INTERIM AMENDMENT TO THE

RECORD OF DECISION FOR THE

EMF SUPERFUND SITE

FMC OPERABLE UNIT

POCATELLO, IDAHO

PREPARED BY:

SEPTEMBER 2012

DECLARATION FOR THE AMENDMENT TO THE RECORD OF DECISION

SITE NAME AND LOCATION

Eastern Michaud Flats Superfund Site

FMC Operable Unit

Pocatello, Idaho

EPA ID# IDD984666610

STATEMENT OF BASIS AND PURPOSE OF AMENDMENT

This decision document presents the selected interim amended remedy for the FMC Operable Unit (FMC OU) of the Eastern Michaud Flats (EMF) Superfund Site located partially on the Fort Hall Reservation in Pocatello, Idaho. The EMF Site has three OUs: two adjacent phosphate ore processing plants—the former FMC Corporation Elemental Phosphorus Plant (FMC OU) and the J.R. Simplot Company Don Plant (Simplot OU)—and an Off-Plant OU encompassing portions of the Site beyond plant properties. Remedies for all three OUs were selected in 1998 in a Record of Decision (ROD) by the U.S. Environmental Protection Agency (EPA) in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. §§ 9601 *et seq.* (CERCLA) and the National Contingency Plan, 40 CFR Part 300 (NCP). Because the FMC Plant was active at the time, the remedy described in the 1998 ROD did not include remedial actions within the Former Operations Area where elemental phosphorus production at the FMC Plant occurred. The ROD assumed continued operation of the plant in compliance with existing Facility health and safety plans and applicable environmental regulations that would protect plant workers and any other potential receptors, including visitors within the Former Operations Area, and that closure of the plant would be a regulatory matter whenever the plant closed, presumably after remedial action was completed. A Consent Decree to implement the remedy was negotiated with FMC and lodged by the United States but never entered by the Idaho District Court.

After closure of the FMC Plant in 2001, it became clear that further investigative work should be performed, including in the Former Operations Area of the plant. EPA issued an Administrative Order on Consent (2003 AOC) to FMC to perform a supplemental remedial investigation

(SRI)/feasibility study (SFS) for the FMC OU. Since 2001, FMC has completed decommissioning and demolishing the former plant buildings, maintained access control of the property, and has monitored groundwater.

Based on results of the investigations, EPA determined that an amendment to the 1998 ROD would be needed to address additional concerns associated with elemental phosphorus and other contaminants within the FMC OU and in doing so replace the remedy selected in the 1998 ROD. EPA is initiating remedial actions under an Interim ROD Amendment (IRODA) because of uncertainties regarding the timeframe for groundwater cleanup and the uncertain status of December 2010 Soil Cleanup Standards by the Shoshone-Bannock Tribes as Applicable or Relevant and Appropriate Requirements (ARAR) under CERCLA. The IRODA will promptly reduce risks to both human health and the environment under current and future land use scenarios. Action is necessary to reduce infiltration of surface water into elemental phosphorus and metals-contaminated soils and subsequent migration of contaminants beyond the FMC OU boundary onto the Simplot OU, potentially affecting that remedy, and toward the adjoining springs or the Portneuf River. The IRODA has been selected in accordance with CERCLA and the NCP and is based on the Administrative Record for the FMC OU.

ASSESSMENT OF THE FMC OU

In accordance with Section 106 of CERCLA (42 U.S.C. § 9606), the interim amended remedy selected in this IRODA is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances, pollutants, and/or contaminants into the environment from the FMC OU. Such a release or threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment.

PRINCIPAL THREAT WASTE

EPA has identified elemental phosphorus existing in concentrations exceeding 1,000 parts per million (ppm) in soil as a source material and principal threat waste at the FMC OU, because it will present a significant risk to human health and the environment should exposure occur. The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by contaminants at a site wherever practicable (NCP Section 300.430(a)(1)(iii)(A)). Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the

environment should exposure occur. EPA's decision to treat these wastes is made on a site specific basis through a detailed analysis of the alternatives using the nine remedy selection criteria.

Elemental phosphorus is a Resource Conservation and Recovery Act (RCRA) ignitable and reactive waste and is also a principal threat waste that has physical properties unlike most contaminants of concern (COC) encountered in environmental response actions. Because of its unique properties, managing elemental phosphorus requires special handling techniques not only for routine handling but also for emergency response. EPA evaluated remedial alternatives in detail in the SFS and during the development of the selected interim amended remedy. The evaluation included analyzing the potential use of treatment technologies. Capping and managing in place was selected over treatment because of the comparative levels of human health and environmental protection provided after implementation, lack of implementable excavation and treatment technologies, potential risks posed to remedial workers, adjacent Facility workers, and the public as well as the high cost compared to the cost of managing in place.

DESCRIPTION OF THE SELECTED INTERIM AMENDED REMEDY

The selected interim amended remedy for the FMC OU replaces the remedy selected in the 1998 ROD. It addresses metals, radionuclides, and other COCs identified in soils, fill, and groundwater at the FMC OU. The selected interim amended 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 in Figure 1 and described in Table 1
- Place approximately 12 inches of soil cover over areas containing slag fill, ore stockpiles, and the former Bannock Paving areas to prevent the exposure to gamma radiation and

fugitive dust of potential future workers. Gamma radiation-protective soil covers will be placed over RA-A, RA-A1, RA-F, and RA-G, as shown in Figure 1 and Table 1

- Excavate contaminated soil from Parcel 3 of FMC's Northern Properties, also known as RA-J, and consolidate 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 prevent contaminated groundwater from migrating beyond the FMC OU and into the Simplot OU and/or adjoining springs or the Portneuf River. Extracted groundwater will either be treated within the FMC OU to drinking water standards and/or risk-based cleanup levels and discharged to an infiltration basin within the FMC OU, where it would percolate down to recharge groundwater or evaporate into the atmosphere, or pumped to a municipal treatment facility in Pocatello for treatment and released in accordance with a National Pollution Discharge Elimination System (NPDES) permit. The treatment option for groundwater will be selected during design
- 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 described in Section 7.2), 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 that prohibit activities that may disturb 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
- Conduct operations and maintenance of implemented remedial actions.

Other actions, including closure and compliance actions under the RCRA, have been and continue to be performed at RCRA-regulated units of the FMC Facility. These actions are not part of the FMC OU because they are under RCRA regulatory authority. The work performed under RCRA jurisdiction remains regulated under RCRA and is not part of this IRODA.

STATUTORY DETERMINATIONS

Consistent with 40 CFR 300.430(a)(i)(B) and 40 CFR 300.430(f)(1)(ii)(C)(1), the remedial action selected by this IRODA is an interim measure and will neither be inconsistent with nor preclude implementation of the final remedy that will be identified in subsequent decision documents. Implementation of this selected interim amended remedy will promptly address current exposures throughout the FMC OU and storm water infiltration and resulting migration of contaminated groundwater toward the Portneuf River.

The measures in this selected interim amended remedy will be protective of human health and the environment, comply with federal and state/tribal requirements that are applicable or relevant and appropriate within the scope of the selected interim amended remedy, and result in cost-effective action and utilize permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. The selected interim amended remedy satisfies the statutory preference for remedies that employ treatment as a principal element, because the

groundwater will be extracted and treated to levels that are protective and meet ARARs. The selected interim amended remedy does not include treatment of elemental phosphorous and other co-located COCs throughout the FMC OU because of the chemical and physical nature of elemental phosphorous and the potential risks and uncertainties associated with the excavation and treatment of elemental phosphorus contaminated wastes.

Because the selected interim amended remedy will result in hazardous substances, pollutants, or contaminants remaining on the FMC OU above levels that allow for unrestricted use and unlimited exposure, a statutory review will be conducted within 5 years after initiation of the remedial action, and every 5 years thereafter to ensure that the interim amended remedy is or will protect human health and the environment.

ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary Section of this IRODA. Additional information can be found in the Administrative Record file for the FMC OU.

- COCs and their respective concentrations (Table 3 and Table 4)
- Baseline risk represented by the COCs (Section 6.0)
- Cleanup levels established for COCs and the basis for these levels (Section 7.2)
- How source materials constituting principal threats are addressed (Section 11.5)
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD (Sections 6.1 and 6.3)
- Potential land and groundwater use that will be available at the FMC OU as a result of the selected interim amended remedy (Section 6.6)
- Estimated capital, annual operations and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected (Table 12 and Table 14)
- Key factors that led to selecting the remedy (Section 10.1)

STATE AND TRIBAL ACCEPTANCE

The State of Idaho has submitted a letter of concurrence for this IRODA which is located in Appendix A. The Shoshone Bannock Tribes have submitted a letter of non-concurrence for this IRODA which is located in Appendix B.

AUTHORIZING SIGNATURE

This amendment to the ROD documents an interim remedy to address source control and groundwater contamination emanating from the Eastern Michaud Flats Superfund Site, FMC OU.

EPA Region 10 approves the selected interim amended remedy as described in this IRODA.

Lori Cohen, Associate Director
Office of Environmental Cleanup

9/27/12
Date

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TABLE OF CONTENTS

DECLARATION FOR THE AMENDMENT TO THE RECORD OF DECISION.....I

INTERIM ROD AMENDMENT DECISION SUMMARY FOR THE FMC OU 1

1. SITE NAME, LOCATION, AND DESCRIPTION 1

2. SITE HISTORY AND ENFORCEMENT ACTIVITIES 6

2.1 History of the FMC OU 6
2.2 CERCLA Investigations, Decision Documents, and Enforcement Summary 6
2.2.1 RCRA Enforcement Action and Consent Decree 6
2.3 Suspected Causes of Contamination and Contaminated Media 7
2.4 Summary of Previous Environmental Investigations 9
2.5 1998 Record of Decision 10
2.6 2003 Administrative Order on Consent 11

3. COMMUNITY PARTICIPATION 12

4. SCOPE AND ROLE OF SELECTED INTERIM AMENDED REMEDY 13

4.1 Original 1998 ROD for the EMF Site (including FMC OU) 14
4.2 Summary of the RCRA and CERCLA Programs at the FMC Facility 14
4.3 Basis for this ROD Amendment 15
4.4 Scope of this Interim Amended Remedy 16
4.5 Reasons for An Interim Rather Than A Final Remedy 18
4.5.1 Shoshone-Bannock Tribes' Soil Cleanup Standards 19
4.5.2 Groundwater Remedy Timeframe 20

5. SITE CHARACTERISTICS 20

5.1 Physical Site Characteristics 20
5.2 Nature and Extent of Soil Contamination and Conceptual Site Model 21
5.3 Nature and Extent of Groundwater and Surface Water Contamination 22
5.3.1 General Groundwater Characteristics and Observations 22
5.4 Summary of Groundwater Contamination in the Western Ponds Area 23
5.5 Summary of Groundwater Contamination in the Central Plant Area 24
5.6 Joint Fence Line/Calciner Ponds Area 25
5.7 Northern Properties 26
5.8 Phosphorous TMDL in the Portneuf River and Its Impacts on the FMC OU 26

6. SUMMARY OF SITE RISKS 27

6.1 Human Health Risks 27
6.1.1 Former Operations Area 28
6.1.2 FMC-Owned Northern Properties 29
6.1.3 Southern Undeveloped Area and the Western Undeveloped Area 29
6.2 Ecological Risks 29
6.2.1 Summary of Ecological Risks at the Former Operations Area 30

6.2.2 Summary of Ecological Risks at the FMC-Owned Northern Properties, the Southern Undeveloped Area, and the Western Undeveloped Area 30
6.3 Risk and Impacts Associated with arsenic and Phosphorus in Groundwater Migrating Off Site and Impacting Surface Water 31
6.4 General Impacts of Phosphorus on Rivers and Reservoirs 32
6.5 Impacts Observed in the Portneuf River 33
6.6 Uncertanties in the Risk Assessments 33
6.7 Conclusion of the Risk Assessments 35

