Proposed Plan for Addressing Residual Contamination at the
FMC Corporation (Yakima)Superfund Site, Yakima, Washington

INTRODUCTION

The U.S. Environmental Protection Agency (EPA) invites public comment on this ***Proposed Plan***[1] to address residual contamination at the FMC Corporation (Yakima)Superfund Site (Site) in Yakima, Washington. EPA is the lead agency for site activities, supported by the Washington State Department of Ecology. EPA proposes to amend the ***Record of Decision*** (ROD) to include new actions to address residual contamination at the Site. EPA evaluated four remedial alternatives and believes that Alternative #2 - Institutional Controls is the preferred alternative for the ROD amendment.

The Site is located at 4 West Washington Avenue, approximately 1 mile east of the Yakima International Airport (see Figure 1). FMC Corporation (FMC) operated a pesticide formulation plant at the Site from 1951 to 1986. The Site was contaminated with ***pesticides*** due to releases during facility operations.

The Site was placed on the ***National Priorities List*** (NPL) on September 8, 1983. The cleanup was conducted pursuant to a Consent Decree and in conformance with the ***Comprehensive Environmental Response, Compensation, and Liability Act*** (CERCLA) ROD issued in 1990. Cleanup of the Site under the ROD included removing pesticide contaminated soil and concrete and incinerating the contaminated materials onsite or disposal at an off-site hazardous waste landfill.

MARK YOUR CALENDAR
Public Comment Period: This Proposed Plan is being issued by the EPA for public comment. The comment period begins August 15, 2011 and comments will be accepted until September 14, 2011. Comments are to be provided by mail, fax or email to:

Craig Cameron
U.S. Environmental Protection Agency
309 Bradley Boulevard, Suite 115
Richland, Washington 99352
e-mail: cameron.craig@epa.gov
fax: 509 376-2396

At this time no public meeting has been scheduled. To request a public meeting, please contact Craig Cameron no later than August 22, 2011.

A remedy will be selected only after the public comment period has ended and comments received have been reviewed and considered. Responses to significant comments will be presented in a Responsiveness Summary that will be included with the ***Record of Decision Amendment.***

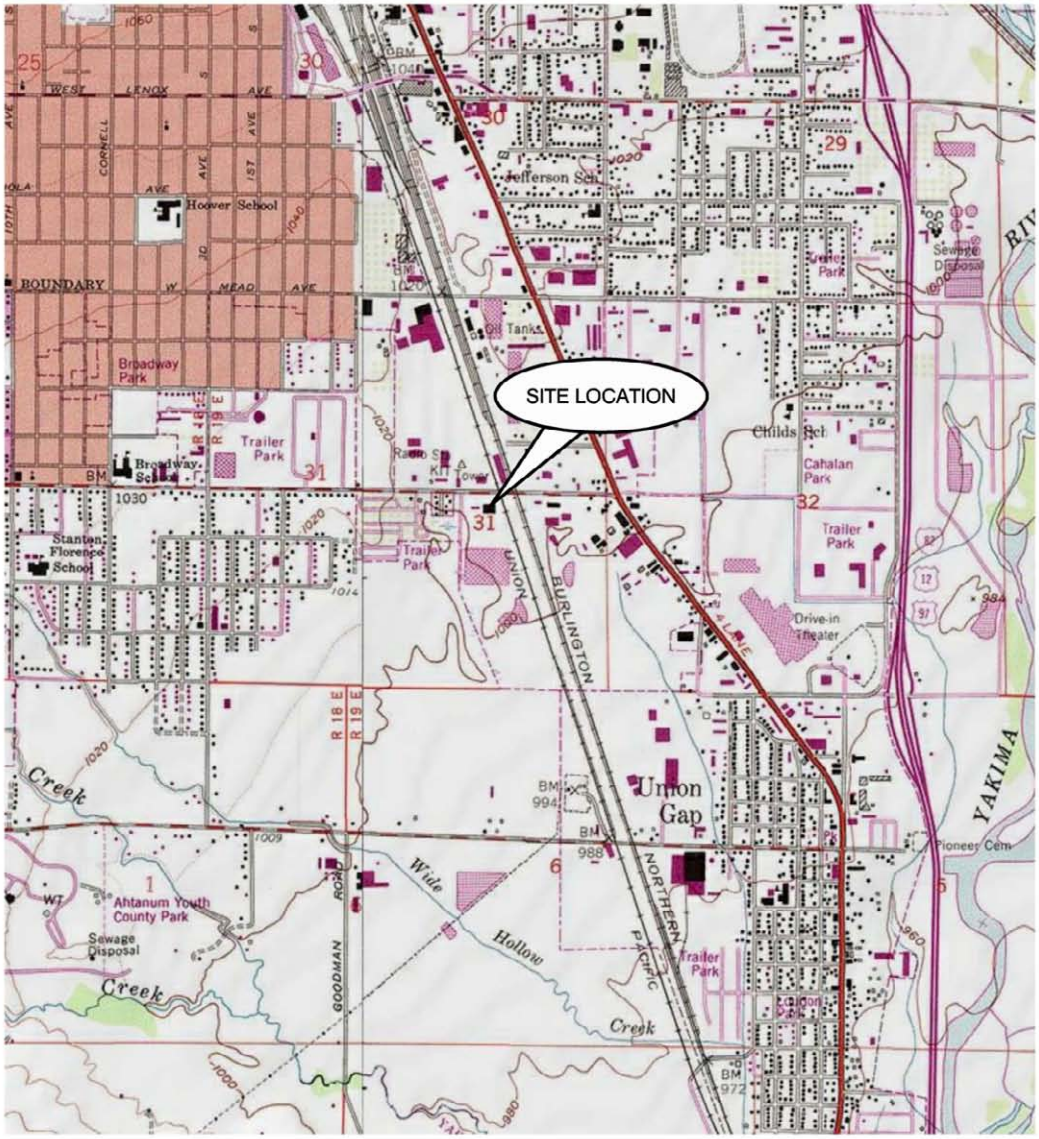
The Proposed Plan and supporting documents are provided in an Administrative Record file for the site found at either of these two locations:

Yakima Central Library	EPA Region 10
Yakima Valley Libraries	Records Center
102 North 3rd Street	1200 6th Avenue, Suite 900
Yakima, WA 98901	Seattle, WA 98101
509 452-8541	206-553-1200.

The file can also be found online at:
http://yosemite.epa.gov/R10/cleanup.nsf/sites/fmcyakima

[1] Important technical and administrative terms are used throughout this Proposed Plan. When these terms are first used, they appear in ***bold italics***. Explanation of these terms and other helpful notes are provided in the Glossary of Terms at the end of this Proposed Plan.

Figure 1. Site Location



SCALE 1:24,000

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References:
TOPO!® Software
U.S.G.S. 7.5 Minute Series (Topographic) Quadrangle,
Yakima East, WA
Version: 1985; Current: 1981

A 1993 ***Explanation of Significant Differences*** (ESD) addressed the impracticability of cleaning up contaminated soil below the seasonal low water table. and provided for the removal of contaminated concrete surfaces, among other changes to the initial on-site incineration remedy.

The Site has been cleaned up to be protective by meeting industrial cleanup standards appropriate for this site and has been redeveloped. The latest review of the remedy *(Third Five Year Review Report for FMC Yakima Superfund Site, Yakima, Washington – September 2008)* indicates that land uses are consistent with industrial exposure assumptions. However, there are no ***institutional controls*** in place to prevent exposure and limit activities to those consistent with industrial land use. Future uses may change, and unless the Site is cleaned up to support ***unrestricted use/unlimited exposure*** (UU/UE), institutional controls need to be put in place. EPA proposes to amend the ROD to include new actions to ensure the remedy continues to be protective into the future. Furthermore, the ROD included the following language regarding groundwater

> "Groundwater monitoring will continue quarterly for two years following completion of the remedial action, and then for three more years on an annual basis. If contamination is detected above the cleanup goals, and groundwater remediation proves to be necessary, it will be addressed in a subsequent ROD."

Groundwater monitoring subsequent to the soil remediation did detect DDT and endosulfans slightly above the risk–based levels identified in the ROD, and also some evidence of the presence of the pesticides dieldrin and aldrin, which had not been identified as contaminants of concern in the ROD. While DDT and endosulfans have subsequently declined below the risk-based levels again, levels of dieldrin have been detected as high as 0.14 µg/l (which equates to a potential carcinogenic risk from GW exposure of 3.5×10^{-5}) and detection limits have not been low enough to rule out the presence of aldrin, another site-related pesticide. As part of this amendment, EPA is also proposing to update the remedial action objectives for groundwater and add the pesticides aldrin and dieldrin to the list of ***contaminants of concern*** (COCs) for the Site.

