how that flow or discharge of the

groundwater was determined. A reference should be provided. It may be better or more relevant to this cleanup instead to include in this text the amount of groundwater that discharges to the Portneuf River from the FMC plant with a reference.

FMC Response: The sentence was taken directly from the Regional Hydrogeologic Setting (Section 3.3-1) of the EMF RI Report; a reference has been added to the text. As suggested in Appendix A of EPA's Guidance for Scoping the Remedial Design (EPA/540/R-95/025), March 1995, Section 2.1 presents a background summary setting forth a brief description of the site including the geographic location and a description of the physiographic, hydrologic, geologic, etc. features of the site. FMC has not independently estimated the groundwater flow flux from the FMC plant that discharges to the Portneuf River. However, a sentence has been added at the end of Section 2.1.5 as follows:

> "Total groundwater discharge to the Portneuf River from the west, including flow from the EMF Site, in the area between and including Swanson Road Spring and Batiste Spring has been estimated to be between 36 to 55.5 cfs (Groundwater Model Report; MWH, 2010b) and approximately 20 cfs (Simplot, 2013)."

"Simplot, 2013. 2012 Annual Report, Groundwater / Surface Water Remedy, Simplot Operable Unit, Prepared by Formation Environmental, May 2013" has been added to Section 7 (References).

2. 3.1.3 Preliminary Extracted Groundwater Management Options Design, Option B, page 3-5 Total phosphorus (orthophosphate) should also be included or be considered for treatment. Table 3-1 selected monitoring wells that are cross-gradient and down-gradient of the extraction network. This table should select data or groundwater quality of the monitoring wells directly up-gradient of the extraction system or within the flow path. These groundwater concentrations would be equal or greater than the Pocatello POTW influent standards. Table 4-2 in this document shows a maximum detection concentration of 697 mg/L of Phosphorus.

   FMC Response: The introduction to Section 3.1 (Completed Studies Relevant to the RD) makes clear the design studies summarized in this section were components of the SFS and are included to provide relevant background for the design work. The summaries are not (and were not intended to be) comprehensive and the reference documents cited in Section 3.1 should be referenced if more detailed information is required. The preliminary design for the groundwater chemical precipitation and filtration treatment system described in the SFS Report and summarized in the Work Plan will remove phosphorus. As stated in the Work Plan, "chemical precipitation (when combined with filtration) is capable of removing all COCs that would exceed the MCLs or other remedial action criteria in extracted groundwater" and as noted in the comment, phosphorus is identified as a groundwater COC in Table 4-2 of the Work Plan. FMC has previously responded to the portion of the comment regarding the selection of wells used on Table 3-1, most recently in FMC's response to EPA Specific Comment 16 on the Extraction Zone Hydrogeologic Study Work Plan. As stated in that response, the actual analytical results from the individual extraction well groundwater samples during the six-hour step tests and the composite groundwater sample that will be collected during the 72-hour combined pump test (pursuant to the Extraction Zone Hydrogeologic Study Work Plan) will be the best representation of the extracted groundwater quality. No revision to the Work Plan is warranted.

3. Page 3-3. Re: Capillary break in caps. What is this referring to? If using slag to form break, isn't gamma emission an issue?

   FMC Response: As stated in the response to the EPA comment on Section 3.1.3 above, Section 3.1 (Completed Studies Relevant to the RD) makes clear the design studies summarized in this section were components of the SFS and are included to provide relevant background for the design work. Section 3.1.1 (Preliminary ET Cap Design) summarizes the preliminary design contained in the SFS Report and specifically the Comparison of Conventional and Alternative Capping Systems for Use at the FMC Plant OU, June 2009 (Appendix D to the SFS Report). The comment is correct that the summary states that slag is identified in the preliminary design for a 1-foot thick layer of coarse crushed rock (slag or gravel) to serve as a capillary break. As described in Sections 3.2.1 and 3.2.2 (Field Studies to Fill Data Gaps and Gamma Cap Performance Evaluation) of the Work Plan, additional field studies were proposed (and have now been completed or are in progress) to obtain additional data and perform additional evaluations (e.g., infiltration modeling) to finalize the ET cap and gamma cap (for shielding gamma emissions from underlying slag) designs during the RD. Finally, as noted in FMC's response to EPA Specific Comment 1 on the Gamma Cap Performance Evaluation Work Plan, RESRAD Version 6.5 was used to model a 12 inch soil cap (preliminary gamma cap) and a 24 inch soil cap (preliminary ET cap). The source (slag) geometry and cap soil density parameters were the same for both model runs. A comparison of the results showed the exposure rate associated with a 24 inch soil cap was 2.6 percent of the exposure rate associated with a 12 inch gamma cap (i.e., a 24 inch cap provided about 97 percent additional shielding to the shielding of a 12 inch gamma cap). No revision to the Work Plan is warranted.