7. REMEDIAL ACTION OBJECTIVES, CLEANUP LEVELS, AND THE BASES FOR THEIR SELECTION 35

7.1 Remedial Action Objectives 36
7.2 Summary of Contaminants of Concern, Cleanup Levels, and the Basis for Their Selection 37
7.2.1 Contaminants of Concern and Cleanup Levels for COCs in Groundwater 37
7.2.2 Contaminants of Concern and Cleanup Levels for COCs in Soil 38

8. SUMMARY OF REMEDIAL ALTERNATIVES 39

8.1 Common Elements 39
8.2 Description of Landfill Caps and Soil Covers 42
8.2.1 Gamma Soil Covers 43
8.2.2 Evapotranspiration (ET) Cap 43
8.3 Soil Alternatives 44
8.3.1 Soil Alternative 1 (No Action) 44
8.3.2 Soil Alternative 2 (Common Elements, Receptor-Initiated Remediation, Gamma Soil Cover and ET Capping, and Clean and Treat Off Site) 44
8.3.3 Soil Alternative 3/Selected Interim Amended Soil Remedy (Common Elements, Gamma Soil Cover and ET Capping, Excavate and Consolidate RA-J, Clean and Treat Off Site) 44
8.3.4 Soil Alternative 4 (Common Elements, Gamma Soil Cover and ET Capping, Excavate and Consolidate RA-A & RA-J, Clean and Treat Off Site) 45
8.3.5 Soil Alternative 5 (Common Elements, Gamma Soil Cover and ET Capping, Excavate and Consolidate RA-A, RA-I, & RA-J, Clean and Treat On Site) 46
8.3.6 Soil Alternative 6 (Common Elements, Gamma Soil Cover and ET Capping, Excavate and Consolidate RA-A, RA-I, & RA-J, Clean and Treat On Site, Excavate and Treat Buried Railcars) 46
8.4 Other Soil Alternatives 46
8.4.1 Soil Alternative 7 (Common Elements, Gamma Soil Cover and ET Capping, Deep Excavate and Consolidate [including all RCRA Waste Ponds], Clean and Treat On Site) 47
8.4.2 Soil Alternative 8 (Deep Excavation and Consolidation [Including all RCRA Waste Ponds], Clean and Treat On Site, Disposal Off Site) 47
8.5 Groundwater Alternatives 48
8.5.1 No Action Groundwater Alternative 48

8.5.2 Groundwater Alternative 1 (Source Control, Institutional Controls, and Long-Term Monitoring) 48
8.5.3 Groundwater Alternative 2/Selected Interim Amended Groundwater Remedy (Source Control, Institutional Controls, Long-Term Monitoring, Hydraulic Containment of Contaminated Groundwater at the Former Operations Area Boundary, and Treatment and Disposal of Contaminated Groundwater)..... 49
8.5.4 Groundwater Alternative 3 (Source Controls, Institutional Controls, Long-Term Monitoring, Hydraulic Containment of Contaminated Groundwater at Former Operations Area Boundary, Groundwater Extraction at Source Areas, and Treatment and Disposal of Contaminated Groundwater) 50

9. COMPARISON OF SELECTED INTERIM AMENDED REMEDY AND ALTERNATIVES 51

9.1 Threshold Criteria 52
9.1.1 Overall Protection of Human Health and Environment 52
9.1.2 Compliance with ARARs 54
9.2 Balancing Criteria 57
9.2.1 Long-Term Effectiveness and Permanence 58
9.2.2 Reduction of Toxicity, Mobility, or Volume of Contaminants Through Treatment 59
9.2.3 Short-Term Effectiveness 61
9.2.4 Implementability 62
9.2.5 Costs 64
9.3 Modifying Criteria 66
9.3.1 State and Tribal Acceptance 66
9.3.2 Community Acceptance 66
9.3.3 State and Tribal Comments 66

10. THE SELECTED INTERIM AMENDED REMEDY 67

10.1 Summary of the Rationale for the Selected Interim Amended Remedy 67
10.2 Detailed Description of the Selected Interim Amended Remedy 68
10.2.1 Institutional Controls 71
10.3 Cost Estimate for the Selected Interim Amended Remedy 71
10.4 Estimated Outcomes of the Selected Interim Amended Remedy 72

11. STATUTORY DETERMINATIONS 73

11.1 Protection of Human Health and the Environment 73
11.2 Compliance with ARARS 73
11.3 Cost-Effectiveness 75
11.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable 76
11.5 Preference for Treatment As A Principal Element 76
11.6 Five-Year Review Requirement 79

12. RESPONSIVENESS SUMMARY 80

13. RESPONSE TO COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD 81

13.1 COMPILED COMMENTS FROM THE PUBLIC 81

13.1.1 Support of the Preferred Alternative 81
13.1.2 Opposition to the Preferred Alternative 81
13.1.3 Characterization of the FMC OU 84
13.1.4 Future Development and Land Use at the FMC OU 86
13.1.5 Support and Opposition for a Pilot Study for Treatment and Excavation of Elemental Phosphorus 87
13.1.6 Overall Protection of Human Health and the Environment 88
13.1.7 Design of the Groundwater Extraction System 89
13.1.8 Groundwater Modeling 90
13.1.9 Groundwater Compliance Zone 91
13.1.10 Evapotranspiration Cap and Gamma Cap Design 92
13.1.11 Human Health and Ecological Risk Drivers 93
13.1.12 Health and Safety of Handling Elemental Phosphorus 96
13.1.13 Risks Posed by Subsurface Elemental Phosphorus 99
13.1.14 Long-Term Reactivity of Subsurface Elemental Phosphorus 100
13.1.15 Fate and Transport of Elemental Phosphorus in Contact with Groundwater 101
13.1.16 Long-Term Effectiveness of Capping Versus Short-Term Effectiveness of Excavation 102
13.1.17 Buried Materials Within the Slag Pile 104
13.1.18 Phosphine Gas Generation 105
13.1.19 Phosphine Gas Monitoring 106
13.1.20 Other Gases of Concern 106
13.1.21 CERCLA Ponds Versus RCRA Ponds 107
13.1.22 Land Disposal Restriction Treatment System 108
13.1.23 Novel Remedial Approaches 109
13.1.24 Idaho National Laboratory 110
13.1.25 Natural Disaster Contingencies 111
13.1.26 Clean Closure of FMC OU 112
13.1.27 Gamma Radiation and Radon-222 112
13.1.28 Health of Downstream Fish and Wildlife 114
13.1.29 Public Health Concerns 115
13.1.30 Financial Responsibility of FMC 116
13.1.31 EPA Involvement During FMC Operations 116
13.1.32 EPA Community Outreach 117
13.1.33 EPA's Coordination with FMC Corporation 119
13.1.34 CERCLA Regulations 121
13.1.35 Selection of an Interim ROD Amendment 121
13.1.36 Tribal Soil Cleanup Standards as an ARAR 124

13.1.35 Selection of an Interim ROD Amendment 121
13.1.36 Tribal Soil Cleanup Standards as an ARAR 124
13.1.37 Management Involvement 126
13.1.38 Transporting Waste to Gay Mine 126
13.1.39 Slag as a Commodity 126
13.1.40 EPA Representation in Pocatello 127
13.1.41 Cost Estimates for Excavation and Treat Elemental Phosphorus 127
13.1.42 Background Calculation of Gamma Radiation 128
13.1.43 American Indian Environmental Office Representation 129
13.1.44 NASA Consultation 129
13.1.45 Land Use Designation 129
13.1.46 Construction and Debris Landfill 130
13.1.47 Remedy Management System 130

13.2 RESPONSES TO THE DECEMBER 2, 2011 COMMENTS FROM THE SHOSHONE-BANNOCK TRIBES REGARDING THE FMC OPERABLE UNIT PROPOSED PLAN 132

13.2.1 EPA Failed to Perform an Ecological Risk Assessment 132
13.2.2 The Proposed Interim Groundwater Remedy Does Not Meet CERCLA Waiver Requirements 136
13.2.3 Other Concerns with the Proposed Groundwater Remedy 137
13.2.4 The Tribes Preferred Groundwater Alternative 139
13.2.5 The Proposed Interim Soil Remedy Does Not Meet CERCLA Waiver Requirements 140
13.2.6 The Proposed Interim Soil Remedy Does Not Meet the Threshold Criterion of Protection of Human Health and the Environment 142
13.2.7 EPA Should Amend Its Remedial Action Objectives to Address Phosphine and Include Protection of Subsurface Strata 145
13.2.8 The Proposed Interim Soil Remedy Does Not Meet the Threshold Criterion of ARAR Compliance 145
13.2.9 The Proposed Interim Soil Remedy Does Not Meet the CERCLA Primary Balancing Criterion of Long-Term Effectiveness and Permanence 146
13.2.10 The Proposed Interim Soil Remedy Does Not Meet the CERCLA Primary Balancing Criteria of Reduction of Toxicity, Mobility, and Volume Through Treatment 148
13.2.11 Other Concerns With the Proposed Soil Remedy 149

13.3 RESPONSES TO THE DECEMBER 2, 2011 COMMENTS FROM ROGER TURNER, REPRESENTING THE SHOSHONE-BANNOCK TRIBES REGARDING THE FMC OPERABLE UNIT PROPOSED PLAN 151

13.3.1 General Comments 151
13.3.2 Groundwater Comments 152
13.3.3 Buried Pipes and Tanks Comments 153
13.3.4 New Utility Lines and Extraction Wells Comments 154
13.3.5 Treatment of Elemental Phosphorus in the Soils 156

13.3.6 RCRA Violations with the Discarding of Waste Below and Near the Furnace Building 160
13.3.7 ET Cap Details Are Too Vague 161
13.3.8 Tribal Air Quality Rules as Applicable or Relevant and Appropriate Regulations (ARARs) Under CERCLA Actions 161

13.4 EPA RESPONSE TO THE DECEMBER 2, 2011 COMMENTS FROM THE FMC CORPORATION REGARDING THE FMC OPERABLE UNIT PROPOSED PLAN 164

13.5 RESPONSES TO THE DECEMBER 2, 2011 COMMENTS FROM J.R. SIMPLOT COMPANY REGARDING THE FMC OPERABLE UNIT PROPOSED PLAN . 193

14. REFERENCES 200

LIST OF ACRONYMS USED IN THE IRODA 202

FIGURES 1 THROUGH 17 204

TABLES 1 THROUGH 15 222

STATE OF IDAHO LETTER OF CONCURRENCE ..... APPENDIX A

SHOSHONE BANNOCK TRIBES LETTER OF NON-CONCURRENCE .... APPENDIX B

LIST OF FIGURES

Figure 1: Soil Alternative 3 Selected Interim Amended Remedy 205
Figure 2: EMF Regional Setting 206
Figure 3: FMC Facility 207
Figure 4: FMC Operable Unit 208
Figure 5: Former Elemental Phosphorus (P4) Production Area, CERCLA Ponds, RCRA Ponds, and Slag Pile 209
Figure 6: Location of Equipment and Infrastructure Prior to Plant Closure Within the Former Operations Area 210
Figure 7: Location of Remediation Areas Within the FMC OU 211
Figure 8: Shallow Groundwater Flow Paths and Areas Beneath the FMC Facility 212
Figure 9: Groundwater Concentration Map for Arsenic 213
Figure 10: Groundwater Concentration Map for Potassium 214
Figure 11: Groundwater Concentration Map for Sulfate 215
Figure 12: Groundwater Concentration Map for Nitrate 216
Figure 13: Groundwater Concentration Map for Total Phosphorus/Orthophosphate 217
Figure 14: Groundwater Concentration Map for Selenium 218
Figure 15: Former Furnace Building, Secondary Condenser, and Phosphorus Loading Dock 219
Figure 16: Groundwater Alternative 2 Selected Interim Amended Remedy Approximate Locations of Proposed Extractions Wells and Piping/POTW Option 220