To address residual contamination at the Site, EPA has evaluated remedial alternatives including: 1) No Action; 2) Institutional Controls; 3) Soil Excavation and Off-Site Landfilling and Institutional Controls; and 4) Groundwater Extraction and Treatment and Institutional Controls. A detailed evaluation of the alternatives is provided in the ***supplemental feasibility study*** **(SFS)** report (FMC, June 2011) and is also summarized later in this Proposed Plan. The preferred alternative to address the residual contamination at the Site is Alternative #2 - Institutional Controls. The Site is located in an industrial area and has been remediated to meet industrial-land use based cleanup levels. Institutional controls need to be added to the remedy to ensure that future activities are consistent with industrial exposure assumptions and to prevent exposure to contaminated groundwater until the groundwater is restored to support beneficial uses as a potential drinking water resource. This preferred alternative would be protective of human health and the environment, comply with applicable or relevant and appropriate requirements under federal and state environmental laws, and is the most cost-effective alternative.

The EPA is issuing this Proposed Plan as part of its public participation responsibilities under Section 117 of CERCLA and Section 300.430(f)(2) of the ***National Oil and Hazardous Substances Pollution Contingency Plan*** (NCP). This Proposed Plan summarizes information that can be found in greater detail in the SFS report and other documents in the ***Administrative Record*** file for the Site. EPA encourages the public to review these documents to gain a more comprehensive understanding of the Site and CERCLA activities that have been conducted at the Site.

SITE BACKGROUND

The FMC Yakima Superfund Site is located at 4 West Washington Avenue, Yakima, Washington. It is approximately 1 mile east of the Yakima International Airport (see Figure 1). The Site is a 58,000-square-foot fenced area that was leased by FMC from Union Pacific Railroad and is bounded to the east by Union Pacific Railroad tracks. Most of the surrounding area is zoned light-industrial. There are a few parcels bordering the western side of the property (across Longfibre Road) that are zoned residential (see Figure 2). However, these parcels are up-gradient from the direction of groundwater flow.

FMC formulated pesticide dusts at the Site from 1951 until 1986. Pesticide liquids were formulated there in the 1970s. Between 1952 and 1969, FMC disposed of wastes containing pesticides in an on-site pit. An estimated 2,000 pounds of waste consisting of raw material containers, soil contaminated by leaks or spills, and process wastes was dumped into the excavated pit and covered with soil. After 1969, waste materials were disposed of at Yakima Valley Disposal in Yakima and at Chemical Waste Management's Arlington, Oregon facility.

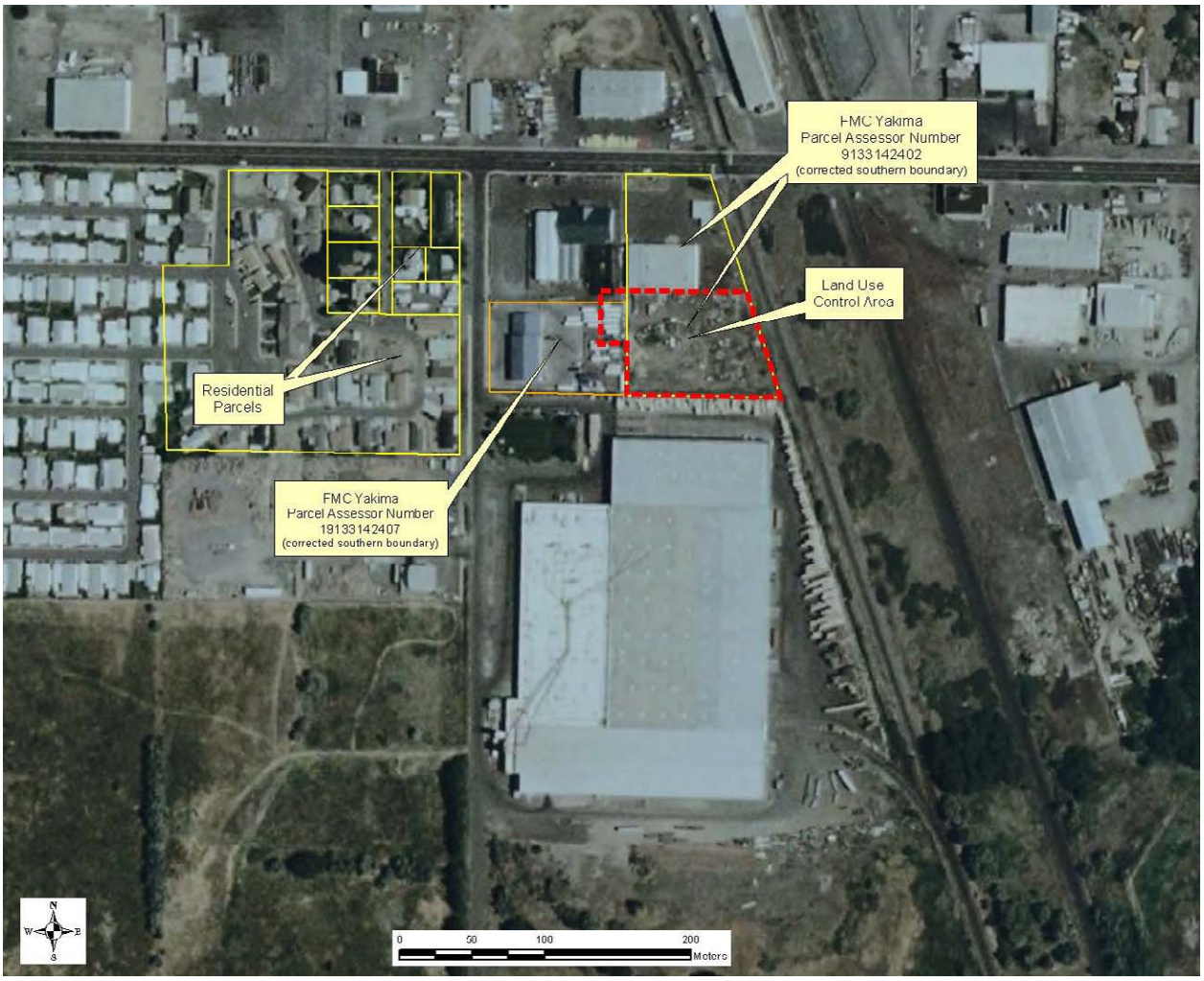
The Site currently contains an active metal fabrication facility, parking lot, and equipment storage yard owned by Stephens Metal Products. Two businesses have purchased parts of the original FMC leased property west of Stephens Metal Products and have erected buildings, a Country Farm & Garden True Value Hardware store and Butlers Welding and RV Accessories. Most current operations are on paved ground, isolated from contamination remaining at depth.

Site History

Investigations of contamination at the Site were conducted in the 1980s and culminated with the ***Remedial Investigation/Feasibility Study*** (RI/FS) which began in 1987. EPA required FMC to remove the disposal pit contents in two phases in 1988 and 1989 prior to the completion of the RI/FS. Waste from the removal activities was disposed of offsite at an approved hazardous waste landfill.

The 1990 ROD required soil and concrete contaminated with pesticides above health-based levels to be removed and incinerated onsite or disposed offsite in an approved disposal facility. Structures remaining on site included an office building, a warehouse with loading dock, and a parking lot. Groundwater monitoring was also a requirement of the ROD, with the

Figure 2. Map Showing Site and Neighboring Parcels (includes the proposed land use control area)



provision that if contamination is detected above the cleanup goals the need for groundwater remediation would be evaluated, and if necessary, addressed in a subsequent ROD..

After initiation of remedial action in 1992, EPA modified the selected remedy and cleanup goals for soils on April 21, 1993, in an ESD. EPA deemed that changes were necessary due to difficulties encountered during implementation of the selected remedy, in particular the discovery that the depth of contamination in some areas was greater than expected and below the water table. Changes included relaxing the cleanup goal from a lifetime excess cancer risk of $1x10^{-6}$ to a risk of $5x10^{-6}$ for excavation at depths greater than 2 feet, but less than 7 feet below ground surface (bgs) and a determination that the extent of the excavation would not exceed 7 feet bgs. EPA determined that excavation below 7 feet was technically impracticable, and that the material did not pose an exposure risk or a threat to the groundwater. EPA considers acceptable excess lifetime cancer risk to fall within the range of $1x10^{-6}$ to $1x10^{-4}$ (this can be thought of simply in terms of a range of risks from one in a million to one in ten thousand). For UU/UE, a $1x10^{-6}$ risk level must be attained without limiting exposure.

The excavation phase consisted of excavating contaminated material, followed by sampling the bottom and sides of the excavations to determine if the cleanup standards were met. If the remaining material was still above cleanup standards, excavation and sampling of an area continued until the cleanup standards were met. Contaminated material was stockpiled in a lined area on the west side of the property prior to incineration. At the conclusion of the excavation phase, the material was incinerated. Incinerator ash was stored in bags until sampling determined that it met the required standards for placement back within the excavation. The ash was then used as a soil cover over the cobble backfill.