4. Section 3.1.2, Page 3-4. Note that the groundwater remedy also must lead to a permanent remedy for groundwater based on the information obtained.

   FMC Response: As stated in the response to the EPA comment on Section 3.1.3 above, Section 3.1 (Completed Studies Relevant to the RD) makes clear the design studies summarized in this section were components of the SFS and are included to provide relevant background for the design work. Section 3 of the Work Plan was not intended to describe the remedy objectives and performance standards which are described in Section 4 of the Work Plan. No revision to the Work Plan is warranted.

5. Section 4.0, Page 4-2. This section describes remedy elements and performance standards. Note in the document that performance standards testing will be in the PSVP not just in design and RA construction.

   FMC Response: The last paragraph in the introductory text of Section 4 (Remedy Work Elements, Objectives, and Performance Standards) of the Work Plan has been revised as suggested by the comment as follows:

> "Achievement of the performance standards will be demonstrated throughout the RD process in the Remedial Design Reports, ~~and~~ during RA construction in accordance with the Construction Quality Assurance Plan (CQAP), and by verification measurements / testing pursuant to the Performance Standards Verification Plan(s) (PSVPs)."

6. Section 4.1.2, Page 4-3. Performance standards for ET cap. How do you test whether or not infiltration is occurring through the cap? This question is more a placeholder as it is a design issue.

   FMC Response: As described in Sections 3.2.1 (Field Studies to Fill Data Gaps and Gamma Cap Performance Evaluation) of the Work Plan, additional field studies were proposed (and have now been completed or are in progress) to obtain additional data and perform additional evaluations (e.g., ET cap performance modeling) to finalize the ET cap design during the RD. The results of the soil geotechnical and agronomic testing and vegetation/root density testing obtained during implementation of the Data Gap Work Plan will allow the use of site-specific inputs for the ET cap performance modeling that will be used to evaluate / finalize the ET cap design. The ET cap modeling inputs and output (e.g., predicted long-term deep infiltration through the ET cap) will be provided to EPA as a component of the Soil Preliminary (30%) Design Submittal. No revision to the Work Plan is warranted.

7. Section 4.1.3, Page 4-5. The performance standard for the gamma cap will include a direct measure of effectiveness.

   FMC Response: As stated in FMC's response to EPA's Specific Comment 2 on the Gamma Cap Performance Evaluation Work Plan: "While the results of the gamma cap performance evaluation will be used to inform development of the PSVP, it is premature to comment on a document not yet submitted for EPA review. FMC envisions a combination of approaches to verify that each performance standard is met and maintained. This combination would include, at a minimum, tests for soil density and thickness during construction of the caps (as part of the Construction Quality Assurance and Quality Control) and direct measurements at various locations following construction." Consistent with that response and as suggested by the comment, the *Performance Standard* paragraph in Section 4.1.3 (Gamma Caps) has been revised to add the following sentence:

   > "Achievement of the RAO and soil cleanup level for radium-226 will be demonstrated by verification measurements pursuant to the Performance Standards Verification Plan."

8. Section 4.1.5, Page 4-7. Excavation. There will need to be a performance standard measuring gamma.

   FMC Response: In order to be consistent with RAO 1 (from Section 2.4.1 of the Work Plan which is identical to RAO 1 presented in Section 7.1 of the IRODA), the *Objective* stated in Section 4.1.5 (Excavation and Consolidation) lists all the potential exposure pathways (external gamma radiation exposure, inhalation of radon in potential future buildings, incidental soil ingestion, dermal absorption, and fugitive dust inhalation); however, because the selected remedy requires removal of surficial soil contamination, post-excavation soil sampling is more appropriate and can be directly compared to the soil cleanup levels specified in the IROD and Table 4-1 (now renumbered to Table 4-2) in the Work Plan. The *Performance Standard* sentence in Section 4.1.5 has been revised to more clearly state:

> "The performance standard for this element of work is the successful implementation of the final design ~~as~~ and demonstration that the soil cleanup levels have been achieved by confirmation soil sampling pursuant to the Performance Standards Verification Plan."