Figure 17: Groundwater Alternative 2 Selecting Interim Amended Remedy Approximate Locations of Proposed Extraction Wells and Piping/Extraction – Infiltration Basin Option.....221

LIST OF TABLES

Table 1: Summary of RAs, RUs, Description of Fill, and Associated RCRA SWMUs 223
Table 2: Waste Fill Profile by Remediation Area (RA) 229
Table 3: Typical Levels and Concentrations of Contaminants of Concern Present In Source Materials.....230
Table 4: Maximum Detected Groundwater Concentrations and Maximum Contaminant Levels 231
Table 5: Summary of Risks for the FMC OU.....232
Table 6: Summary of Groundwater Risks for the FMC OU.....236
Table 7: Summary of Ecological Risks for the Northern Properties, Western Undeveloped Area, and Southern Undeveloped Area.....238
Table 8: Contaminants of Concern in Groundwater and Cleanup Levels for the FMC OU 2441
Table 9: Contaminants of Concern in Soil and Cleanup Levels for Risk Drivers for the FMC OU.....242
Table 10: Soil Alternatives Summary of Comparative Rankings.....243
Table 11: Groundwater Alternatives Summary of Comparative Rankings.....244
Table 12: Key Features, Capital Costs, and O&M Costs of Soil Alternatives 245
Table 13: Estimated Areas for Capping and Consolidation of Soil Alternatives 246
Table 14: Key Features, Capital Costs, and O&M Costs of Groundwater Alternatives 247
Table 15: Key Features, Capital Costs, and Costs of O&M of the Selected Interim Amended Remedy.....247

INTERIM ROD AMENDMENT DECISION SUMMARY FOR THE FMC OU

1. SITE NAME, LOCATION, AND DESCRIPTION

The Eastern Michaud Flats (EMF) Superfund Site (U.S. Environmental Protection Agency [EPA] ID# IDD984666610) is located in southeast Idaho, approximately 2.5 miles northwest of Pocatello, Idaho (Figure 2). The Site includes two adjacent phosphate ore processing plants: the former FMC Corporation Elemental Phosphorus Plant (FMC Plant) and the J.R. Simplot Company Don Plant (Simplot). Both began operating in the 1940s. FMC began processing phosphate ore and manufacturing elemental phosphorus at the FMC Plant in 1949 and continued until the FMC Plant ceased operations in December 2001 and was subsequently demolished. The FMC and Simplot operations (which include the plants, other areas related to their operations, and adjacent owned areas) occupy approximately 2,475 acres (approximately 1,450 for FMC and 1,025 for Simplot). The FMC Operable Unit (OU) is one of three OUs that constitute the EMF Superfund Site. The other two are the Simplot OU and the Off-Plant OU. The EMF Superfund Site encompasses the areal extent of contamination at or from both FMC and Simplot operations, including what the 1998 Record of Decision (ROD) described as the *Off-Plant Subarea* (now OU). The term *off-site* has been mistakenly used at times to describe this area in documents in the Administrative Record. This Interim ROD Amendment (IRODA) only addresses the FMC OU.

Over the years, numerous names have been used to describe FMC-owned properties. This IRODA uses the definitions in the table below to describe different geographic areas within and adjacent to the FMC Plant. Also included in this table are terms used in the Proposed Plan that correspond to the terms used in this IRODA.

Definition of Terms for Geographic Areas at the FMC Facility

Term Used in the IRODA	Term Used in the Proposed Plan	Description
FMC Plant	FMC Plant	This is used as a generic term throughout the IRODA to describe the FMC Corporation Elemental Phosphorus Production Facility in Pocatello, Idaho.
FMC Facility	FMC Facility	All areas owned by FMC. Sometimes used as *Facility* (see 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)	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 Figure 4).
Former Operations Area	Interior Footprint of the FMC Plant, 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 Figure 3.
Former Elemental Phosphorus (P_4) Production Area	Former Furnace Building	Areas within the FMC Facility where primary elemental phosphorus production occurred, including the furnace building, secondary condenser, phos dock, slag pit, and the former kiln scrubber ponds and calciners. See Figure 5.
CERCLA Ponds	CERCLA Ponds	Areas within the FMC Facility where process wastes were managed in unlined surface impoundments and are addressed under this IRODA. See Figure 5.
RCRA Ponds	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 Figure 5.

Term Used in the IRODA	Term Used in the Proposed Plan	Description
Slag Pile	Slag Pile	Area containing most of the above grade slag by-product from FMC Plant operations. See Figure 5.
Northern Properties	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 Figure 3.
Western Undeveloped Area (WUA)	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 Figure 3.
Southern Undeveloped Area (SUA)	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 Figure 3.

The FMC OU is on FMC-owned land, most of which is located partially within the Fort Hall Indian Reservation, as shown in Figure 4. The easternmost portions of the FMC OU (approximately 27 percent of the FMC OU) as well as the entire Simplot OU are located outside the Reservation boundary. The nearest residence is within one-half mile north of the Northern Properties. The Portneuf River flows adjacent to the most northeastern portion of the FMC OU. The river runs through an area of the Reservation known as *the Bottoms,* where many of Shoshone-Bannock traditional and ceremonial activities occur, including fishing and gathering of native plants. In addition, some tribal members rely on fish from the Portneuf River as a food source.

Groundwater beneath the FMC OU generally flows north and west from the Former Operations Area until it converges and discharges to the Portneuf River in the vicinity of Batiste Springs. Groundwater flow has been divided into the following three flow regimes:

- Northward flow from the western and central portions of the FMC OU is limited to the area south of I-86 by converging flow of groundwater from the west and northwest
- 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 and comingles beneath the eastern side of the Former Elemental Phosphorus Production Area, and exits from beneath the FMC OU to the northeast.

Virtually all groundwater flowing beneath the FMC and Simplot Facilities discharges to the Portneuf River at Batiste Spring and the Spring at Batiste Road (aka Swanson Road Springs).

In 1998, EPA issued a ROD for cleanup of the EMF Site, including the FMC OU. The ROD addressed several media, including capping of contaminated soils, groundwater monitoring, and contingent groundwater extraction, but did not fully address the Former Operations Area, because it was assumed the FMC Plant would continue to operate and comply with health and safety plans as well as other environmental regulations, such as RCRA. This IRODA again

selects capping and management of soil and fill at the FMC OU but over a different geographic area and with minor differences from the 1998 ROD. It also selects groundwater extraction and treatment at the FMC OU as a requirement rather than a contingency.

The ROD and this IRODA present remedial actions selected in accordance with Section 117 of CERCLA, as amended, 42 USC §§ 9601 *et seq.,* and the National Contingency Plan, 40 CFR Part 300 (NCP).

This IRODA will become part of the Administrative Record file consistent with Section 300.825(a)(2) of the NCP. The Administrative Record contains the information on which selection of this interim remedial action was based and is available for review at the following locations:

Idaho State University Library
Government Documents
850 South 9th Avenue
Pocatello, Idaho 83209
208-282-3152

Shoshone-Bannock Library
Tribal Business Center
Pima Drive and Bannock Avenue
Fort Hall, Idaho 83203
208-478-3882

American Falls Library
308 Roosevelt Street
American Falls, Idaho 83211
208-226-2335

EPA Region 10 Superfund Records Center
1200 Sixth Avenue, Suite 900, ECL-076 (7th Floor)
Seattle, WA 98101
206-553-4494

2. SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 HISTORY OF THE FMC OU

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

2.2 CERCLA INVESTIGATIONS, DECISION DOCUMENTS, AND ENFORCEMENT SUMMARY

FMC, Simplot, and EPA entered into a 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 entire Site. During the RI/FS, the Site was divided into three "Subareas:" (1) the FMC Subarea, consisting of the FMC Corporation Elemental Phosphorus Plant and other FMC-owned properties at the Site; (2) the Simplot Subarea, consisting of the J.R. Simplot Company Don 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 the 1998 ROD, although the ROD refers to both *OUs* and *subareas* in different places.

As required under the 1991 AOC, FMC and Simplot developed a number of EMF Site studies and reports. These included the *Preliminary Site Characterization Summary* (BEI 1994) and the *Remedial Investigation Report for the EMF Site (EMF RI Report;* BEI 1996). 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 *1997 FMC Subarea FS Report* and the 1998 ROD.

2.2.1 RCRA Enforcement Action and Consent Decree

At about the same time that EPA Region 10 was developing the 1998 ROD, the U.S. Department of Justice (DOJ) and EPA entered into negotiations with FMC regarding alleged violations of

RCRA requirements at the then-operating FMC Plant. These included the alleged failure of FMC to obtain a permit or interim status for some of its hazardous waste ponds, operating waste disposal ponds that did not meet RCRA Minimum Technological Requirements (MTR), late submittal of RCRA Pond closure plans, and other violations.

A Consent Decree was negotiated regarding these violations and was entered by the U.S. District Court in Idaho on July 13, 1999. The Consent Decree included a civil penalty of approximately $11.9 million, required FMC to install a range of upgrades to assure management of hazardous waste in accordance with RCRA requirements, and specified a schedule for developing and implementing pond closure plans. It also specified a set of 14 Supplemental Environmental Projects (SEP).

This RCRA Consent Decree was not a driver for and did not specify any of the investigative or other work that has been performed in the CERCLA process. The CERCLA RI/FS AOC was issued by EPA to FMC and Simplot in May 1991, approximately 6 years before the RCRA compliance negotiations began. Similarly, the RCRA Consent Decree did not set investigative requirements for the 2003 supplemental RI (SRI)/supplemental FS (SFS) AOC EPA issued to FMC. The RCRA Consent Decree did not establish any cleanup goals or criteria for CERCLA remediation. This summary is provided to explain the different roles of the RCRA and CERCLA programs and processes in remediating the entire FMC Facility.

2.3 SUSPECTED CAUSES OF CONTAMINATION AND CONTAMINATED MEDIA

The former FMC Plant began operation in 1949 and produced elemental phosphorus from phosphate-bearing shale ore mined regionally until its closure in 2001. Figure 6 presents the location of the Former Operations Area. Ore was shipped by rail to FMC during the summer months and stockpiled. The ore was crushed, screened, and formed into briquettes prior to heat treatment (known as *calcining*). The calcining process involved heating the ore briquettes to a sintering temperature of approximately 1,200°F to 2,000°F to form nodules. Carbon monoxide (CO), a by-product of the phosphorus furnace reaction, was used as fuel to fire the calciners. The nodules were blended with coke and quartzite (known as *silica*) to make the phosphorus furnace feed. This mix of nodules, coke, and silica was fed into four electric arc furnaces. The furnace reaction primarily yielded gaseous elemental phosphorus (product), CO gas (used as an energy

source for the process), slag (by-product/waste), ferrophos (by-product), precipitator dust (waste), calciner solids (waste), and phossy solids (waste). The elemental phosphorus gas was subsequently condensed to a liquid state and stored in sumps and tanks in the furnace building as well as at the phosphorus loading dock 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. At various times, some of the wastes or by-products were sold or had some commercial value. With the exception of ferrophos, the materials remaining on the FMC OU have no commercial value and are wastes or fill materials that will require long-term management.