During the excavation phase, it was determined that contamination depth was greater than estimated in the RI/FS. In addition, excavation unearthed a second pesticide disposal pit located directly west of the first pit. These factors resulted in a significant increase in the amount of soil excavated and incinerated. During the remedial action, 5,600 cubic yards of contaminated material were excavated and treated.

At the conclusion of the remedial action after demobilization of the incinerator, FMC determined that 1,000 cubic yards of additional soil under the stockpile liner were contaminated due to breaches in the liner. Equipment operation on the stockpile area had punctured the liner in a number of places, and precipitation leached contaminants from the stockpile to the ground below. This additional contaminated soil was sent off site to an approved hazardous waste landfill. EPA conducted an inspection of the Site on August 19, 1993, and found that no additional work was required beyond periodic groundwater monitoring.

SITE CHARACTERISTICS

As described in the Site Background section, the Site originally consisted of 58,000 square feet of fenced property leased by FMC from Union Pacific Railroad bounded by Union Pacific's tracks to the east. The Site is within an area of the city of Yakima, Washington that is zoned for light industrial use. The Site is at 4 West Washington Avenue and the nearest intersecting street is Longfibre Road to the west. The nearest residentially zoned area is west of

Longfibre Road, which is up-gradient with respect to the groundwater flow direction. The groundwater gradient is very shallow, and flow is dominated by regional recharge due to seasonal irrigation taking place off the Site.

The Site slopes to the southeast with a grade of less than 1 percent. The Site is 1.5 miles west of the Yakima River (outside of the 500-year flood plain) and 1 mile north of Wide Hollow Creek. No surface water bodies exist on site. Vegetation within the fenced Site and over the residual groundwater plume consists of tall weeds and grasses. The groundwater occurs in alluvial silty sands and gravels and flows southeastward toward the Yakima River. Groundwater levels fluctuate seasonally with the high in the fall (average of 2 feet bgs) corresponding to the agricultural growing season (regional irrigation), and a low in the winter (approximately 7 feet bgs). Groundwater flows in a southeasterly direction with a seepage velocity of about 7 feet/day. This aquifer is classified as a potential drinking water aquifer, however there are currently no wells used for drinking water in the shallow ***aquifer*** within a 1-mile radius.

The Site is currently redeveloped with an RV sales business, a hardware store, and a metals fabrication facility. See Figure 3 for an aerial view of the operational areas of the FMC Yakima pesticide formulation facility as they were in 1992 and Figure 4 for an aerial photograph from 2008 showing the current businesses. The current users are aware of the Site's Superfund status and have received copies of the latest Five-Year review.

Residual contamination at the Site consists of pesticides in groundwater and the soil at depths just above the low water table level. Regular monitoring shows a groundwater plume exists below the yard area of the Stephens Metal Products property. Figure 5 shows the locations of structures, the primary former disposal pit, and groundwater monitoring wells on the Stephens Metal Products property. Contaminants detected above risk-based standards in groundwater during the 2007 monitoring effort (performed to support the third Five-Year review) include dieldrin. Historically, concentrations have been the highest during the fall. None of the residually contaminated soil would be considered to be source materials that constitute a principal threat. The pesticides in soils are relatively immobile and exist at low concentrations compared to pre-remediation conditions.

SUMMARY OF SITE RISKS

Site risks were significantly reduced by the actions taken to date and as long as activities remain consistent with industrial land use exposure assumptions, the Site meets the ROD requirement to reduce risks to a lifetime cancer risk of $1x10^{-6}$ or less. However, if activities were to change to something more akin to residential use, then the risks would likely exceed that risk level. This would especially be true if someone were to dig into the lower portion (7 feet or more bgs) of the former pit area or if someone tried to drink from the shallow groundwater aquifer (see Figure 5 showing location of former pit area and the groundwater monitoring network). Exposure routes that would apply to adults and children for residential or unrestricted use would include dermal contact with contaminated soil, incidental soil ingestion, inhalation of dried soil that has been excavated, and ingestion of drinking water. It should be noted that ingestion of contaminated groundwater is unlikely as the City of Yakima provides drinking water

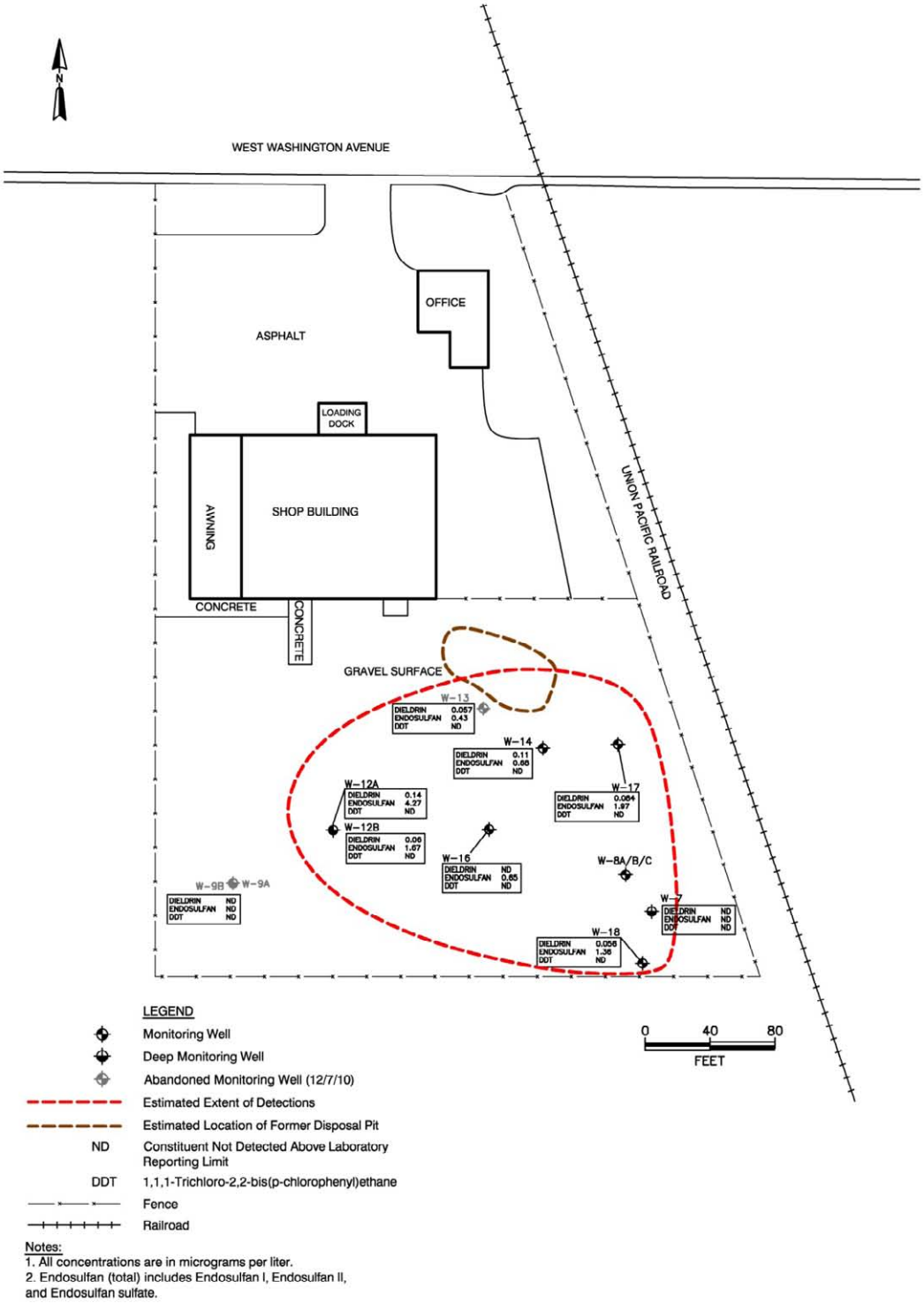
Figure 3. Aerial Photograph from 1992 Showing FMC's Operational Areas (center of photograph) and Parcel Boundaries

Note: Lower parcel boundaries are inaccurately drawn, but are shown correctly in Figure 2. (Source: Yakima County assessor's website - Yakima County GIS – Washington, Land Information Portal)

Figure 4. Aerial Photograph from 2008 Showing Redevelopment of Site

Note: Lower parcel boundaries are inaccurately drawn, but are shown correctly in Figure 2. (Source: Yakima County assessor's website - Yakima County GIS – Washington, Land Information Portal)

Figure 5. Groundwater Monitoring Detections from 2007 Sampling Event and Former Pit Location



to businesses and residences in the area and the water is supplied from other sources that are safe for drinking.