9. Section 4.2.2, Page 4-9. Gas monitoring performance standards will need to be in the final PSVP.

   FMC Response: The *Performance Standard* sentence in Section 4.2.2 (Gas Monitoring program) has been revised to replace "Remedial Action Work Plan" with "Performance Standards Verification Plan."

10. Section 4.3.1, Page 4-10. Text should state that additional changes to the groundwater system may be necessary for meeting the performance standards which will be implemented after ESD or other ROD modification. Operation should be for determining how to remediate groundwater, the purpose of operation is not to obtain a TI waiver.

    FMC Response: The second paragraph in Section 4.3.1 (Groundwater Extraction System) of the Work Plan has been revised as suggested by the comment as follows:

> "As stated in the IRODA, EPA recognizes that operation of the extraction system will not likely achieve the groundwater quality ARARs throughout the FMC Plant OU within a reasonable timeframe (the groundwater model indicates that it will require >100 years to restore groundwater quality below the arsenic MCL within the FMC Plant Site). During implementation of the groundwater extraction remedy, the aquifer system will have been stressed and additional site-specific data will be collected to determine if the groundwater restoration RAO can be achieved within a reasonable timeframe. The data and information obtained during implementation of the groundwater extraction system may indicate a need for modification of the system or operation of the system that is substantively different than the implemented groundwater remedial action (per the RAWP) and operation of the system (per the OM&M plan) that presumably would be documented in an Explanation of Significant Difference (ESD), IRODA amendment and/or final ROD. The data and information obtained during implementation of the groundwater extraction system may also ~~If the data~~ indicate a need for a Technical Impracticability (TI) or other waiver for a portion of the groundwater plume that would also be documented in an Explanation of Significant Difference (ESD), IRODA amendment and/or final ROD ~~could be recommended during the Five-Year Review process~~. Institutional controls will remain in place to control groundwater use until RBCs and MCLs (or site-specific background levels where those are higher) for groundwater COCs are achieved at the FMC Plant OU."

11. Table 6.1 and 6-2. EPA review may take as long as 60 days to ensure participation of all the stakeholders.

    FMC Response: Tables 6.1 and 6.2 have been revised to update the RD/RA schedule based on actual milestones through November 8, 2013, revised planned schedule, and a 60 calendar day (44 business days) EPA review period for deliverables. To the extent that extended periods for EPA and stakeholder review of documents that have been experienced to date are in excess of 60 days, coupled with the inclusion of a 60 calendar day review for all future deliverables as shown on the schedules in Figures 6-1 and 6-2, has prolonged design development such that construction of the soil remedy would not commence until 2015. FMC will develop, as separate critical path deliverables, the site-wide grading and storm water management design submittals (i.e., 30% and Pre-Final and Final engineering design submittals). With timely EPA review and approval of these design submittals, site grading should commence during the 2014 construction season. Site-wide grading that creates an integrated stormwater management system is a required precursor to cap construction and is otherwise independent of and does not prejudice the final cap designs (i.e., gamma and ET caps). A schedule for these critical path deliverables will be included in subsequent monthly reports.

SHOSHONE-BANNOCK TRIBES
COMMENTS- Remedial Design Work Plan for the FMC OU
August 2013

It is very important to the Shoshone-Bannock Tribes that this, and all documents required by the UAO, reasonably recognizes and documents this site is within the Fort Hall Reservation. Reading the above document would require one to look very hard and identify in an obscure location this site is within the Reservation and impacting our resources.

FMC Response: The first sentence of the second paragraph on the first page (page 1-1) of the Work Plan states "The FMC OU, consisting of the FMC Plant Site and other FMC-owned properties at the EMF Site, is on privately-owned fee land, most of which is located within the exterior boundaries of the Fort Hall Indian Reservation." Figures 1-1 and 1-2 both show the Fort Hall Reservation Boundary. No revision to the Work Plan is warranted.