FMC used waste material (predominately slag) as fill to grade its property and expand its operations area. Slag is a source of gamma radiation, while other process wastes are RCRA-characteristic wastes because of their ignitability/reactivity and/or high metals content. Molten elemental phosphorus leaked from the furnace building into the soil below and formed a plume of now-solid elemental phosphorus beneath the Former Elemental Phosphorus Production Area. Because elemental phosphorus is pyrophoric at sufficient concentrations, it is classified a RCRA ignitable waste. Depending on the specific moisture content, pH, and other liquid constituents in contact with the elemental phosphorus, it may also be classified as a RCRA reactive waste. Process water (known as *phossy water*) was used to isolate elemental phosphorus from contact with air and was also used to slurry precipitator dust. Numerous surface impoundments were historically dewatered and/or capped, but many contain various process wastes. The railroad swale was designed as a storm water retention area but also received phossy water (and therefore elemental phosphorus) from process spills in the furnace building and phosphorus loading dock. Phossy water, phossy solids, and precipitator slurry were typically managed separately in a series of surface impoundments located to the west of the Former Elemental Phosphorus Production Area. Some of these impoundments are a source of contamination in groundwater. A number of these surface impoundments are RCRA-regulated units (Ponds 8S, 11S, 12S, 13S, 14S, 15S, 16S, 17, 18A, 8E, and 9E; see Figure 1 and Figure 5) and are not subject to action under this IRODA beyond the RCRA/CERCLA cap integration activities in the selected interim amended remedy. These RCRA-regulated units have already been closed and capped by FMC with EPA oversight pursuant to the applicable RCRA regulations and the 1999 RCRA Consent Decree.

Air deposition from FMC Plant emissions, including fugitive dust, has dispersed contaminants to surface soil adjacent to the Former Operations Area, north of the historic ore stockpile. Air deposition from former and ongoing EMF Plant (Simplot and FMC Plant operations) emissions has been confirmed within the FMC OU, the Simplot OU, and the Off-Plant OU. Risks posed by air deposition within the FMC OU will be addressed by this interim remedial action.

2.4 SUMMARY OF PREVIOUS ENVIRONMENTAL INVESTIGATIONS

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*, *Supplemental Remedial Investigation Report* (*SRI Report;* MWH, 2009a), *Supplemental Remedial Investigation Addendum Report* (*SRI Addendum Report*; MWH, 2010a), and *Groundwater Current Conditions Report* (*GWCCR*; MWH, 2009b). The 1996 *EMF RI Report* provides detailed information for the FMC, Simplot, and Off-Plant OUs (often called *subareas* in 1990s-era documents) for air, soil, and groundwater. The FMC OU 2009 SRI evaluated FMC OU areas not investigated during the RI because of ongoing FMC Plant operations but 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, 2010b) for the FMC OU.

Development and Description of Remediation Areas

During the SRI/SFS, the impacted areas of the Former Operations Area were divided into 24 remediation units (RU). 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 based upon investigations 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, combining (or in some cases dividing) RUs and parcels into new geographical areas based on remedial action similarities facilitated the SFS processes and remedy selection analyses and should, in the future, facilitate remedy implementation. These areas 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. Figure 7 presents the RAs that were used as part of the development and evaluation of each remedial alternative described in the Proposed Plan for the FMC OU. Table 1 includes a summary of RAs, RUs, description of fill materials, and associated SWMUs.

2.5 1998 RECORD OF DECISION

In 1998, EPA issued a ROD for cleanup of the EMF Superfund Site, including the FMC subarea currently referred to as the *FMC OU*. It concluded that releases from the FMC Plant contained elevated levels of hazardous substances, also more generally referred to as COCs (primarily metals and radionuclides), which affected the FMC Facility and some surrounding areas. Of greatest concern were process wastes containing ignitable reactive phosphorus, primarily in pre-RCRA-era waste ponds, and radionuclide and radon levels that posed unacceptable risks under potential future industrial land use scenarios.

The selected remedy in the 1998 ROD for the FMC OU included—

1. Capping the Old Phossy Waste Ponds and Calciner Solids Storage Area and lining the Railroad Swale to reduce or eliminate infiltration of rainwater and prevent incidental exposure to contaminants
2. Monitoring groundwater and implementing legally enforceable controls that will run with the land to prevent use of contaminated groundwater for drinking purposes under current and future ownership; groundwater monitoring and enforceable controls will continue until COCs in groundwater beneath the FMC OU decline to below the maximum contaminant levels (MCL) or risk-based concentrations (RBC) for those substances
3. Implementing legally binding land use controls that will run with the land to prevent potential future residential land use and control potential future worker exposures

4. Implementing a contingent groundwater extraction/treatment system if contaminated groundwater migrates beyond FMC-owned property and into adjoining springs or the Portneuf River; containment of contamination shall be achieved via hydrodynamic controls such as long-term groundwater gradient control provided by low-level pumping; extracted groundwater will be treated and recycled within the plant to replace unaffected groundwater that would have been extracted and used in plant operations
5. Conducting operations and maintenance on capped areas and the groundwater extraction system, if implemented.

FMC implemented some of the actions called for in the 1998 ROD voluntarily, with some informal EPA oversight. These actions included groundwater monitoring and recording land use restrictions as institutional controls. Required capping and contingent groundwater extraction/treatment system were not implemented. Pursuant to the SRI/SFS AOC issued in 2003 and described immediately below, FMC has continued to perform groundwater monitoring on a regular basis.

2.6 2003 ADMINISTRATIVE ORDER ON CONSENT

In December 2001, FMC stopped production of elemental phosphorus and closed the FMC Plant. EPA and FMC entered into an AOC to conduct a supplemental RI/FS in October 2003 that required FMC to investigate and evaluate the FMC OU areas that were not investigated under the 1991 RI/FS AOC and determine whether additional actions were needed to protect human health and the environment. The 2003 SRI/SFS AOC required the following activities:

1. Complete a memorandum updating the original RI:

- Update the conceptual site model (CSM) and identify former working areas in the Former Operations Area that were not addressed by the remedy selected in the 1998 ROD
- Delineate areas not previously evaluated in the RI/FS
- Develop an RBC for elemental phosphorus in soil
- Update the *EMF RI Report.*

In December 2004, EPA approved FMC's final *Remedial Investigation Update Memorandum* (*RI Update Memo*; BEI, 2004).

2. Conduct an SRI to refine the extent of contamination and associated risks. FMC conducted SRI field work between May and December 2007. The *SRI Report* was approved by EPA in November 2009. The *SRI Addendum Report* (December 2009) and the *GWCCR* (July 2009) included additional SRI studies.

3. Submit an SFS report that develops and evaluates remedial alternatives using CERCLA remedy selection criteria to identify a preferred alternative to address the risks at the FMC OU. The final *SFS Report* was approved by EPA on July 18, 2011.

3. COMMUNITY PARTICIPATION

There is a long history of Tribal and community interest in the FMC Facility. Over the years, EPA has provided numerous opportunities to involve and inform interested parties. EPA will continue to support Tribal and community involvement.

The Proposed Plan for this IRODA was issued for public comment in accordance with Section 117 of CERCLA, as amended, and Section 300.435(c)(2)(ii) of the NCP. The Proposed Plan was made available on September 26, 2011, and a public notice was published in the following publications, announcing the commencement and length of the public comment period and the availability of the Administrative Record file for public review:

- September 26, 2011, and November 9, 2011, *Idaho State Journal–Pocatello*
- September 26, 2011, and November 9, 2011, *Power County Press*
- September 21, 2011, and November 9, 2011, *ShoBan News*
- September 26, 2011, *Blackfoot Morning News*
- November 9, 2011, *Aberdeen Times*

In addition, notices were posted in public locations around the Fort Hall Reservation on October 5, 2011.

The Proposed Plan was made available on September 26, 2011, in the Administrative Record file at the following locations:

Idaho State University Library

Government Documents

850 South 9th Avenue

Pocatello, Idaho 83209

208-282-3152

Shoshone-Bannock Library

Tribal Business Center

Pima Drive and Bannock Avenue

Fort Hall, Idaho 83203

208-478-3882

American Falls Library

308 Roosevelt Street

American Falls, Idaho 83211

208-226-2335

EPA Region 10 Superfund Records Center

1200 Sixth Avenue, Suite 900, ECL-076 (7th Floor)

Seattle, WA 98101

206-553-4494

Four public meetings were held to present details related to the Proposed Plan and to solicit public comments. The first public meeting was held on October 12, 2011, at the Fort Hall Tribal Council Chambers. The second was held on October 13, 2011, at Chubbuck City Council Chambers. The third was held on November 15, 2011, at Chubbuck City Council Chambers. The fourth was held on November 16, 2011, at Fort Hall Tribal Council Chambers and Auditorium. A public comment period was open from September 26 through December 2, 2011. The attached Responsiveness Summary addresses comments received on the Proposed Plan during the public comment period.

4. SCOPE AND ROLE OF SELECTED INTERIM AMENDED REMEDY

This IRODA replaces the previously selected CERCLA remedy, Remedial Action Objectives (RAO), and cleanup levels for the FMC OU. Implementation will be coordinated with the actions

implemented under RCRA jurisdiction at the FMC Facility; it does not supersede RCRA actions and requirements for which FMC is also responsible. The interim amended remedy will address immediate human health and environmental risks at the FMC OU, address sources of groundwater contamination in the FMC OU that contribute to groundwater and surface water contamination in the larger EMF Site, and will neither exacerbate conditions at the FMC OU or any other portion of the EMF Site nor interfere with the implementation of any future final remedy. This IRODA will eventually be followed by a Final ROD Amendment that will further address compliance with all Applicable or Relevant and Appropriate Requirements (ARAR), consistent with CERCLA, including any waivers.

4.1 ORIGINAL 1998 ROD FOR THE EMF SITE (INCLUDING FMC OU)

In 1998, EPA issued a ROD for cleanup of the Site, including the FMC OU. The ROD addressed several media, including capping of contaminated soils, groundwater monitoring, and contingent groundwater extraction, but did not fully address the Former Operations Area—specifically, the former Elemental Phosphorus Production Area—because it was assumed that the FMC Plant would continue to operate and comply with Facility health and safety plans and applicable environmental laws and regulations, such as RCRA and the Clean Water Act. The ROD requirements are described in detail in Section 2.5.

4.2 SUMMARY OF THE RCRA AND CERCLA PROGRAMS AT THE FMC FACILITY

As described in Sections 2.2.1 and 2.2.2, there are RCRA-regulated units that are not part of the FMC OU or this IRODA. SWMUs at the FMC OU that are not regulated hazardous waste units are subject to both RCRA Corrective Action requirements and to CERCLA Remedial Action requirements. This interim action is expected to satisfy the RCRA Corrective Action requirements for those non-RCRA-regulated units.

RCRA-regulated waste ponds (Ponds 8S, 11S, 12S, 13S, 14S, 15S, 16S, 17, 18A, 8E, and 9E) at the FMC Facility contain elemental phosphorus wastes and other phosphorus compounds that are producing phosphine gas beneath their caps. Previously approved RCRA closure plans for these ponds anticipated the potential for phosphine gas generation and included a contingent gas-collection system beneath the caps. Carbon treatment technology for safely removing and

treating phosphine gas from the extracted gas was subsequently added for some of these ponds. EPA's RCRA program is developing additional strategies to treat and manage phosphine gas production within the RCRA pond area.

The current CSM for the CERCLA RAs does not anticipate that they will produce phosphine gas in quantities that would pose a significant risk to human health and the environment. Because the CERCLA ponds were not lined, there are no significant levels of water that remain commingled with the waste. Also, because the waste is generally dry, there is no free water with which elemental phosphorus can react with to produce appreciable levels of phosphine. Nevertheless, the selected interim amended remedy in this IRODA includes a comprehensive gas-monitoring program that will include phosphine and potentially other gases and extraction should conditions at areas covered by the selected interim amended remedy warrant it.[1] Implementation of this interim action will be coordinated with all RCRA program activities at the FMC Facility.