Under CERCLA and in accordance with the ROD, the acceptable risk levels and associated cleanup levels for groundwater are based on drinking water standards known as ***maximum contaminant levels*** (MCLs) from the federal Safe Drinking Water Act (SDWA), where such standards are available and protective. For contaminants of concern that do not have MCLs, cleanup levels are calculated to comply with the Washington Model Toxics Control Act (MTCA) and be protective. MCLs and many portions of MTCA are the critical applicable or relevant and appropriate requirements (ARARs) for the Site, in accordance with Section 121(d)(2) of CERCLA. There are no MCLs for the pesticides of concern at this site, but risk-based goals were calculated for DDT and endosulfans that helped support the decision in the ROD that no action was warranted for groundwater, and to guide evaluation of post-remediation groundwater monitoring results and the potential need for additional action. subsequent to the removal of material from the disposal pit in 1988 and 1989, certain pesticide contamination (namely the DDT series [see the first three entries in the abbreviations for Table 1 for the chemicals included in this series] and endosulfan) groundwater monitoring within some of the area where contaminated soil had been excavated did detect DDT and endosulfans slightly above the risk–based levels identified in the ROD, and also some evidence of the presence of the pesticides dieldrin and aldrin, which had not been identified as contaminants of concern in the ROD. While DDT and endosulfans have subsequently declined below the risk-based levels again, levels of dieldrin have been detected as high as 0.14 µg/l and detection limits have not been low enough to rule out the presence of aldrin, another site-related pesticide. No MCL has been established for aldrin or dieldrin, which, affect the body in much the same way so that their effects are additive. If ingested chronically, the highest concentrations in the groundwater plume of aldrin plus dieldrin (0.14 micrograms per liter - µg/L) could result in an excess cancer risk of approximately $3.5x10^{-5}$ which is above the MTCA Method B acceptable level for unrestricted exposure to groundwater. The concentration of dieldrin drops during the other seasons, so this risk estimate is conservative because chronic exposure would be to concentrations less than 0.14 µg/L.

The Site has been redeveloped for light industrial use and provides very poor habitat for biota. There are shallow-rooted grasses growing in some locations on the Site, and it is highly unlikely that there are any complete exposure pathways for plants and animals to contaminated soil and groundwater. The groundwater plume is stable and within the property of the Stephens Metal Products yard.

BASIS FOR PROPOSED ROD AMENDMENT

The Site has been cleaned up to meet industrial cleanup standards and has been redeveloped. The latest review of the remedy *(Third Five Year Review Report for FMC Yakima Superfund Site, Yakima, Washington – September 2008)* indicates that land uses are consistent with industrial exposure assumptions. However, there are several issues that need to be addressed which are the subject of this proposed ROD Amendment. Those issues are:

- The ROD did not provide for any institutional controls to ensure land use remains consistent with industrial land uses, as required by CERCLA and Washington State's Model Toxics Control Act (MTCA) when a site does not meet levels considered acceptable for unrestricted use or unlimited exposure.

- Groundwater monitoring has been done pursuant to the ROD and while concentrations of some pesticides have attenuated to below acceptable levels; aldrin and dieldrin remain slightly above levels considered acceptable for unrestricted use/unlimited exposure (as high as 0.14 µg/L, which could result in an excess cancer risk of approximately 3.5×10^{-5} and exceeds the MTCA Method B acceptable level for unrestricted exposure to groundwater). Therefore to satisfy the ROD and RAO for groundwater, EPA has evaluated the need to take further response actions and determined that institutional controls and monitoring are the only actions necessary and appropriate to prevent unacceptable uses of groundwater until such time as groundwater meets levels considered acceptable for unrestricted use or unlimited exposure. No additional groundwater remedy is considered necessary because the soil remediation actions taken to date and attenuation of groundwater are expected to result in restoration of the groundwater in a reasonable timeframe of 30 years or less. This expectation is based on the historic trends of declining contaminant concentrations in groundwater since the remedial actions in 1992-93.

- The ROD did not identify aldrin and dieldrin as groundwater COCs and did not establish a cleanup level for aldrin. This proposal would add those pesticides as COC in groundwater and establish cleanup goals for them.

- In addition, since the RAO for groundwater in the ROD to evaluate the need for additional actions has been satisfied by the monitoring and the SFS supporting this Proposed Plan that RAO needs to be replaced.

It is EPA's current judgment that the preferred alternative identified in this Proposed Plan, or one of the other alternatives considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from past releases of hazardous substances into the environment.

PROPOSED CLEANUP LEVELS

See Table 1 for proposed soil and groundwater cleanup levels. The proposed soil cleanup levels are based on the goal of attaining 1×10^{-6} lifetime excess cancer risk or a hazard quotient of 1 for contaminants that do not cause cancer. Two exceptions are the proposed cleanup levels for aldrin and dieldrin. These levels are based on the soil to protect groundwater values calculated using the MTCA Three Phase Model. The proposed soil cleanup levels for aldrin and dieldrin, which are more conservative than the 1×10^{-6} risk values, are intended to promote the restoration of groundwater with respect to these two contaminants.

The groundwater cleanup levels will be used to evaluate monitoring results are the more stringent values chosen from the MCLs or the MTCA B Groundwater levels (with one exception – see Table 1). The proposed cleanup levels support unrestricted use and unlimited exposure and

represent what must be attained in order to eliminate the need for institutional controls. However, the technical impracticability of excavating below the water table and the industrial land use may warrant using institutional controls to limit exposure to a $1x10^{-6}$ risk rather than fully cleaning up the Site to meet the proposed cleanup levels. Final soil and groundwater cleanup levels will be selected in the ROD Amendment.

Table 1. Proposed Cleanup Levels

Compound	**Soil Cleanup Level (mg/kg)[1]**	**Groundwater Cleanup Level (µg/L)[2]**
Aldrin	[To be provided in final draft]	0.0026
Cadmium	80	8
Chromium VI	240	48
DDD	4.2	0.36
DDE	2.9	0.26
DDT	2.9	0.26
Dieldrin	0.0028/0.00014	0.0055
DNOC[3]	8.5	-
Endosulfans	480	96
Ethion	40	8
Malathion	1600	320
Ethyl Parathion[4]	480	96
Zinc	24000	4800

Notes:
1 MTCA B Soil concentrations except for aldrin and dieldrin. The aldrin and dieldrin cleanup levels for soil are based on the MTCA Soil To Protect Groundwater levels. The first value is for unsaturated soil and the second value is for soil saturated with water (below the water table).
2 MTCA B Groundwater concentrations.
3 No risk information in IRIS so no MTCA Level B values available. Cleanup level is from the ROD.
4 Called parathion in the MTCA and IRIS tables.

Abbreviations:
DDD = 1,1-dichloro-2,2-bis(p-chlorophenol)ethane
DDE = 1,1-dichloro-2,2-bis(p-chlorophenol)ethylene
DDT = 1,1,1-trichloro-2,2-bis(p-chlorophenol)ethane
DNOC = 4,6-dinitro-o-cresol
IRIS = Integrated Risk Information System
mg/kg = milligrams per kilogram
µg/L = micrograms per liter
MTCA = Model Toxics Control Act
ROD = Record of Decision.

REMEDIAL ACTION OBJECTIVES

The EPA proposes to retain the first two RAOs for the Site (1 and 2, below) and replace the third RAO, which called for "Further defining the extent of groundwater contamination and confirming that contamination does not exceed health-based levels, or if the quality of the groundwater exceeds those levels during monitoring, evaluating the need to take appropriate measures" with two new groundwater RAOs, so that the updated remedial action objectives that the proposed remedial action must meet would read as follows:

1. Prevent human exposure to contaminated soil, structures, and debris that exceed health-based cleanup levels;

2. Reduce the potential for the contaminated soil to act as a source for groundwater contamination;

3. Prevent human ingestion of groundwater from the Site that exceeds health-based cleanup levels for contaminants of concern; and

4. Ensure groundwater is restored to its beneficial use as a drinking water resource in a reasonable timeframe.

These RAOs address the original risks posed by the site and the residual site risks summarized above. The remedial alternatives considered in the SFS have been evaluated on how they achieve these goals, how they meet ARARs of environmental laws and regulations, and how they meet the CERCLA remedial evaluation criteria, recognizing that the first two RAOs have been accomplished by the actions taken to date. The following sections discuss the remedial alternatives and the evaluation of the alternatives.

SUMMARY OF REMEDIAL ALTERNATIVES

The four alternatives evaluated in the SFS are summarized in this section. Common elements for three of the alternatives are provided in Table 2.

Alternative #1 – No Action is required for comparison purposes with more active alternatives. The No Action alternative is not protective into the future because there are no enforceable controls on land use that would prevent activities that would pose unacceptable risks to human health and the environment. Since the No Action alternative does not meet the threshold criterion of overall protectiveness, it was not evaluated in detail for the other criteria.