1. Section 1.3
Somewhere in this section should include the Shoshone-Bannock Tribes, their role in review and project oversight.

FMC Response: The organizational structure presented in Section 1.3 is consistent with the UAO. No revision to the Work Plan is warranted.

2. Figure 1.3
Include the Tribes

FMC Response: The organizational structure presented in Figure 1-3 is consistent with the UAO. No revision to the Work Plan is warranted.

3. Section 2.1
Identify this site is within the exterior boundaries of the Fort Hall Reservation.

FMC Response: Refer to the response to the response to Tribes "General Comment" above. No revision to the Work Plan is warranted.

4. Section 2.1.5 – Pg 2-3 1st full paragraph
Add and migrates into the Off-Plant OU as surface water and into springs which discharge onto the Fort Hall Reservation.

FMC Response: The area between and including Swanson Road Spring and Batiste Spring, where FMC- and Simplot-impacted groundwater discharges and mixes with the Portneuf River, and migrates into the Off-Plant OU as surface water is not located within the boundary of the Fort Hall Indian Reservation. No revision to the Work Plan is warranted.

5. Section 2.2 Site History 3rd paragraph
Historical management of these materials has resulted in impacts to soils and shallow groundwater at the FMC Plant OU. In addition, downgradient discharge of shallow groundwater from beneath the FMC Plant OU into the Portneuf River has contributed to the impairment of surface water quality in the Off-Plant OU **ADD including the Fort Hall Bottoms within the Fort Hall Reservation which is a traditional sensitive cultural area.**

FMC Response: The Portneuf River is part of the EMF Off-Plant OU and thus the sentence is accurate as written. The EMF RI Report, EMF Ecological Risk Assessment (Ecology and Environment, 1995) and more recently the EPA Lower Portneuf River Preliminary Assessment/Site Inspection (Report dated September 2005) evaluated water quality and sediments in the Portneuf River including the Fort Hall Bottoms and did not identify levels of contaminants above risk levels that require remedial action. In addition, there are numerous non-EMF sources of contaminants to the Portneuf River that contribute to its impaired status as identified in the Portneuf River TMDL (IDEQ, February 2010). Without a discussion of these other facts, that go far beyond the summary presented in Section 2.2 (Site History) of the Work Plan, the addition suggested by the comment is not appropriate. No revision to the Work Plan is warranted.

6. Add a short sentence identifying the deep aquifer beneath the FMC OU has also been impacted, with measurements of COCs to a lesser extent

FMC Response: As described in the GWCCR, during 2002, deep aquifer zone wells within the FMC Plant OU were selected for sampling and analysis for the routine CERCLA and an expanded parameters list. This special program was conducted in response to EPA questions regarding the EMF RI findings that the deep aquifer zone was not impacted in the FMC western ponds area and EMF joint fenceline area. All of the sample results were below the representative (background) levels with the exception of the fluoride result for well 125 (0.98 mg/l) which was slightly higher than the Michaud representative concentration (0.80 mg/l), but was far below the comparative value of 4 mg/l. EPA also requested and FMC agreed to again monitor the deep wells on the FMC OU during 2009 as documented in the Summary of Results for the FMC 2Q2009 Groundwater Monitoring Event, submitted to EPA on July 30, 2009. In summary, the results from the 2009 sampling of deep wells located near the FMC Plant Site northern property (wells TW-5D and 109) confirm the EMF RI finding that FMC impacted groundwater is not migrating beyond the Plant Site in the deep groundwater zone. The EMF RI findings and results of the supplemental deep well sampling do not justify adding the sentence as suggested in the comment, which would have to be qualified with the above information, to the summary presented in Section 2.2 (Site History) of the Work Plan. No revision to the Work Plan is warranted.

7. Remove the following: it is estimated that FMC-impaired groundwater migrating downgradient from the FMC Plant Site northern boundary accounts for less than 5 percent of the total load of EMF site contaminants. If this remains in, qualify and provide specific details how this estimation is made and if EPA agrees.