4.3 BASIS FOR THIS ROD AMENDMENT

Two significant developments at the EMF Superfund Site have led to the need for and selection of this interim remedy:

- The remedy described in the 1998 ROD did not include remedial actions within the Former Elemental Phosphorus Production Area of the FMC Plant. The ROD assumed indefinite continued operation of the plant by FMC. The ROD assumed that the FMC Plant would be operated in accordance with existing Facility health and safety plans and applicable regulatory requirements for operating facilities, which would protect plant workers and any other potential receptors, including visitors within the Elemental Phosphorus Production Area, and that closure of the FMC Plant would similarly be a regulatory matter whenever the plant closed, presumably after remedial action was completed. A Consent Decree to implement the FMC OU portion of the ROD was negotiated with FMC and lodged by the United States but never entered by the Idaho District Court. Following closure of the FMC Plant in 2001, EPA concluded that further

[1] Phosphine, hydrogen sulfide, and hydrofluoric acid were measured at detectable levels in the soil column within the Former Operations Area. Hydrogen cyanide was sampled for but not detected. No levels of these gases were detected in ambient air. The results of this sampling event are documented in the *Site Wide Gas Assessment Report for the FMC Plant Operable Unit* (MWH, 2011). This and other information will be used in developing the gas-monitoring program in the Remedial Design (RD) phase.

investigatory work would be required, including in the Former Elemental Phosphorus Production Area. EPA therefore issued the 2003 SRI/SFS AOC. Since FMC Plant closure in 2001, FMC has completed the SRI/SFS and demolished all the buildings within the FMC OU, maintained access control of the property, and has performed ongoing groundwater monitoring. Results of the studies support the need to take additional remedial action to protect human health and the environment at the FMC OU.

- In the course of implementing the Simplot OU portion of the remedy selected in the 1998 ROD, additional studies related to development of the Portneuf River Daily Maximum Load (TMDL) have been performed, and data and other information has been collected that demonstrate that ongoing COC releases to groundwater and surface water are of greater significance than was recognized at the time of the 1998 ROD. The primary source of phosphorus and other COC loading to groundwater and ultimately surface water is from the Simplot OU. EPA therefore issued an IRODA for the Simplot OU in January 2010, and a First Consent Decree Amendment to the 2002 Simplot OU Consent Decree to implement this Simplot OU IRODA was entered in Idaho District Court in August 2010, under which Simplot is addressing COCs in groundwater, including phosphorus. Similarly, additional actions that were not included in the 1998 ROD are needed at the FMC OU to reduce arsenic and other COCs in groundwater migrating off site and into the Portneuf River.

4.4 SCOPE OF THIS INTERIM AMENDED REMEDY

This IRODA selects capping or covering and in-place management of soil and fill at the FMC OU, includes groundwater extraction and treatment as a requirement rather than a contingency, and requires long-term monitoring and land use controls. 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. Evapotranspiration (ET) caps, soil covers to protect against gamma radiation, land-use restrictions, and a groundwater pump and treat system are projected by EPA to provide protection of human health and the environment. ET caps prevent the leaching and migration of COCs (such as arsenic and phosphorus constituents) in fill and soil to groundwater by preventing precipitation from infiltrating contaminated fill and soil. Properly maintained ET

caps, when combined with institutional controls, achieve all RAOs for protection of human health and the environment with respect to potential soil exposure pathways, including: (1) gamma radiation emission, (2) incidental ingestion, (3) direct dermal exposure, (4) the threat of elemental phosphorus fire, and (5) inhalation of fugitive dust.

Soil covers eliminate exposure to gamma radiation (*gamma soil covers*). Properly maintained gamma soil covers, when combined with institutional controls, achieve all RAOs for potential human exposure pathways for (1) gamma radiation, (2) incidental ingestion, (3) direct dermal exposure, and (4) inhalation of fugitive dust.

Elemental phosphorus within the FMC OU, because of its pyrophoric nature, its dispersion in the soil column, and the volume present, cannot be easily and safely excavated, disposed of, or treated. The most viable option EPA found for treating elemental phosphorus is with caustic hydrolysis, which requires excavation and then treatment. No viable in situ treatment option that would prevent the need to excavate elemental phosphorus was identified. The risks associated with excavating elemental phosphorus at the FMC OU far exceed the risks associated with managing it in place. EPA conducted an extensive evaluation of all known available technologies and methods and has coordinated with many different experts to determine whether the excavation and treatment or off site disposal of elemental phosphorus can be safely conducted. In addition to conducting the previous evaluation and in parallel with implementing this interim remedial action, to address continued concerns raised by the Shoshone-Bannock Tribes (Tribes), EPA has committed to working with the Tribes to facilitate another independent review of technologies and approaches to excavate and/or treat elemental phosphorus within the subsurface of the FMC OU. However, the proposed review will not delay implementation of this IRODA.

As described in Section 4.2, capped RCRA-regulated waste ponds at the FMC Facility are being addressed through RCRA and are not part of FMC OU or this CERCLA selected interim amended remedy.

Land-use restrictions will limit FMC OU activities to commercial/industrial uses, prohibit activities that may disturb the selected remedial alternative, and restrict human consumption of groundwater. Land-use restrictions will also strictly manage when, where, and how non-remedial excavation can occur (for example, digging to access utility lines).

Groundwater extraction from the shallow aquifer will provide hydraulic containment of contaminated groundwater thereby preventing further down-gradient migration of FMC OU COCs. Extraction wells will capture affected shallow groundwater before it can migrate down-gradient beyond the Former Operations Area toward the Portneuf River. Extracted groundwater will either be treated to drinking water standards (MCLs) and/or risk-based cleanup levels and discharged to an infiltration basin within the FMC OU, where it would percolate down to recharge groundwater or evaporate into the atmosphere, or it will be routed to a municipal treatment in Pocatello for treatment prior to discharge in compliance with the treatment facility's National Pollution Discharge Elimination System (NPDES) permit. The decision on how to treat groundwater will be made during the Remedial Design (RD).

4.5 REASONS FOR AN INTERIM RATHER THAN A FINAL REMEDY

There are two primary reasons an IRODA has been issued rather than a Final ROD Amendment:

- Elemental phosphorus within the FMC OU cannot be easily and safely excavated. The Tribes recently promulgated soil cleanup standards (SCS) that, among other things, require excavation and/or treatment of all buried elemental phosphorus within the FMC OU. Although the Tribes' SCSs may be ARARs for future actions, EPA is continuing to evaluate them. Further, given the stringency of these standards and their implications for addressing buried elemental phosphorus contaminated material, among other COCs, EPA cannot predict when a final determination regarding their status as ARARs will be made.
- The groundwater remedy calls for extraction and treatment of groundwater beneath the FMC OU. Based on the current groundwater modeling simulations, achieving groundwater restoration (i.e., meeting drinking water standards, which are ARARs, and/or risk-based groundwater cleanup levels) is predicted to take longer than 100 years. However, the conclusion is highly uncertain, because groundwater flow conditions will change significantly during implementation of the interim remedy. Data collected during the design and implementation will improve EPA's understanding of the timeframe for groundwater cleanup.

EPA believes that the selected interim amended remedy in this IRODA is protective of human health and the environment. EPA anticipates a final remedy decision for the FMC OU within 5 to 10 years after the completion of implementation of this IRODA.

4.5.1 Shoshone-Bannock Tribes' Soil Cleanup Standards

In December 2010, the Tribes promulgated stringent SCS that require, among other things, excavation and/or treatment of all buried elemental phosphorus on the Fort Hall Reservation. Among the Tribes' stated goals in promulgating the SCS is restoring all land within the Reservation to its original state prior to the contamination that the standards are designed to address. This selected interim amended remedy does not meet these standards. However, because of the interim nature of this action, ARARs do not have to be met at this time. EPA is evaluating the Tribes' standards to determine whether these regulations may be ARARs. This evaluation will require careful federal review to determine whether these unique and potentially precedential SCS should be fully evaluated prior to a decision as to whether all or a part of the SCS are ARARs. CERCLA requires that ARARs must be met or waived upon completion of remedial action. At the time that EPA selects a final remedy, EPA will more definitively address groundwater restoration within a reasonable restoration timeframe, will determine whether all or a part of the Tribal SCS are ARARs, and will if necessary determine the applicability of the ARAR waiver provisions in §121(d)(4) of CERCLA. EPA will consult with the Tribes on the selection of the final remedy, including consideration of any proposed waiver or waivers.

It is important to note that even if EPA concludes that excavation and/or treatment of contaminated soil and waste in accordance with the new Tribal regulations (or otherwise) should and could be implemented, the ET capping and groundwater treatment selected in this IRODA is necessary to address the continued FMC OU groundwater contributions to Simplot OU groundwater and to surface water contamination. This remains true even if EPA concluded that excavation and/or treatment of contaminated soil and waste were warranted. Contaminated groundwater would continue to migrate off site during the 20 to 40 years estimated to complete such an action.

This IRODA for the FMC OU allows the prompt implementation of the selected interim amended remedy and eliminates current potential exposures while the Tribal SCSs undergo

evaluation and analyses. Prompt implementation of the selected interim amended remedy is necessary to prevent infiltration of surface water into elemental phosphorus-contaminated soils and subsequent migration of contaminants toward adjoining springs or discharging to the Portneuf River. Even if EPA were to select an excavation and treatment remedy in the future, the interim remedial action is necessary to stop this infiltration during a 2–4-decade-long treatment process. The selected interim amended remedy is also necessary to promptly eliminate direct contact, inhalation, and ingestion risks associated with other COCs within the FMC OU.

4.5.2 Groundwater Remedy Timeframe

The second reason for an interim rather than final remedy relates to groundwater. The groundwater remedy calls for extraction and treatment of groundwater beneath the FMC OU. Based on the current groundwater modeling simulations, achieving groundwater restoration (i.e., meeting drinking water standards, which are ARARs, and/or risk-based groundwater cleanup levels) is predicted to take longer than 100 years. However, many of the simulation inputs require assumptions such as hydraulic conductivity, transmissivity, and sorption coefficients that may not be accurate, and groundwater flow conditions will change significantly after implementation of the remedy, thus making total time to meet cleanup levels exceedingly difficult to predict at this time. The final ROD Amendment will more definitively address groundwater restoration within a reasonable restoration timeframe.

Simplot OU contributions to surface water and groundwater are being addressed pursuant to the Simplot OU Consent Decree, as amended. The groundwater remedy for the FMC OU has been designed to be consistent with the remedy for the Simplot OU.

5. SITE CHARACTERISTICS

5.1 PHYSICAL SITE CHARACTERISTICS

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.

5.2 NATURE AND EXTENT OF SOIL CONTAMINATION AND CONCEPTUAL SITE MODEL

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. Table 1 describes the individual RAs and associated wastes. Table 2 provides a profile of the RA and waste fill in each and includes the average fill depths, total fill volume, predominant fill type, and secondary fill type. *Predominant Fill Type* in Table 2 describes the primary material in the fill, while *Secondary Fill Type* describes other materials observed in the fill to a lesser extent. RA-H does not contain fill material. Table 3 presents typical levels and concentrations of COCs in source and waste materials at the FMC OU. 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 from surface runoff.

Phosphine gas can 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. 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).

5.3 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. For purposes of evaluation, the FMC OU was partitioned into the following areas for evaluation in the *GWCCR* (see Figure 8). The four following areas were partitioned based on similar operations and similar groundwater flow direction for the *GWCCR:*

- Western Ponds Area
- Central Plant Area
- Joint Fence Line/Calciner Ponds Area
- Area North of Highway 30 and I-86 (FMC Northern Properties)

5.3.1 General Groundwater Characteristics and Observations

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 8). 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).