Alternative #2 – Institutional Controls involves adding legally enforceable controls through a Uniform Environmental Covenants Act covenant. Both the State and EPA would have the ability to pursue legal action if site uses change and become inconsistent with the industrial land use exposure assumptions. Institutional controls would be designed to maintain activities consistent with industrial land use, including forbidding excavation into contaminated soils and preventing the use of the shallow groundwater aquifer for drinking water purposes. The institutional controls would remain in place as long as needed, which would be until the Site can meet UU/UE. See Figure 6 for the locations affected by implementation of Alternative 2.

Alternative #3 – Soil Excavation and Off-Site Landfilling and Institutional Controls involves the excavation and removal of the primary continuing source of groundwater contamination – contaminated soil in the former pit area near to or below the lower water table. Contamination levels below the 1992 cleanup levels but above the proposed cleanup levels may also contribute to continued groundwater contamination. This remedy would include efforts to dig partly into the saturated zone and would require some engineering controls to deal with the presence of groundwater in the bottom of the excavation. This alternative would place institutional controls over portions of the former operational areas of the Site as they would still contain residual contamination above unrestricted cleanup levels. See Figure 7 for the locations affected by implementation of Alternative 3.

Alternative #4 –Groundwater Extraction and Treatment and Institutional Controls entails pumping the slightly contaminated groundwater, treating it to remove contaminants, and disposing of the contaminated treatment resin off site at an EPA approved disposal facility. The treatment system would be sized to address the plume in the shallow groundwater of the Stephens Metal Products property. It is estimated that two extraction wells are required for the system to operate efficiently and effectively. Like alternatives 2 and 3, institutional controls would be placed over portions of the former operational areas of the Site to limit activities to those consistent with industrial land use exposure assumptions. See Figure 8 for the locations affected by implementation of Alternative 4.

Table 2. Common Elements of Remedial Alternatives (excluding No Action alternative)

Element	**Description**
Institutional Controls	Institutional Controls are an integral part of alternatives #2 through 4. The controls would be required to ensure that future activities remain consistent with industrial land use exposure assumptions. The controls would be imposed over a land use control area and be designed to prevent access to contaminated soils below 2 feet bgs and prevent well drilling and use of contaminated groundwater. The controls would also include provisions to protect monitoring wells. Controls would remain in place until the site meets UU/UE.
Continued Groundwater Monitoring	Groundwater monitoring needs to continue until groundwater is restored to the highest beneficial use. This monitoring would be a common element of alternatives #2 through 4. Monitoring activities will follow the approved groundwater monitoring plan which specifies frequency of sampling and analysis. Monitoring wells will be maintained and replaced if necessary.

EVALUATION OF ALTERNATIVES

As part of the SFS, the remedial alternatives were subjected to a detailed comparative evaluation to identify the advantages and disadvantages of each alternative relative to one another. The detailed evaluation was conducted using the criteria defined in the NCP. A summary of the comparative evaluation is presented in this Proposed Plan. Four remedial alternatives were initially evaluated in the SFS against the evaluation criteria. Brief definitions of the evaluation criteria are provided in the following text box:

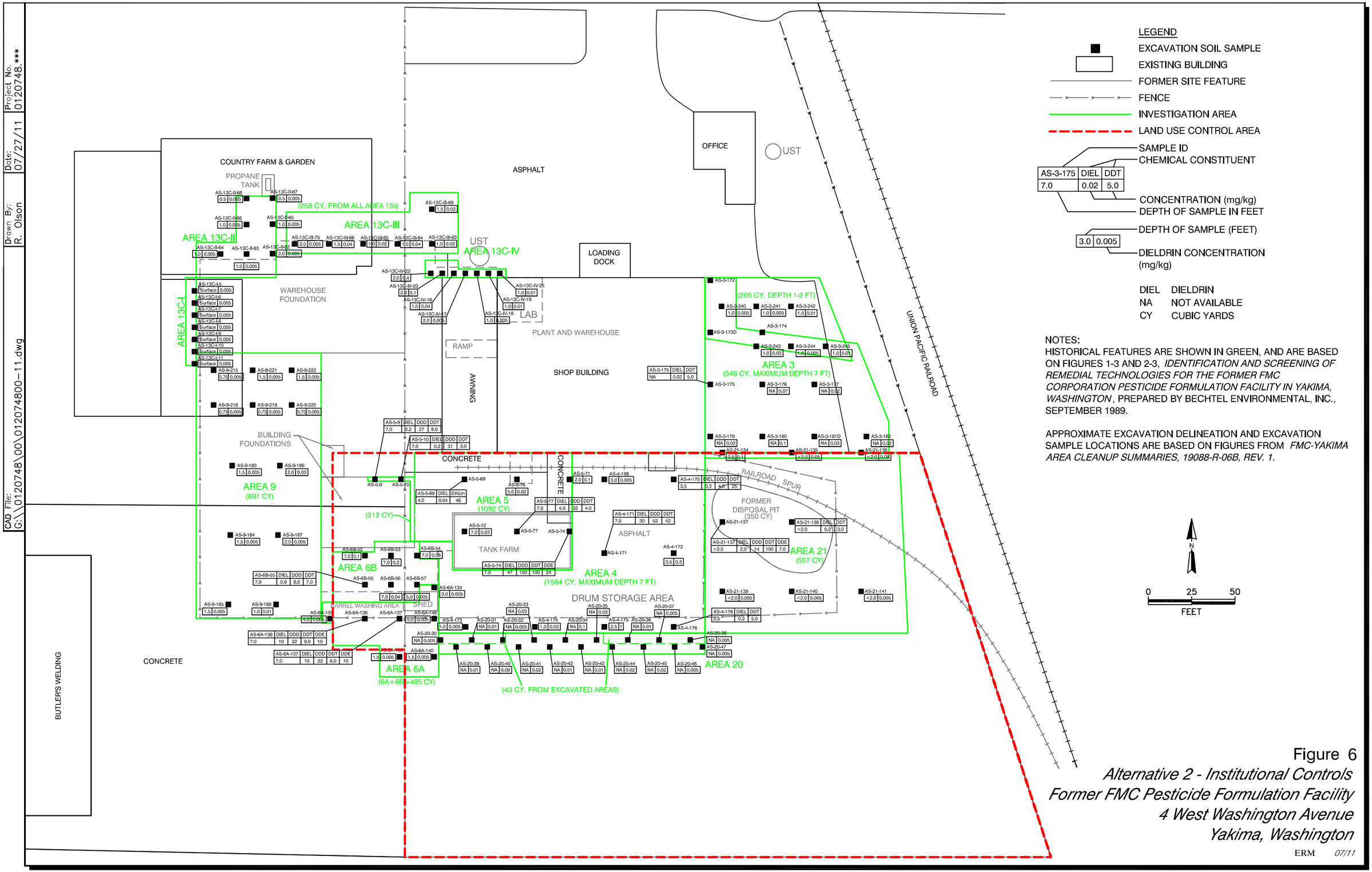


Figure 6
Alternative 2 - Institutional Controls
Former FMC Pesticide Formulation Facility
4 West Washington Avenue
Yakima, Washington