FMC Response: The sentence is accurate as written; however, more recent reference documents will be added to the text as follows:

> "In addition, downgradient discharge of shallow groundwater from beneath the FMC Plant OU into the Portneuf River has contributed to the impairment of surface water quality in the Off-Plant OU; however, based on mass loading calculations performed by Simplot (Simplot, 2012 and Simplot, 2013), it is estimated that FMC-impacted groundwater migrating downgradient from the FMC Plant Site northern boundary accounts for less than 5 percent of the total mass load of EMF Site contaminants migrating to the river (i.e., Simplot is the predominant source of contamination to the river)."

The reference documents will also be added to Section 7 (References):

> Simplot, 2012. 2011 Annual Report Groundwater/Surface Water Remedy, Simplot Operable Unit, Eastern Michaud Flats Superfund Site, Pocatello, Idaho, Prepared by Formation Environmental, March 2012.
>
> Simplot, 2013. 2012 Annual Report Groundwater/Surface Water Remedy, Simplot Operable Unit, Eastern Michaud Flats Superfund Site, Pocatello, Idaho, Prepared by Formation Environmental, May 2013.

8. **Section 3.1.1- Pg 3-2 Last paragraph**
Remove…. Therefore, the RCRA pond caps' design represents an overly conservative assessment of required thicknesses. Hydrogeological data was not generated and assumptions may not be appropriate with changing weather and moisture patterns.

FMC Response: The text is accurate as written and was taken directly from the EPA-approved Comparison of Conventional and Alternative Capping Systems for Use at the FMC Plant OU, June 2009 (Appendix D to the SFS Report). No revision to the Work Plan is warranted.

9. **Pg 3-3** Based on this calculation, a storage layer with minimum thickness of 24 inches would be necessary to store the anticipated winter precipitation in the Pocatello areas.
Weather in the local area has been irradict [sic] and changing. During 2013, daily rainfall amounts exceeded a six month average, it was noted on several different occasions where 2.5 inches to 4 inches of rainfall occurred. Tribes request new calculations based with a safety factor of 50% annual precipitation with calculations factoring that amount being delivered within a 24 hour timeframe.

FMC Response: Section 3.1.1 (Preliminary ET Cap Design) of the Work Plan presents a summary of completed design studies relevant to the RD. Per response to EPA Specific Comment 6: As described in Sections 3.2.1 (Field Studies to Fill Data Gaps and Gamma Cap Performance Evaluation) of the Work Plan, additional field studies were proposed (and have now been completed or are in progress) to obtain additional data and perform additional evaluations (e.g., ET cap performance modeling) to finalize the ET cap design during the RD. The results of the soil geotechnical and agronomic testing and vegetation/root density testing obtained during implementation of the Data Gap Work Plan will allow the use of site-specific inputs for the ET cap performance modeling that will be used to evaluate / finalize the ET cap design. The ET cap modeling inputs and output (e.g., predicted long-term deep infiltration through the ET cap) will provided to EPA as a component of the Soil Preliminary (30%) Design Submittal. No revision to the Work Plan is warranted.

10. **Section 3.1.2 Preliminary Groundwater Extraction System Design**
Gross Alpha, Gross Beta, Radium 226 must be added to the list of COC. Any water expected to be put in an evaporation pond, percolation pond, discharging to Portneuf River or anywhere else must include the radiological parameters present in the water. Any treatment options should include sampling for a full suite of metals and radiologicals to identify any changes in concentration or species due to the treatment. Because this water is all discharging within the Fort Hall Reservation, we want to know exactly what chemicals (including radiological) are being put back into the water system that flows within our homeland.

FMC Response: Section 3.1.2 (Preliminary Groundwater Extraction System Design) of the Work Plan presents a summary of completed design studies relevant to the RD. The comment appears to confuse a summary of the preliminary design developed during the SFS with the 30%, 60% and pre-final / final design submittals during the RD. With respect to the suggested sample analyses, Section 8.1 of the EPA-approved GWCCR presents a summary of the over 20 years of groundwater sampling and analyses at the FMC OU:

> Supplemental sampling events for expanded metals, organic compound and radionuclide analytical parameters have provided further evidence supporting the findings of the EMF RI that the following constituents are not FMC-related contaminants in groundwater:
>
> - Metals: aluminum, antimony, beryllium, cadmium, copper, lead, molybdenum, mercury, silver, thallium and zinc;
> - Organic Compounds; and
> - Radionuclides.

No revision to the Work Plan is warranted.