The *GWCCR* concluded that the groundwater quality and the area of EMF-impacted groundwater essentially remained unchanged from 1991 through 2010. Figures 9 through 14 present updated groundwater concentration maps for arsenic, potassium, sulfate, nitrate, total phosphorus/orthophosphate, and selenium, respectively, for the FMC OU. These constituents

were selected for the concentration maps as the primary indicator parameters, based on their physical characteristics which EPA used to delineate the area of EMF-impacted groundwater. Table 4 shows maximum detected groundwater concentrations during the 1991 through 2010 period, the range of contaminants, and associated MCLs. Because of the arid nature of the EMF Site, radiological and chemical constituents will typically only leach from source and fill materials into the underlying soils if there is hydraulic head (e.g., an uncovered wet waste pond) collection in low areas of rainwater runoff, or unlined ponds.

The average depth of the FMC groundwater contaminant plume varies across the FMC OU as follows:

- Elevated terrain in joint FMC-Simplot fence line area (e.g., Well 161): 160'–200' bgs
- Western Pond area (e.g., Pond 8S wells): 90'–140' bgs
- Northern Former Operations Area fence line (e.g., Well 110): 65'–100' bgs
- FMC Northern Property Parcel 3—near FMC trailers (e.g., Well 517): 60'–100' bgs
- FMC Northern Property Parcel 3—southeast corner I-86 and West Pocatello interchange (e.g., Well TW-12S): 50'–90' bgs
- Batiste Springs (FMC Northern Property Parcel 6) near Batiste Spring well house: 15'–45' bgs.

EMF impacted groundwater does not migrate beneath FMC Northern Properties Parcels 1, 4, and 5.

5.4 SUMMARY OF GROUNDWATER CONTAMINATION IN THE WESTERN PONDS AREA

The nature of impacts to groundwater in the Western Ponds Area can be summarized as elevated concentrations (i.e., greater than background levels) of common ions, lowered pH, and elevated concentrations of nutrients such as ammonia, nitrate, and total phosphorus/orthophosphate, and metals such as arsenic and manganese. Arsenic (MCL of 10 µg/L) is the most significant groundwater COC in this area measured at a concentration above an MCL (many COCs, like total phosphorus/orthophosphate, a major concern at the EMF Site, do not have an MCL, see Table 4 and Figures 9 through 14.)

Over the 10 years of routine monitoring, elemental phosphorus has been sporadically detected in both upgradient and downgradient wells at Pond 8S. Although detected at a small number of monitoring wells in the Former Operations Area, elemental phosphorus has not been detected downgradient of FMC OU because elemental phosphorus oxidizes in groundwater to phosphorus/orthophosphate very quickly.

5.5 SUMMARY OF GROUNDWATER CONTAMINATION IN THE CENTRAL PLANT AREA

The nature of impacts to groundwater in the Central Plant Area can be summarized (like the Western Ponds Area) as elevated concentrations (i.e., greater than background levels) of common ions, lowered pH, and elevated concentrations of nutrients such as ammonia, nitrate, and total phosphorus/orthophosphate, and metals such as arsenic and manganese. Arsenic (MCL of 10 µg/L) is the most significant groundwater COC in this area measured at a concentration above an MCL (many COCs, like total phosphorus/orthophosphate, a major concern at the EMF Site, do not have an MCL, see Table 4 and Figures 9 through 14.)

Over the 10 years of routine monitoring, elemental phosphorus has been consistently detected only in monitoring wells 108 and 122, as well as in rinsate blanks associated with the elemental phosphorus sampling and analysis events.

The Central Plant Area (RA-B) (see Figure 8) includes the former furnace building, secondary condenser, and phosphorus loading dock (see Figure 15). These were the primary elemental phosphorus product production, storage, and handling areas within the Former Elemental Phosphorus Production Area.

Elemental phosphorus was produced within the four electric arc furnaces in the furnace building. The furnaces produced elemental phosphorus gas which passed through a series of condensers where the elemental phosphorus was condensed into a liquid, collected in subsurface, brick-lined concrete sumps, and maintained above the melting point of 112°F (44°C). The elemental phosphorus was pumped by displacement with water through above-ground piping to the phosphorus loading dock (also within RA-B), located directly north of the furnace building. Releases of liquid elemental phosphorus from the furnace building elemental phosphorus sumps, the phosphorus loading dock and condensers led to elemental phosphorus migrating beneath the

furnace building approximately 85 feet to groundwater. Significant heat required to mobilize elemental phosphorus in a mobile, molten state was transferred to the soil column in the vicinity of the furnace building and the slag pit during continuous operation of the furnaces. The temperature in the soil column and groundwater in the vicinity of the furnace building remained above the 112°F melting point of elemental phosphorus, and elemental phosphorus migrated approximately 700 feet downgradient of the furnace building where it cooled, solidified, and remains. Elemental phosphorus is sparingly soluble in water (< 3 mg/L), but migration in groundwater while the soil column and groundwater were heated above 112°F during operations appears to be the source of the elemental phosphorus levels detected in monitoring wells 108, 121, 122, and 123.

Although it has been detected at a small number of monitoring wells in the Former Elemental Phosphorus Production Area, elemental phosphorus has not been detected downgradient of monitoring wells 108, 121, 122, and 123. Elemental phosphorus will rapidly oxidize to total phosphorus/orthophosphate in groundwater. The phosphorus/orthophosphate concentrations in groundwater resulting from oxidation of elemental phosphorus in the Former Elemental Phosphorus Production Area are indistinguishable from total phosphorus concentrations measured elsewhere at the EMF Site (see Figure 13). The MCL for elemental phosphorus is 0.00073 mg/L and elemental phosphorus concentrations were measured in wells 108 and 122 at 0.258 mg/L and 0.000719 mg/L respectively.

5.6 JOINT FENCE LINE/CALCINER PONDS AREA

The nature of impacts to groundwater in the Joint Fence Line/Calciner Ponds Area are elevated concentrations (i.e., greater than background levels) of common ions, lowered pH, and elevated concentrations of nutrients such as ammonia, nitrate, and total phosphorus/orthophosphate, and elevated levels of metals such as arsenic (MCL 10 ug/liter) and selenium (MCL 50 ug/liter) above their respective MCLs (many COCs, like total phosphorus/orthophosphate, a major concern at the EMF Site, do not have an MCL, see Table 4 and Figures 9 through 14).

Elemental phosphorus has not been detected in groundwater in this area.

5.7 NORTHERN PROPERTIES

The groundwater impacts in the area north of Highway 30 and I-86 are elevated concentrations (i.e., greater than background levels) of common ions, elevated concentrations of nutrients such as nitrate and total phosphorus/orthophosphate, and levels of arsenic above MCLs. The area north of Highway 30 and I-86 includes a series of wells that historically and currently are on the fringe or outside of the EMF-impacted groundwater area. These wells form a "fence" of sentry wells to the north of the EMF Site that are used to monitor contaminant migration from the EMF Site (both the Simplot and FMC OUs) to their discharge point in the springs located along the Portneuf River north of I-86. Elemental phosphorus has not been detected in groundwater in this area and arsenic is the only contaminant detected above an MCL.

5.8 PHOSPHOROUS TMDL IN THE PORTNEUF RIVER AND ITS IMPACTS ON THE FMC OU

In 1999, the Idaho Department of Environmental Quality (IDEQ) prepared a water body assessment and TMDL for phosphorus (measured as total phosphorus or dissolved orthophosphorus) for the Portneuf River. The water body assessment and TMDL concluded that the springs downgradient of the EMF Site (non-point sources) were responsible for the largest mass loading of phosphorus to the Portneuf River, approximately 75 to 80 percent of total observed loading levels from all sources. In 2003, the Portneuf River TMDL Implementation Plan identified mass reduction goals for identified contributing sources, including an approximately 95 percent reduction for EMF Site sources. Although the 1998 selected remedy for the Simplot OU included a groundwater extraction system designed primarily to capture arsenic, co-located phosphorus in the groundwater was anticipated to also be captured in what EPA and Simplot believed would be sufficient quantities to meet the 95 percent loading reduction goal. Phosphorus in any of its forms was therefore not identified as a COC in the ROD with a specific performance standard. For the FMC OU, the 1998 ROD called for a contingent groundwater extraction plan that could be triggered based on the identification of a future requirement. Control of phosphorus loading from EMF sources could not be accomplished only utilizing the extraction system that was designed for arsenic remediation.

EPA has therefore determined that augmentation of the 1998 selected remedy utilizing additional actions is necessary to meet the phosphorus mass reduction goals and the target concentration of 0.075 mg/L phosphorus in surface water defined in the TMDL. As outlined in the TMDL, this target concentration will address risks to aquatic receptors in the Portneuf River posed by elevated phosphorus levels that were not adequately addressed by the selected remedy in the 1998 ROD.

6. SUMMARY OF SITE RISKS

This interim remedy addresses human health risks associated with potential exposure to soil, fill, and groundwater, and ecological risks associated with phosphorus migrating through groundwater and discharging to surface water (the Portneuf River).

6.1 HUMAN HEALTH RISKS

With EPA oversight and subject to EPA approval, FMC performed a human health risk assessment (HHRA), as documented in the *SRI Report*, which included a CSM that summarizes potential risks at the FMC OU. EPA's acceptable excess cancer risk range is 10^{-6} 10^{-4} (e.g., one in a million to one in ten thousand). EPA's Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-30 typically recommends action at sites when cancer risks exceed 10^{-4}. Non-cancer risks are measured by "hazard quotients" (HQ) or "hazard indices" (HI). A non-cancer HQ or HI is the ratio of estimated site-specific exposure to the estimated exposure at which no adverse health effects are likely to occur. When non-cancer HIs are less than one, EPA does not typically consider taking action. However, the risk threshold for cancer and non-cancer effects are not a discrete line and EPA may consider site-specific conditions in making remedial decisions. EPA generally considers excess cancer risks below 10^{-6} to be acceptable. Within the range of 10^{-6} and 10^{-4}, action is discretionary and EPA may consider environmental impacts, uncertainties in the risk estimates, data quality, and other factors in making remedial decisions. Excess cancer risk is the risk of developing cancer over and above the risk of developing cancer for the population of the United States, typically called background risk. The U.S. population background risk is one thousand times higher than the high end of EPA's acceptable risk range. The background population cancer risk range is approximately 3×10^{-1} to 5×10^{-1} (e.g., 1 in 3 to 1 in 2). "Excess" means the risks associated with the contamination at a hazardous waste site are

in addition to the background population risk. “Incremental risks” refers to risks associated only with the hazardous waste site and do not include the large population for background risk. Further discussions of some ecological risks are found in Section 6.2, and of human health and ecological risks associated with exposure to phosphorus and arsenic in the Portneuf River are found in Section 6.3.

6.1.1 Former Operations Area

Because residential use is not anticipated on the Former Operations Area (see Figures 3 and 6), and current workers are subject to formal health and safety procedures, the human exposure of concern is future workers. The SRI HHRA evaluated risks to potential future workers for the Former Operations Area. Carcinogenic risks to potential future workers associated with exposure to residual source/fill materials exceed EPA’s acceptable excess cancer risk range of 10^{-6} to 10^{-4}. Incremental excess cancer risks for future workers were as high as 4×10^{-3}. These risks are primarily from radium-226. Risks from chronic and subchronic exposures via other pathways (i.e., ingestion and inhalation) also exceed some risk parameters for this selected interim amended remedy for some incidental fill source materials. For non-carcinogenic risks, HQs for future workers were as high as 139, primarily because of the presence of elemental phosphorus. Elemental phosphorus in the subsurface within some RAs is a potentially acute hazard if excavated or otherwise disturbed. The elemental phosphorus could ignite, causing burns and inhalation hazards from intensely irritating phosphoric acid aerosols with potential to drift beyond the immediate area. Table 5 shows the summary of human health incremental cancer risks, incremental non-cancer HQs, elemental phosphorus HQs, acute risk hazards, and risk drivers for the FMC OU by RA and for each exposure scenario.