ERM 07/11

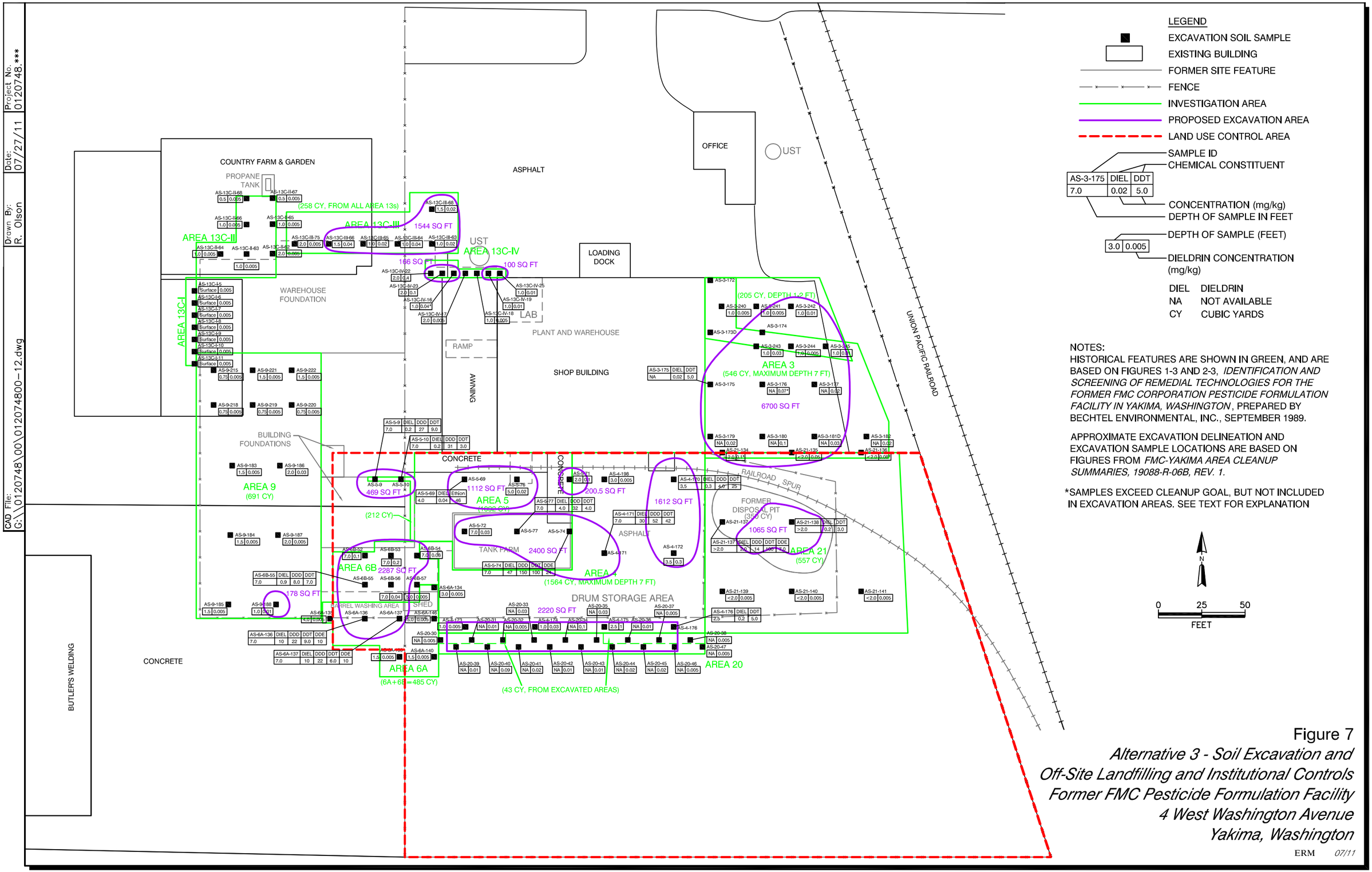


Figure 7

Alternative 3 - Soil Excavation and Off-Site Landfilling and Institutional Controls
Former FMC Pesticide Formulation Facility
4 West Washington Avenue
Yakima, Washington

ERM 07/11

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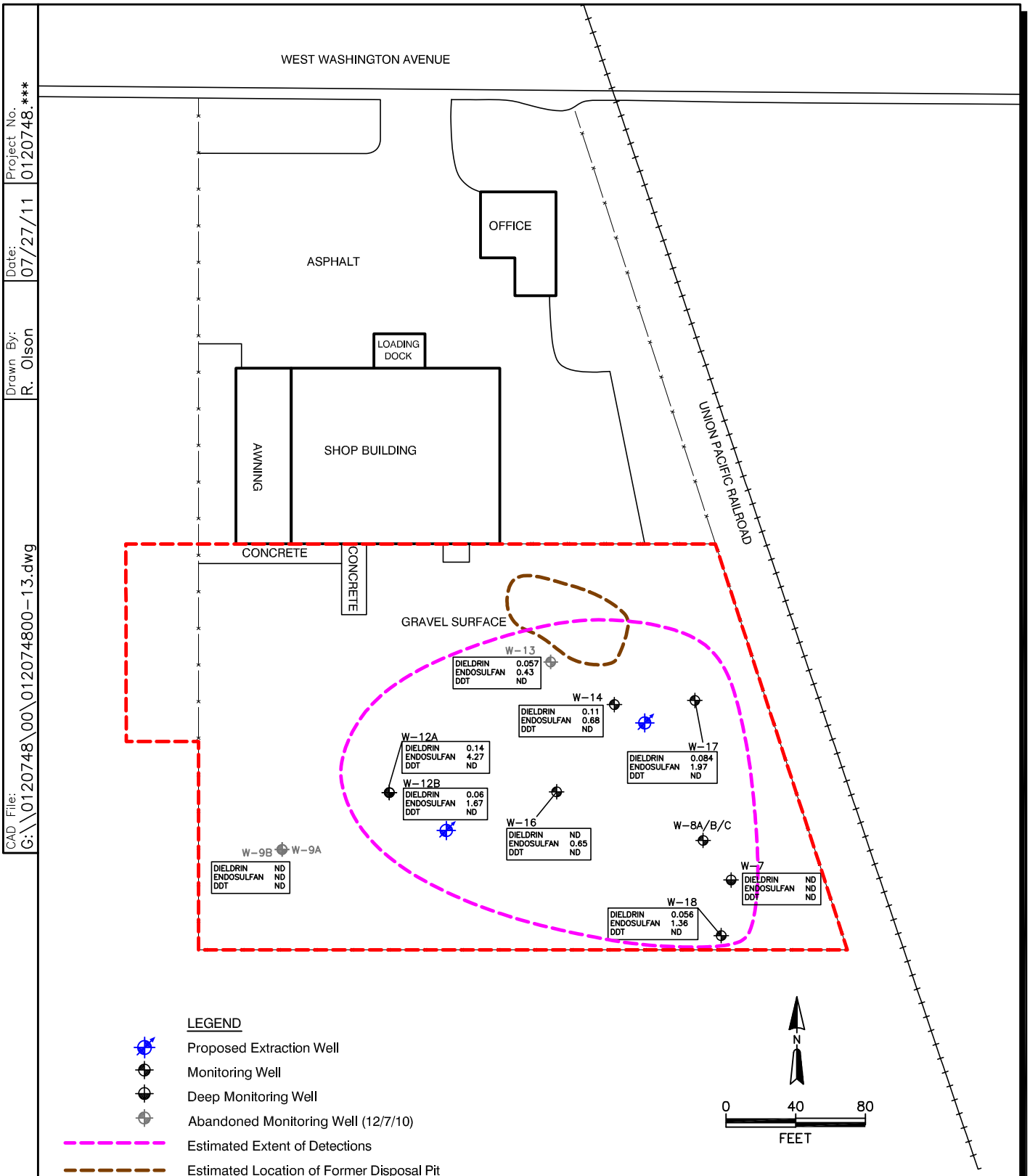
Drawn By: R. Olson
Date: 07/27/11
Project No. 0120748.***



LEGEND

- Proposed Extraction Well
- Monitoring Well
- Deep Monitoring Well
- Abandoned Monitoring Well (12/7/10)
- Estimated Extent of Detections
- Estimated Location of Former Disposal Pit
- Land Control Use Area
- ND — Constituent Not Detected Above Laboratory Reporting Limit
- DDT — 1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane
- Fence
- Railroad

Notes:
1. All concentrations are in micrograms per liter.
2. Endosulfan (total) includes Endosulfan I, Endosulfan II, and Endosulfan sulfate.

Figure 8

Alternative 4 - Groundwater Extraction, Treatment and Institutional Controls
Former FMC Pesticide Formulation Facility
4 West Washington Avenue
Yakima, Washington

ERM 07/11

Project No. 0120748.***
Date: 07/27/11
Drawn By: R. Olson
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Nine Criteria to Evaluate Remedial Alternatives
Threshold Criteria
Overall Protectiveness of Human Health and the Environment determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
Compliance with ARARs evaluates whether the alternative meets Federal and State environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver may be justified. ARARs must be met or waived upon or before completion of remedial action.
Primary Balancing Criteria
Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.
Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.
Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
Cost includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate to within a range of +50 to -30 percent.
Modifying Criteria
State/Support Agency Acceptance considers whether the State agrees with the EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.
Community Acceptance considers whether the local community agrees with the EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

The nine criteria are categorized into three groups: threshold criteria, primary balancing criteria, and modifying criteria. The two "modifying criteria" are applied after state and community input on the Proposed Plan is received. A remedial alternative must meet the first two "threshold criteria," overall protection and compliance with ARARs, to be eligible as a preferred alternative. The five "primary balancing criteria" allow for a comparison of major trade-offs among the alternatives.

State and community acceptance are the modifying criteria and cannot be fully considered until public comments are received. The modifying criteria are of equal importance to the primary balancing criteria in the final evaluation of remedial alternatives. The remedial alternatives evaluation from the SFS is summarized below.

Threshold Criteria –

Overall Protection of Human Health and the Environment

Alternative #1 – the "No Action" alternative would not provide adequate protection of human health and the environment if future activities are not limited to industrial uses as no

measures would be taken to control exposure to residual contamination in the soil and groundwater to reduce risks. The alternative does not meet the threshold criteria and is not discussed further in this evaluation.

Alternative #2 would be protective of human health and the environment by limiting activities to those that are consistent with industrial use so that exposure to residual contamination in the soil and groundwater does not result in unacceptable risks. The institutional controls would be designed to prevent extraction and use of groundwater from the shallow, contaminated aquifer and to prevent intrusion into contaminated soil at depth. The institutional controls would be necessary as long as exposures must be limited to industrial land use exposure assumptions (until the Site meets UU/UE).