11. **Section 4.1.4 Integration of Caps**
Monitoring of Phosphine, Hydrogen Cyanide, Hydrogen Fluoride should be done during all times of construction activities and soil movements at the site. These gases are known to be present at the site. Movement of soils and integration of CERCLA caps into the RCRA caps requires monitoring of all toxic gases known to be present at the site.

FMC Response: Section 4.1.4 (Integration of Caps) presents an accurate description of the Cap/Cover Integration element of the remedy as set forth in Section 8.1 of the IRODA which is different than the remedy element for Phosphine and Other Gas Monitoring element of the IRODA that is described in Section 4.2.2 (Gas Monitoring Program) of the Work Plan. The suggestion that gas monitoring "should be done during all times of construction activities and soil movements at the site" is inconsistent with the IRODA which specifies that gas monitoring will be performed after the caps are installed at RAs B, C, D, F1 and K where elemental phosphorus is present in the subsurface. Industrial hygiene monitoring (e.g., personal phosphine monitoring) during construction will be performed pursuant to the Health and Safety Plan. No revision to the Work Plan is warranted.

12. **Section 4.2. Institutional Controls Program**
Clearly spell out what legally enforceable institutional controls FMC plans to implement for all or part of the FMC OU including where they will file and what specifically will be filed. As appropriate for the needed control is vague. Also need to stress the importance of filing with the Shoshone Bannock Tribes Land Use Department not just Power County.

FMC Response: The purpose of Section 4 of the Work Plan is to describe the deliverables that will be prepared and submitted over the course of the RD as required by the UAO. This comment is directed at the content of the ICIAP that will be prepared and submitted pursuant to the RDRA schedule presented in Section 6 of the Work Plan. No revision to the Work Plan is warranted.

13. **4.2.2 Gas Monitoring Program**
A phosphine monitoring program will be implemented at RAs B, C, D, F1, and K where elemental phosphorus is present in the subsurface to identify any phosphine releases to ambient air or soil chemistry disturbances and to identify if phosphine is moving laterally or impacting ecological resources.
Phosphine must not migrate outside the caps or CERCLA OU. Monitoring of the soil chemistry must occur outside the OU as well as on the soil cover cap material.

FMC Response: Section 4.2.2 (Integration of Caps) presents an accurate description of the Cap/Cover Integration element of the remedy as set forth in Section 8.1 of the IRODA for Phosphine and Other Gas Monitoring which states "Monitoring of the soil properties (chemical and physical) within the cap materials to ensure there are no changes in the basic soil properties that would threaten the cap integrity or vegetative cap." The IRODA specifies the RAs where gas monitoring is required and does not include any requirement for monitoring "outside the OU." No revision to the Work Plan is warranted.

14. **4.3.1 Groundwater Extraction System Pg 4-10**
The Shoshone-Bannock Tribes will vigorously oppose any Technical Impartibility [sic] Waiver FMC attempts to obtain and EPA proposes to offer in exchange for cleanup of groundwater at the FMC OU. If both EPA and FMC recognize the less than robust groundwater extraction remedy they selected will not achieve long-term protection a better remedy, regardless of expense should have been selected.

FMC Response: Refer to the revisions to the second paragraph in Section 4.3.1 (Groundwater Extraction System) of the Work Plan in response to EPA Specific Comment 10. Those revisions clarify the CERCLA administrative / regulatory processes that would be followed for substantive changes to the IRODA groundwater remedy, including a potential TI determination. The Tribes non-concurrence with the IRODA remedy is well documented in the IRODA. Other than the revision in response to EPA Specific Comment 10, no other revision to the Work Plan is warranted.

14 (cont). Stressing the aquifer during the groundwater extraction remedy can be reasonably expected to have far reaching impacts. Additional off-site groundwater well testing should be completed. Original wells thought to be impacted during the PASI and included in the original RI should be re-evaluated to identify any changes in COC presence.

FMC Response: The EMF RI Report and the Groundwater Current Conditions Report for the FMC Plant Operable Unit, June 2009 - Final (GWCCR) provide tabulated lists of surrounding production wells. More importantly, as documented in EMF RI Report, GWCCR and FMC’s annual RCRA, CERCLA and Calciner Pond Groundwater Monitoring Reports (most recent annual reports for calendar year 2012), production patterns at Simplot or surrounding agricultural or other production wells have no observable influence on the groundwater potentiometric surface or inferred flow direction at the FMC OU. In addition, during FMC plant operation and utilization of production wells at the FMC OU, FMC’s production pumping had no observable influence on the groundwater potentiometric surface or flow direction in areas surrounding the FMC OU. No revision to the Work Plan is warranted.