Groundwater contamination exceeded MCLs or RBCs (for COCs for which there are no MCLs). Incremental risks to future workers who ingest groundwater from the FMC OU were estimated to be as high as 5×10^{-3}, primarily due to arsenic. An HI of 61 was primarily attributable to elemental phosphorus. Arsenic, elemental phosphorus, fluoride, manganese, nitrate, selenium, vanadium, and uranium were evaluated as part of the *GWCCR* to determine incremental risk for future workers who ingest groundwater. Table 6 shows the summary of groundwater risk associated with the FMC OU.

6.1.2 FMC-Owned Northern Properties

For the Northern Properties (see Figure 3), current and future industrial use and potential residential use was considered possible and evaluated. The *SRI Addendum* HHRA evaluated risks to potential future residents and workers for the Northern Properties. The cumulative total lifetime excess cancer risks to the most exposed receptors (i.e., hypothetical future residents and future outdoor workers) were 2×10^{-3} and 6×10^{-4}, respectively. Radium-226 via external exposure via the gamma radiation pathway, and arsenic exposure via the groundwater ingestion pathway comprised over 90 percent of the cumulative total excess cancer risk estimates for both hypothetical future residents and future outdoor workers. The highest cumulative total reasonable maximum exposure (RME) non-cancer risk estimate to hypothetical future residential receptors was 62, from (potential) consumption of homegrown produce ingestion, drinking groundwater and ingesting soil associated with cadmium in soil and arsenic in groundwater. A cumulative total RME non-cancer HI of 1.8 was calculated for future workers. This HI is associated with the groundwater ingestion pathway, primarily arsenic exposure.

6.1.3 Southern Undeveloped Area and the Western Undeveloped Area

For the SUA and the WUA (Figure 3), current and future industrial use was considered possible and evaluated. No unacceptable risks to future workers were identified in these areas (Table 5).

6.2 ECOLOGICAL RISKS

EPA completed an ecological risk assessment (ERA) in July 1995 for all three operable units of the Site, including the FMC OU. The ERA did not identify any unacceptable risks to ecological receptors for the FMC OU. However, because no suitable habitat exists in the Former Operations Area, including the older non-RCRA regulated ponds, the focus of the ERA was on ecosystems in the Off-Plant OU.

EPA conducted a Site tour and ecological risk assessment meeting with FMC, IDEQ, and the Tribes in May 2003 in support of an assessment to determine whether the 1995 ERA needed to be amended as part of the SRI/SFS for the FMC OU following the closure of the FMC Plant in December 2001. Consistent with EPA ERA methodology and guidance, the group identified and assessed habitat of the FMC OU and concluded that the Former Operations Area lacked suitable habitat and is unlikely to be used by wildlife. The assessment also concluded that the Northern

Properties, SUA, and WUA were more likely to be used by wildlife. Based on this assessment and consistent with Section 300.430 of the NCP, EPA concluded that the 1995 ERA did not need to be formally amended.

6.2.1 Summary of Ecological Risks at the Former Operations Area

Elimination of FMC Plant infrastructure did not improve the Former Operations Area (Figures 3 and 6) as suitable habitat. As discussed in the 2004 *RI Update Memo,* access by large mammalian species (e.g., mule deer) to disturbed/developed areas of the FMC OU is also restricted by other migration barriers (e.g., Highway 30, I-86 and the Targhee Canal to the north of the FMC OU, the Simplot Facility to the east of the FMC OU, the steep terrain within the Bannock Hills to the south of the FMC OU, in addition to the wire fencing surrounding the Former Operations Area, and the cyclone fencing surrounding the RCRA pond closure area). There is also a lack of drinking water, and the disturbed areas are small compared to the home range of most of the avian species that can access these areas. Each of these factors limits the extent to which potential wildlife receptors could be exposed to hazardous substances within disturbed areas of the FMC OU. These areas also lack "especially sensitive habitats (or) critical habitats of species protected under the Endangered Species Act."

The RI did not assess risk to microorganisms in the Former Operations Area. An appropriate RI to characterize any site (EPA's obligation pursuant to Section 300.430(d)), including the baseline risk assessment, does not require a complete analysis of impacts to microorganisms in the soil regardless of whether EPA ultimately decides that these areas require remediation.

6.2.2 Summary of Ecological Risks at the FMC-Owned Northern Properties, the Southern Undeveloped Area, and the Western Undeveloped Area

In June 2008, FMC submitted the *Draft SRI Report* that included the results of the 2007 field investigations conducted within the FMC OU. In August 2008, based on consultation with the Tribes and regulatory review and comment on the *Draft SRI Report*, EPA determined that additional investigations were needed at the SUA and WUA and the Northern Properties to assess ecological and human health risks. These areas were extensively sampled in 2008. The *Supplemental Ecological Risk Assessment Addendum* was included as *Appendix E of the SRI Addendum Report* (November 2009) and presents the analysis and findings of the study.

The supplemental ERA for the WUA and SUA and Northern Properties evaluated risks to two types of plants, soil invertebrates, four types of birds including the red-tailed hawk and bald eagle, and small and large mammals, including mice, pygmy rabbit, Townsends big-eared bat, and mule deer (see Table 7). These species may be exposed to contaminants in soils through uptake into plants, and by transfer into items in the food chain. The assessment estimated risks for cadmium, chromium, fluoride, lead, mercury, selenium, vanadium, and zinc. However, only fluoride was found to present unacceptable risks to ecological receptors in one or more of the study areas. Risks to plants and four bird receptors were considered to be uncertain and below a level of concern since exposures did not exceed the lowest-observed-adverse-effects level (LOAEL). Risks to red-tailed hawks at Parcel 3 were considered unlikely because hawks would not spend as much time at the FMC OU as assumed in the risk assessment.

In summary, the sampling results and supplemental ERA generally showed that although slightly elevated levels of contamination associated with the FMC OU were detected in surficial soils due to air deposition, the levels of contaminants were generally below ecological levels of concern. There was a marginal potential risk to the horned lark from fluoride. These findings are consistent with the 1995 ERA. Table 7 shows the ecological risks associated with the Northern Properties and the SUA and WUA. Consistent with EPA guidance, community or population level impacts are unlikely to be associated with these marginal exceedances, and consideration of remedial alternatives based on the findings of the ERA is not warranted.

6.3 RISK AND IMPACTS ASSOCIATED WITH ARSENIC AND PHOSPHORUS IN GROUNDWATER MIGRATING OFF SITE AND IMPACTING SURFACE WATER

Although at high enough concentrations phosphorus can also present risks to human health, risks posed by phosphorus/orthophosphate are primarily associated with excessive phosphorus loading of surface water, at lower concentrations than what would be toxic to human as drinking water, resulting in significant degradation of habitat. The concentration of phosphorus in groundwater in the operations area was as high as 697 mg/L (well 150) in 1993. After dilution and attenuation in groundwater, phosphorus levels in water discharging near the Portneuf River have recently been as high as 29 mg/L (reported in 2007) measured at Batiste Springs. Due to these

concentrations, EPA requires additional actions to further reduce phosphorus concentrations in surface water attributable to the FMC OU.

Although there is no MCL or other regulatory standard for phosphorus in ground or surface water, the Portneuf River TMDL set a target total phosphorus criterion of 0.075 mg/L. The sections that follow describe impacts associated with phosphorous in surface water.

Arsenic in ground and surface water poses a potential threat to people who may drink the water. The concentration of arsenic in groundwater in the FMC OU was as high as 2,660 µg/L (well 150) in 1992. After dilution and attenuation in groundwater, arsenic levels in water discharging near the Portneuf River have recently been as high as 37µg/L (reported in 2007) measured at Batiste Springs. The current MCL for arsenic is 10 µg/L.

6.4 GENERAL IMPACTS OF PHOSPHORUS ON RIVERS AND RESERVOIRS

Excessive levels of phosphorus cause unhealthy, excessive growth of aquatic plants, such as periphyton (algae growing on rock surfaces), rooted and non-rooted macrophytes, and phytoplankton. Excessive growth of aquatic plants degrades the ecological communities in the river, thereby altering available prey species for fish in the ecosystem. Phosphorus introduced to a river can be transported in the water column in both soluble and particulate forms. Soluble phosphorus is utilized for growth by floating and non-rooted macrophytes (e.g., epiphyton attached to rooted plants). Particulate phosphorus can settle to the river bed and support the growth of rooted plants.

In addition to creating a nuisance for recreational use of the river, the increased biomass and consequent decomposition can deplete oxygen and degrade water quality that impacts fish and other aquatic life inhabiting the water, including reduced reproduction and growth of fish and invertebrates.

EPA's Environmental Monitoring and Assessment Program (EMAP) has collected samples of water, fish, and macroinvertebrates from a large number of water bodies from arid regions of the western United States. Correlating the concentrations of phosphorus and fish and macroinvertebrates densities provides empirical evidence that elevated phosphorus is an indirect stressor on aquatic life. Waters with elevated phosphorus concentrations are substantially more likely to have impacted fish and macro invertebrate communities.

6.5 IMPACTS OBSERVED IN THE PORTNEUF RIVER

Total phosphorus concentrations in the Portneuf River, downstream of the EMF Site, are more than 10 times higher than the Portneuf River TMDL target. This To Be Considered (TBC) value is an important indicator for the to-be-selected phosphorus cleanup standard. Pursuant to the 2010 Simplot OU Consent Decree Amendment, the total phosphorus cleanup standard for both the Simplot and FMC OUs will be selected in a future decision document(s).

Large volumes of groundwater entering the river from distinct springs and indistinct upwelling discharge directly into the Portneuf River between Batiste Road and Siphon Road. Groundwater impacted by arsenic, phosphorus, and other COCs also enters the river in this stretch. The range of dissolved oxygen (DO) at points between Batiste Road and Siphon Road is greater than upstream monitoring points. Downstream of Batiste Springs, the minimum daily DO concentration drops as much as 3 mg/L, and is routinely measured below the Idaho water quality standard of 6 mg/L in the early morning hours in late summer.

Downstream of Batiste Road, the macrophyte biomass increases by two factors of 100 compared to areas immediately upstream of the Facility, and this part of the river exhibits low macroinvertebrate diversity, consistent with water quality and habitat degradation associated with excessive nutrients.

Phosphorus levels in the Portneuf River significantly degrade water quality and habitat in the American Falls Reservoir due to excessive blue-green algal growth and associated reductions in hypolimnetic DO. Despite contributing less than 6 percent of the average annual inflow to American Falls Reservoir, the Portneuf River contributes approximately two-thirds of the total phosphorus load to the reservoir in an average flow year.

The phosphorus levels in the Portneuf River have significantly reduced DO. Reduced DO results in substantial risk to ecological receptors including: increased morbidity, increased mortality, and reproduction and growth effects in the Portneuf River.

6.6 UNCERTANTIES IN THE RISK ASSESSMENTS

Risk assessments entail levels of uncertainty due to incomplete knowledge of exposures and contaminants toxicities. Human cancer risk from radionuclides and gamma radiation are based

on Health Effects Assessment Summary Tables—Radionuclide Tables. Chemical toxicity values were used from an EPA peer-reviewed database for human health (IRIS database). Human health risks are driven by radionuclides and arsenic, which are based on human studies that increase confidence in the toxicity values. Finally, risks from exposure to ignitable elemental phosphorus are severe and highly certain should direct exposure occur.

The selection of contaminants to evaluate in the HHRA for the Northern Properties, SUA, and WUA of the FMC OU has a high degree of certainty because a full suite of contaminants and radionuclides was evaluated. Because the risks associated with radionuclides were unacceptable throughout the majority of the FMC OU, the inclusion of any additional contaminants in the assessment would not have affected the total risk estimates or the conclusion of unacceptable risk and the need for remedial action. In addition, the Northern Properties do not presently have residents on any parcels nor should they have residents in the future because of recorded environmental covenants which run with the land and which limit the Northern Properties to industrial uses.