Alternative #3 would be protective of human health and the environment by removing and appropriately disposing of soil contamination that may act as a source of groundwater contamination and by placing institutional controls over other areas of the Site that were previously remediated to meet industrial cleanup levels. Excavated contaminants would be disposed of in an approved off-site landfill. Institutional controls would be necessary until the Site meets UU/UE.

Alternative #4 would be protective because contaminated groundwater would be removed and treated and institutional controls would limit exposure to residual soil contamination to meet industrial land use exposure assumptions. Also, institutional controls would be necessary to prevent use of groundwater prior to restoration of groundwater to all beneficial uses.

Compliance with ARARs

Alternative #2 complies with ARARs because the Site already meets industrial cleanup levels for soils (meets MTCA Method C regulations for industrial properties) and this alternative would add the institutional controls required under MTCA when Method C cleanup levels are used, and meet the MTCA requirement for institutional controls to prevent exposure to groundwater until the aquifer supports beneficial uses. The groundwater contaminants that have maximum contaminant levels already meet those standards and the other contaminants will meet acceptable risk levels within a reasonable restoration timeframe (within approximately 30 years).

Alternative #3 complies with ARARs, in part, by removing soil contamination which could act as a source of groundwater contamination to promote restoration of the aquifer. The Site has already been cleaned up and meets industrial cleanup standards from MTCA. Institutional controls would limit activities to those consistent with industrial land use and prevent exposure to groundwater until it supports all beneficial uses.

Alternative #4 complies with ARARs by restoring the aquifer to beneficial uses and because the Site already meets industrial cleanup levels from MTCA. Institutional controls would limit activities to those consistent with industrial land use and prevent exposure to groundwater until the remedy restores the groundwater to support all beneficial uses.

Balancing Criteria –

Long-term Effectiveness and Permanence

Alternative 2 provides for protection in the long term by using an enforceable covenant (Uniform Environmental Covenants Act covenant) to limit exposures to those consistent with industrial exposure assumptions. Groundwater is only slightly contaminated, and plume concentrations above acceptable risk levels are contained within the Site boundaries. Groundwater will be available for beneficial uses within a reasonable restoration timeframe and will continue to be monitored to assure that it does.

Alternative 3 provides long-term protection by removing additional soil contamination beyond what was originally excavated and treated as required by the ROD and ESD. This would result in a slight reduction in the risk consequences of inadvertent intrusion (violation of institutional controls) for those areas receiving excavation and would potentially speed up restoration of the groundwater. Institutional controls through an enforceable covenant would be necessary as portions of the Site would not meet UU/UE.

Alternative 4 provides long-term protection by restoring the groundwater to beneficial uses and by providing an enforceable covenant to limit exposures to those consistent with industrial land use. There is a chance that sources in the soil may recontaminate the groundwater thus requiring additional extraction and treatment of groundwater. Therefore, Alternative 4 may not provide long-term effectiveness without relying on attenuation of contaminants in the soil and groundwater.

Based on the forgoing Alternative 3 ranks highest for this criterion because it would reduce the length of the restoration timeframe, at which point all risks considered for this action would be permanently removed. Alternative 4 may similarly reduce the restoration timeframe but likely less reliably and with stated risks of recontamination. Alternative 2 ranks somewhat below Alternatives 3 and 4 because of its comparatively lengthier restoration timeframe.

Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment

Alternative 2 does not result in treatment of contaminants, but rather limits exposure and risks to acceptable levels through administrative controls. The Site has already been cleaned up to meet industrial cleanup levels, and the shallow aquifer is only slightly contaminated above what would allow for beneficial uses. Thus, treatment of contamination is not required for the alternative to be protective or to meet ARARs.

Alternative 3 would allow for treatment of contaminated soil if necessary to meet the waste acceptance criteria (including RCRA land disposal restriction treatment requirements) of the off-site landfill. However, the concentrations in the soil are not likely to require treatment for disposal at a hazardous waste landfill, and therefore treatment is not a principal element of this alternative.

Alternative 4 would provide for treatment of contaminated groundwater and landfilling of treatment media (resins). Groundwater contaminant levels are only slightly above risk-based standards for aldrin and dieldrin, and the level of treatment necessary would be limited. For these reasons, Alternative 4 ranks highest for this criterion, followed by Alternative 3 and 2 in that order.

Short-term Effectiveness

Alternative 2 has no physical short-term impacts on the Site. The covenant could be put in place quickly (within a few months) if this alternative is selected, and the institutional controls designed into the covenant would effectively protect workers and site users in the short term.

Alternative 3 would have short-term impacts to the use of the Site due to the active excavation of soil and the mobilization and then demobilization of excavation and hauling equipment. Also, as happened after the excavations performed in 1992, there may be near-term increases in groundwater contaminant levels due to a stirring up of contamination from source areas undergoing excavation. This effect is expected to be limited and much less significant than what resulted from the 1992 excavations. There would be some short-term increases in industrial safety risks to cleanup workers due to the use of heavy machinery for excavation and hauling. There would also be the potential for dust emissions during excavation and hauling, but there are standard practices to control fugitive dust that could be applied. It is estimated that once crews and equipment are mobilized, field work would be completed within 30 days.

Alternative 4 would have short-term impacts to the full use of the Site because of the installation, testing, and operation of a pump and treat system would limit uses on the portion of the Site containing the groundwater plume. There would be some short-term increases in industrial safety risk to cleanup workers due to drilling activities. The pump and treat system is assumed to run for 30 years to account for the potential influx of contaminants from the soil to groundwater. This duration is also the standard length of time for operations and maintenance (O&M) once a remedy is constructed (in this case, once the pump and treat system is operating and functioning properly).

Alternative 2 ranks highest for this criterion. Alternatives 3 and 4 rank similarly below Alternative 2.

Implementability

Alternative 2 is implementable as the proposed type of covenant (Uniform Environmental Covenant Act covenant) has been adopted by the State of Washington and is enforceable by both the EPA and the State. FMC would need to purchase the subsurface rights to the properties requiring institutional controls (see the proposed land use control area shown in Figure 2).

Alternative 3 is less easily implementable than the other alternatives because excavation into the lower portion of the Site involves addressing groundwater intrusion into the bottom of the excavation. Special shoring and potentially short-term pumping of water from the excavation would be necessary. Otherwise, standard proven excavation and waste handling practices would be employed.

Alternative 4 is implementable because pump and treat technology is proven and would involve standard installation, testing and operational practices.

Alternative 2 ranks highest for this criterion; followed by Alternatives 4 and 3 in that order.

Cost

Table 3 presents a summary of costs for the alternatives.

Table 3. Cost Summary

Remedial Alternative	Description	Direct and Indirect Capital Costs	Total O&M Costs (Undiscounted)	Net Present Worth of Total O&M Costs	Estimated Total Cost
Alternative 2	Institutional Controls	$26,800	$198,086	$74,479	$117,000
Alternative 3	Soil Excavation with Off-Site Landfilling and Institutional Controls	$3,716,725	$208,378	$78,180	$4,365,000
Alternative 4	Groundwater Extraction and Treatment and Institutional Controls	$803,200	$3,051,218	$1,254,078	$2,366,000

Notes:
Present worth costs calculated using a 7% per year future discount rate.
Cost estimates are estimated with accuracies of -30% and +50%.

Alternative 2 would cost approximately $117,000, which is far less than the other alternatives (except for No Action).

Alternative 3 would cost approximately $4,365,000 and represents the most expensive of the alternatives. The cost is based on meeting the soil to protect groundwater cleanup level for dieldrin and disposing of the estimated 2,900 cubic yards of contaminated soil at an approved offsite hazardous waste landfill. For comparison purposes, the cost to meet MTCA B soil cleanup levels for dieldrin would be $2,135,000 including disposing of approximately 1,140 cubic yards at an approved offsite hazardous waste landfill.

Alternative 4 would cost approximately $2,366,000 and is the second most expensive alternative. Alternative 2 ranks highest for this criterion; followed by Alternatives 4 and 3 in that order.

Modifying Criteria

State/Support Agency Acceptance

This criterion will be evaluated once the Proposed Plan has gone out for public comment and any comments received are addressed. The Washington State Department of Ecology is the agency that provides the State's acceptance.

Community Acceptance

This criterion will be evaluated by studying any comments received and how supportive the public is of the various alternatives including the preferred alternative.

PREFERRED ALTERNATIVE

Based on the evaluation of alternatives, the preferred alternative is Alternative #2 – Institutional Controls. Based on the information currently available, EPA believes this alternative will achieve the revised RAOs and that this alternative satisfies the threshold criteria of protectiveness and compliance with ARARs and provides the best balance of trade-offs among the alternatives with respect to the balancing criteria set out in the NCP. Of the alternatives that would be protective and comply with ARARs, institutional controls have the least short-term impacts and given the low levels of residual groundwater contamination are far more cost-effective than further active remediation for groundwater Institutional controls for soil are expected to be needed indefinitely, and institutional controls for groundwater will be necessary as long as the groundwater remains above levels that allow for unlimited use and unrestricted exposure.