14 (cont). Objective: 2) Reduce the migration of COCs in the groundwater to surface water that result in concentrations exceeding risk based concentrations (RBCs) or chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs).
Prevent rather than reduce migration of contaminants off the FMC OU into areas used by the general public and Shoshone-Bannock Tribal members.

FMC Response: The *Objective* statement in Section 4.3.1 (Groundwater Extraction System) of the Work Plan is taken directly from the Remedial Action Objectives (RAOs) specified in the IRODA. Specific to objective 2) in this section, the RAO (number 7.) stated in Section 7.1 of the IRODA is: “Reduce the release and migration of COCs to surface water from FMC OU sources at concentrations exceeding RBCs or ARARs, including water quality criteria pursuant to Sections 303 and 304 of the Clean Water Act.” No revision to the Work Plan is warranted.

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General Comments

1. Several in-text references are not included in section 7.0 References; and some in-text citations do not match references in section 7.0.

   FMC Response: The Work Plan has been reviewed and revised to rectify the references.

Specific Comments

1. List of Acronyms; add the following: AFLB, CQA, EMF, ERP, GWCCR, QCP, RBC, RU, SUA, WUA and any other acronym omitted from the list.

   FMC Response: The Work Plan has been reviewed and the list of acronyms revised for completeness.

2. Section 2.1.4, page 2-3 lines 1-3; Given the natural slope of the land surface at the FMC site, it is not likely that all rainfall, particularly thunderstorm / rain or rain-on snow, is entirely contained within property without engineered controls. Storm water runoff is also identified as a primary release mechanism in section 2.3.1. Please identify the type and location of runoff control and / or revise section 2.3.1 to be consistent with the retention of all storm water onsite.

   FMC Response: The comment appears to be on Section 2.1.5 (Hydrology and Hydrogeologic Setting) not Section 2.1.4. The statement in Section 2.1.5 that "Surface water runoff from the FMC OU former operations area from rain is infrequent and is entirely contained within the FMC Plant Site property" is accurate as written and was taken from the EMF Facilities Hydrology and Drainage (Section 3.2.2) of the EMF RI Report; a reference has been added to the text. As suggested in Appendix A of EPA's Guidance for Scoping the Remedial Design (EPA/540/R-95/025), March 1995, Section 2.1 presents a background summary setting forth a brief description of the site including the geographic location and a description of the physiographic, hydrologic, geologic, etc. features of the site. (emphasis added) The commenter should refer to the EMF RI Report for the requested details. The soil remedy RD will include the design of the site-wide stormwater management system which will maintain the zero stormwater discharge status of the FMC plant site. No revision to the Work Plan is warranted.

3. Section 2.3.1, page 2-8, paragraph 2, line 4; change "surface runoff" to "precipitation".

   FMC Response: The sentence has been revised as suggested by the comment.

4. Section 2.3.1, page 2-8, paragraph 3, lines 2-3; Include citation for data/report of air quality study; or remove statement regarding ambient air phosphine concentrations.

   FMC Response: A reference to the Site Wide Gas Assessment Report for the FMC Plant Operable Unit, December 2010 has been added at the end of the sentence as suggested by the comment.

5. Section 2.3.2, Page 2-9 line 1; Add "shallow" between "all" and "groundwater"

   FMC Response: The sentence is accurate as written, but has been revised to include the entire content of the sentence as presented in the EPA-approved Groundwater Current Conditions report for the FMC Plant OU and a reference to that report as follows:

   "Virtually all groundwater underflowing the EMF facilities discharges to the Portneuf River at Batiste and the Spring at Batiste Road (aka Swanson Road Springs) and as bank seeps and baseflow to the river in the reach bounded by these springs (MWH, 2009b)."

6. Section 2.3.2, Page 2-9, paragraph 2, line 6-7; Precipitation infiltration was identified in section 2.3.1 as a primary pathway. Replace "runoff' with "infiltration".