No additional groundwater remedy is considered necessary because the soil remediation actions taken to date and attenuation of groundwater are expected to result in restoration of the groundwater in a reasonable timeframe of 30 years or less. This expectation is based on the historic trends of declining contaminant concentrations in groundwater since the remedial actions in 1992-93. The continued monitoring component of the alternative would be used to assure that groundwater is restored as expected in a reasonable timeframe.

Associated with this preferred alternative, EPA is proposing to revise the RAOs and to add aldrin and dieldrin as COCs.

EPA expects the Preferred Alternative to satisfy the following statutory requirements of CERCLA §121(b): 1) be protective of human health and the environment; 2) comply with ARARs (or justify a waiver); 3) be cost effective; 4) utilize permanent solutions and alternative

treatment technologies or resource recovery technologies to the maximum extent practicable; and 5) satisfy the preference for treatment as a principal element (or justify not meeting the preference).

COMMUNITY PARTICIPATION

EPA provides information regarding the cleanup of the FMC Yakima Superfund Site through the Administrative Record file for the Site and announcements placed in the Yakima Herald newspaper. Also, information repositories have been established at the main branch of the Yakima Central Library and EPA's Region 10 Records Center to support the public comment period. The public is invited to comment on the remedial alternatives and the preferred alternative provided in this Proposed Plan. The dates for the public comment period, the location of the Administrative Record file and the information repositories are provided on the front page of this Proposed Plan.

For further information on the FMC Yakima Superfund Site, please contact:

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REFERENCES

40 CFR 141, "National Primary Drinking Water Regulations," Code of Federal Regulations.

40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," Code of Federal Regulations.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq.

FMC 1994. *FMC - Yakima Site Remediation Project, Yakima Washington – Remedial Action Completion Report*, Document 19088-R-002 (Revision 2), FMC Corporation.

FMC 2011. *Supplemental Feasibility Study – Former FMC Pesticide Formulation Facility, Yakima, Washington*, FMC/ 0120748 (Revision 0), FMC Corporation.

FMC, 2008. *Five-Year Report: Fall 2007 Groundwater Monitoring Activities, Former FMC Pesticide Formulation Facility, 4 West Washington Avenue, Yakima, Washington*, FMC Corporation.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq.

EPA, 1990. *Record of Decision – Declaration, Decision Summary, and Responsiveness Survey for Remedial Action at FMC Corporation, Yakima, Washington*, U.S. Environmental Protection Agency.

EPA, 1993. *EPA Superfund Explanation of Significant Differences: FMC Corp. (Yakima Pit), EPA ID: WAD0000643577, OU 01, Yakima, WA*, U.S. Environmental Protection Agency.

EPA, 2008. *Third Five-Year Review Report for FMC Yakima Superfund Site, Yakima, Washington*, U.S. Environmental Protection Agency.

WAC 173-340, "Model Toxics Control Act – Cleanup," Washington Administrative Code.

Public Information Repositories

Key documents supporting the proposed action are provided in hard copy form at the following address:

Yakima Central Library	EPA Region 10
Yakima Valley Libraries	Records Center
102 North 3rd Street	1200 6th Avenue, Suite 900
Yakima, WA 98901	Seattle, WA 98101
509 452-8541	206-553-1200.

GLOSSARY OF TERMS

Administrative Record – The body of documents and information that is considered or relied upon to arrive at a final decision for remedial action. An Administrative Record has been established for FMC Yakima Superfund Site and the locations of the record and information repositories are provided in this Proposed Plan.

Applicable or Relevant and Appropriate Requirements (ARARs) – Promulgated cleanup standards, standards of control, and other substantive requirements, criteria, or limitations under Federal or more stringent state environmental laws that may be required to be met during a CERCLA remedial action unless site-specific waivers are obtained.

Aquifer – A saturated and permeable geologic unit capable of producing water as from a well.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (also known as "Superfund") – A Federal law that, among other things, establishes a program to address the liability, enforcement, and cleanup of releases of hazardous substances.

Contaminant – Any chemical or radionuclide or other element, solution, substance, compound, or mixture that is expected to be present at a site based upon past and current land uses and associated releases, and which presents a threat to human health and/or the environment.

Contaminants of Concern (COCs) – Any contaminants expected to be present at a site based upon past and current land uses and associated releases, and which present a threat to human health and/or the environment.

Explanation of Significant Differences (ESD) – A document that describes the nature of significant changes to a remedy selected in a ROD, summarizes the information that led to making the changes, and affirms that the revised remedy complies with CERCLA.

Feasibility Study (FS) – A CERCLA study to develop and evaluate options for remedial action. The FS emphasizes data analysis and is generally performed concurrently and in an interactive fashion with the remedial investigation, using data gathered during the remedial investigation. The remedial investigation data are used to define the objectives of the response action, to develop remedial alternatives, and to undertake an initial screening and detailed analysis of the alternatives. The term also refers to a report that describes the results of the study.

Hazard Quotient – Site-specific exposure to a single contaminant divided by the exposure level at which no adverse health effects are likely to occur.

Institutional Controls – Non-engineered instruments (such as administrative and/or legal controls) that minimize the potential for exposure to contamination by limiting land or resource use.

Maximum Contaminant Level (MCL) – The maximum permissible level of a contaminant in water that is delivered to any user of a public water system.

Model Toxics Control Act (MTCA) – A Washington State environmental law similar to CERCLA. The law and corresponding regulations are considered as ARARs for various CERCLA actions in the state.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP) – Provides the organizational structure and procedures for preparing for and responding to discharges of oil and releases of hazardous substances, pollutants, and contaminants (see 40 CFR 300.1).

National Priorities List (NPL) – A list compiled by the U.S. Environmental Protection Agency of uncontrolled hazardous substance releases in the United States that are priorities for long-term remedial evaluation and response.

Pesticides – Chemicals and other products used to kill, repel, or control pests. The term also applies to disinfectants and sterilants, insect repellents and fumigants, rat poison, mothballs, and many other substances.

Proposed Plan – A document for public review and comment that summarizes the analysis of different cleanup options and explains which option (called the "preferred alternative") is being recommended.

Record of Decision (ROD) – A formal CERCLA document in which a regulatory agency sets forth the selected remedial action at a site and the reasons for its selection.

ROD Amendment – A document that describes the fundamental changes to a remedy selected in a ROD, summarizes the information that led to making the changes, and affirms that the revised remedy complies with CERCLA. A Proposed Plan must be issued for public comment and comments must be addressed prior to finalizing changes to the remedy through a ROD Amendment.

Remedial Action – Those actions consistent with a permanent remedy taken instead of, or in addition to, removal action in the event of a release or threatened release of a hazardous substance into the environment, to prevent or minimize the release of hazardous substances so they do not migrate to cause substantial danger to present or future public health or welfare or the environment (see the "National Oil and Hazardous Substances Pollution Contingency Plan" [NCP], 40 CFR 300.5).

Remedial Action Objectives (RAOs) – Media specific or operable unit specific goals for protecting human health and the environment. They specify the contaminants of concern, the exposure routes and receptors and cleanup levels for each exposure route.

Remedial Investigation (RI) – A process aimed at determining the nature and extent of the problem presented by the release of hazardous substances into the environment. The RI emphasizes data collection and site characterization, and is generally performed concurrently and in an interactive fashion with the feasibility study. The RI includes sampling and monitoring, as necessary, and includes the gathering of sufficient information to determine the necessity for

remedial action and to support the evaluation of remedial alternatives (see the "National Oil and Hazardous Substances Pollution Contingency Plan" [NCP], 40 CFR 300.5).

Resource Conservation and Recovery Act of 1976 (RCRA) – A statute that applies to the generation, management, treatment and disposal of hazardous wastes. RCRA, or its state counterpart laws and regulations, are often selected as ARARs for CERCLA response actions.

Supplemental Feasibility Study (SFS) – A supplemental CERCLA study undertaken to develop and evaluate options for modifying existing remedies based on new information. The SFS is reported on in a document that builds upon previous feasibility study efforts.

Unrestricted Use/Unlimited Exposure (UU/UE) – A term used to describe a situation where a site may be used safely without restrictions for land use or exposure to contaminants.

ACRONYMS AND ABBREVIATIONS

ARARs	Applicable or Relevant and Appropriate Requirements
bgs	Below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COCs	Contaminants of Concern
EPA	Environmental Protection Agency
FR	Federal Register
IRIS	Integrated Risk Information System
MCL	Maximum Contaminant Level
MTCA	Model Toxics Control Act (Washington State statute)
NCP	National Oil and Hazardous Pollution Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
RAOs	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SFS	Supplemental Feasibility Study
USC	United States Code
UU/UE	Unrestricted Use/Unlimited Exposure
WDOE	Washington Department of Ecology