   FMC Response: The sentence has been revised as suggested by the comment as follows:

   "Because of the arid nature of the EMF Site, radiological and chemical constituents will typically leach from source and fill materials into the underlying soils only if there is hydraulic head <u>in unlined ponds</u> (e.g., an uncovered wet waste pond) <u>or due to</u> collection <u>of precipitation runoff</u> in low areas of the site ~~rainwater runoff or in unlined ponds~~."

7. Section 4.1.1. page 4-3, *Performance Standard*; Include containment of all stormwater run-off as a performance standard.

FMC Response: Consistent with FMC's response to IDEQ Specific Comment 2, the Performance Standard in Section 4.1.1 (Site-Wide Stormwater Management and Grading Plans) will be revised as follows:

"The site-wide stormwater management and grading plans ~~do not have performance standards apart from~~ will establish~~ing~~ the subgrade and stormwater management controls such that the ET and gamma caps meet their respective performance standards and maintain the zero stormwater discharge status of the FMC plant site."

8. Section 5.3.4, page 5-6, bullet list; Add Idaho regulations pertinent to this remedy to this list and section 7.0 References.

   FMC Response: As stated in the Work Plan, the list provides examples of standard engineering practices and relevant guidelines for the preparation of the plans and specification for the remedial design and is not intended to list regulations that are potential ARARs. No revision to the Work Plan is warranted.

9. Section 5.3.5, page 5-8, bullet list; Add any permit or water rights applications required by Idaho to this list.

   FMC Response: The bulleted list of 60% design submittal elements contained in Section 5.3.5 (Groundwater Remedy Intermediate (60%) Design Submittal) was taken directly from the UAO. In addition, as stated in FMC's response to IDEQ General Comment 1 on the Extraction Zone Hydrogeologic Study Work Plan, the CERCLA section 121(e)(1) permit exemption for removal or remedial action conducted entirely on-site is applicable to the soil and groundwater remedies. No revision to the Work Plan is warranted.

10. Section 5.3.6.1, page 5-9, bullet list; Add "All permits and authorizations required by the state of Idaho" as a separate bullet.

    FMC Response: The bulleted list of Pre-Final design submittal elements contained in Section 5.3.6.1 (Pre-Final (90/95%) and Final (100%) Engineering Design Submittals) was taken directly from the UAO. In addition, as stated in FMC's response to IDEQ General Comment 1 on the Extraction Zone Hydrogeologic Study Work Plan, the CERCLA section 121(e)(1) permit exemption for removal or remedial action conducted entirely on-site is applicable to the soil and groundwater remedies. No revision to the Work Plan is warranted.

11. Section 5.3.6.1, page 5-9, first bullet; Add "in compliance with Idaho well construction regulations (appropriate citation[s])".

    FMC Response: Refer to response to IDEQ Specific Comment 10.

12. Section 5.4.1, page 5-10, paragraph 1, line 4; Replace 'CQCP' with "CQAP".

    FMC Response: The typographical error has been corrected.

13. Table 6-2, Planned dates are inconsistent with timeframes indicated in the "Schedule per UAO" and /or defined as timeframes in previous sections. Revise table to be consistent with narrative timeframes, or revise narrative timeframes to be consistent with table.

    FMC Response: As the commenter may have noticed, the Planned date, particularly for the "early" RD deliverables are in advance (sooner) than the UAO required deadlines. Those early planned dates were intentional and are consistent with FMC's commitment to move forward expeditiously with the RD and implementation of the remedy. As described in the response to EPA Specific Comment 11, Tables 6.1 and 6.2 have been revised to update the RD/RA schedule based on actual milestones through November 8, 2013, revised planned schedule, and a 60 calendar day (44 business days) EPA review period for deliverables.

14. Table 6-2, Execute PTs to support Groundwater (GW) Remedial Design; Planned dates for comments and reports should be changed to 2014.

    FMC Response: As described in the response to EPA Specific Comment 11, Tables 6.1 and 6.2 have been revised to update the RD/RA schedule based on actual milestones through November 8, 2013, revised planned schedule, and a 60 calendar day (44 business days) EPA review period for deliverables. The typographical errors for the planned dates under Execute PTs to support Groundwater Remedial Design (now "Baseline Planned" in updated Table 6-2) have been corrected.