The assumption that the exposure point concentrations for a given RA were based on the highest concentration of a contaminant within the various fill/source materials identified in the RA, regardless of how much of that fill/source material was actually present in the RA, will likely result in overestimating risk from contaminants in fill/source materials.

For the ERA, established, peer-reviewed sources of toxicity were used for ecological receptors. Although some uncertainty may exist due to extrapolation from tests with non-target populations of ecological receptors, the toxicity values for ecological receptors are considered health protective.

The uncertainty in the ERA for the FMC Former Operations Area stems primarily from, the assumption that wildlife will not visit or use the area due to lack of habitat, lack of access because of barriers and fences, and lack of drinking water sources. Should any of these barriers change in the future, or useable habitat naturally occur in the absence of re-development, unanticipated risks could arise. Intended future uses of the area, however, make unanticipated ecological risks unlikely.

In the Northern Properties, fluoride presented uncertain ecological risks to plants and birds at Parcels 2, 3, 4, and 6 in that exposures exceeded the no-observed-adverse-effects level (NOAEL) but not the LOAEL. At Parcel 3, fluoride presented risks to the red-tailed hawk based on exposure that exceeded the LOAEL. There is uncertainty regarding the fluoride risks, however, because the ERA concluded that risks have likely been overestimated because hawks will feed from the parcels much less frequently than was assumed in the risk assessment.

Finally, the risks to plants from selenium and vanadium were close to regulatory thresholds (i.e., HQs were close to 1), but because the toxicity values were regarded by their developers as having low certainty; the risk estimates for these two metals to plants are low but uncertain.

6.7 CONCLUSION OF THE RISK ASSESSMENTS

Radionuclides, metals, and phosphorus in soils and groundwater at the Former Operations Area of the FMC OU pose cancer risks, non-cancer hazards, and acute risk hazards. In the Northern Properties, risks to workers and hypothetical future residents are associated with soil and groundwater contamination. The phosphorus levels in the Portneuf River have resulted in significant reduction in the natural DO levels of the river, which results in substantial risk to ecological receptors. Implementation of the selected interim amended remedy is necessary to protect human health within the FMC OU and ecological receptors in the Portneuf River and American Falls Reservoir.

7. REMEDIAL ACTION OBJECTIVES, CLEANUP LEVELS, AND THE BASES FOR THEIR SELECTION

RAO provide a general narrative description of what the cleanup of a site or OU will accomplish. Cleanup levels are the more specific numerical endpoint concentrations or risk levels, for each media and/or exposure pathway, that are expected to provide adequate protection of human health and the environment as the selected interim amended remedy is implemented to achieve the RAOs.

As part of this IRODA, EPA is updating the RAOs and cleanup levels selected in the 1998 ROD for the FMC OU with the updated RAOs and cleanup levels described below. These RAOs and cleanup levels address the significant risks identified in the risk assessment for the FMC OU,

including the contribution of the FMC Facility to contamination of the groundwater and impacts to the Portneuf River.

7.1 REMEDIAL ACTION OBJECTIVES

As part of this IRODA, EPA is updating the RAOs and cleanup levels in the 1998 ROD. The 1998 RAOs and cleanup levels were developed and used in the SFS to develop and evaluate alternatives, and they will be used in the future to help guide remedy implementation and to evaluate the performance and protectiveness of the selected interim amended remedy. The remedy includes 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.

7.2 SUMMARY OF CONTAMINANTS OF CONCERN, CLEANUP LEVELS, AND THE BASIS FOR THEIR SELECTION

In addition to replacing the RAOs in the 1998 ROD, this IRODA selects updated COCs and cleanup levels for the FMC OU, in some cases confirming the original cleanup levels, in other cases making changes. The COCs and cleanup levels selected for the risk drivers in this IRODA are listed in Table 8 for groundwater and Table 9 for soil. This IRODA adds elemental phosphorus and total phosphorus to the groundwater COCs, and elemental phosphorus as a COC for soil for the FMC OU.

Section 121(d)(2)(A)(ii) of CERCLA requires that the remedial action selected by EPA "shall require a level or standard of control which at least attains MCLs and water quality criteria established under section 304 or 303 of the Clean Water Act, where such goals or criteria are relevant and appropriate under the circumstances of the release or threatened release." With respect to groundwater, generally if it is suitable for drinking in its natural state, then MCLs are relevant and appropriate.

A key change to an earlier cleanup level is the updated arsenic MCL which dropped from 50 µg/L to 10 µg/L. EPA will define ecological RBC targets for phosphorus in groundwater in a subsequent decision document for both the Simplot and FMC OUs.

These COCs and their respective cleanup levels are based on RBCs or ARARs identified in this IRODA. As discussed in Sections 9.1.2 and 11.2, additional standards (i.e., the 2010 Tribal Soil Cleanup Standards) may be considered as part of the development of the final remedy. EPA expects that the cleanup levels identified for this action will be consistent with those developed for the final remedy for the FMC OU.

7.2.1 Contaminants of Concern and Cleanup Levels for COCs in Groundwater

Table 8 lists the COCs for groundwater for the FMC OU, including total phosphorus and elemental phosphorus. The maximum concentrations detected have been updated as applicable

with periodic groundwater monitoring results and with analytical results collected during the SRI. All maximum detected concentrations were detected within the Former Operations Area within the FMC OU.

As was the case in the 1998 ROD, the cleanup levels for each COC are the MCLs, or the RBC if an MCL is not available. EPA is currently developing an RBC for phosphorus consistent with the Simplot OU IRODA which will be documented in a future decision document and used for the FMC OU as well.

EMF-impacted groundwater discharges to the Portneuf River near Batiste Springs north of I-86. COCs in EMF-affected groundwater are diluted by Michaud aquifer groundwater before discharge into the Portneuf River. Arsenic is the only EMF Site COC greater than an MCL in groundwater discharging into the Portneuf River. Total phosphorus enters the Portneuf River at concentrations greater than the TMDL.

7.2.2 Contaminants of Concern and Cleanup Levels for COCs in Soil

Table 9 presents a list of the COCs and industrial use cleanup levels for the risk drivers in soil for the FMC OU. For the Former Operations Area of the FMC OU this includes elemental phosphorus. For the COCs, cleanup levels for soils were developed for those constituents that were determined to be the risk drivers for surface soils within the FMC OU (because other COCs are collocated with the risk drivers, addressing them will address all other COCs). The risk drivers are COCs that are present in surface soils in concentrations significantly exceeding an incremental cancer risk of 10^{-4} or an incremental HI of 1 for each exposure pathway. Cleanup levels have been defined for arsenic, cadmium, fluoride, lead-210, and radium-226 based on analytical results and the risk assessment performed as part of the SRI that evaluated risks posed by soils at or near the surface. These five constituents were found to be the risk drivers for surface soils (as opposed to buried fill and waste that is known to have generally higher levels of COCs and would pose higher risks to exposed individuals) and therefore cleanup levels were identified for these constituents.

The interim amended remedy for contaminated soils within the Former Operations Area relies on either ET caps or gamma soil covers. They will be installed over all areas known to contain waste and with surface soils that exceed the soil cleanup levels for the five risk driver COCs. All

areas of known or suspected elemental phosphorus contamination at the FMC OU will be capped with an ET cap as part of the interim amended remedy.

The interim amended remedy for contaminated soils within the Northern Properties relies primarily on institutional controls. Excavation and consolidation is proposed for only a limited area of surface soils above industrial/commercial cleanup levels within the Northern Properties. The COCs for the Northern Properties are the same as for the Former Operations Area. However, there are only three risk drivers: cadmium, fluoride, and radium-226. Excavation and consolidation of contaminated soil will ensure that concentrations for the three risk driver COCs will be below the commercial/industrial cleanup standards. Elemental phosphorus is not present within the Northern Properties.

8. SUMMARY OF REMEDIAL ALTERNATIVES

Alternatives for cleanup were developed for soil and groundwater contamination. EPA considered six soil alternatives and four groundwater alternatives. A set of "Common Elements" was developed and included in each soil alternative, except the "no action" alternative. In addition, ET caps and soil covers were considered in several of the soil alternatives. Each of the common elements and alternatives is described below.

8.1 COMMON ELEMENTS

Common elements were present in all remedial alternatives evaluated in the Proposed Plan (except the "no action" alternative and Soil Alternative 8). These common elements were developed to be included with gamma soil covers and ET caps. The following is a brief description of each core element.

1. *Institutional Controls*—Environmental land use easements or covenants, running with the land for the entire FMC OU, which limit activities to commercial/industrial uses, prohibit activities that may disturb the selected interim amended remedial alternative, restrict consumption of groundwater, and require future buildings be constructed using radon-resistant construction methods (passive or active methodologies)
2. *Engineering Controls*—Fencing around the FMC OU, entrance gates, visitor controls, warning signs, and required training for visitors to control access and potential exposures

3. *Soil/Fill Management*—A soil and fill management plan that would prohibit the excavation of areas containing gamma soil covers or ET caps and would strictly manage when and where excavation could occur (for example, digging to access utility lines). An institutional control in the form of a covenant or easement will require compliance with this plan.

4. *Cap/Cover Integration, Monitoring, and Maintenance*—There are 11 capped former RCRA-regulated waste ponds (overseen by EPA under its RCRA program) and five capped calciner ponds (overseen by IDEQ under a Voluntary Cleanup Order) at the former FMC Facility. Each of the alternatives would require construction of one or more caps/covers that may intersect with one or more of the RCRA or calciner pond caps. Careful consideration will be required during remedial design (RD) to maintain integrity of the existing caps, grade the area appropriately for storm water runoff, build access roads that do not interfere with cap integrity, and consider easements and infrastructure in cap/cover design (such as active power lines or access to the Simplot Don Plant substation). The cap/cover designs will incorporate provisions for continued access to monitoring wells, pond leachate collection systems, and other monitoring and/or maintenance systems.

5. *Cap/Cover Monitoring and Maintenance*—All caps/covers implemented under this action would require long-term monitoring and maintenance. The cap/cover monitoring and maintenance program would depend on the cap/cover type. Settlement of fill and soils, erosion due to storm events, vegetation on the surface of the caps/covers, security (such as fences and signs), and storm water/precipitation drainage systems will be monitored and actions taken to make repairs as necessary to ensure they continue to function as designed.

6. *Phosphine and Other Gas Monitoring*—Elemental phosphorus is known or suspected in the subsurface soil/fill in the following areas: furnace building, phosphorus loading dock, and secondary condenser area (in RA-B), slag pit area (in RA-B), Pond 8S recovery process area (in RA-C), railcars buried within the slag pile (in RA-F1), former phossy ponds and precipitator slurry ponds (in RA-C), railroad swale (in RA-K), and areas with underground piping or storm sewers (in RA-E), precipitator slurry (in RAs B, C, D, and

E), and phossy water (in RAs B, C, and D). The current CSM for the CERCLA RAs does not anticipate that they will produce phosphine or other gases in quantities that would pose a significant risk to human health and the environment. Because the CERCLA ponds were not lined there are no significant levels of water that remain commingled with the waste. Also the waste is generally dry; there is no free water with which elemental phosphorus can react to produce appreciable levels of phosphine. Nevertheless the selected interim amended remedy in this Interim Amendment to the ROD includes a comprehensive gas monitoring program that will include phosphine and potentially other gases and extraction should conditions at areas covered by the selected interim amended remedy warrant it. Phosphine and other gas monitoring will be conducted in areas that have been identified to potentially generate phosphine or other gases in the future to ensure that phosphine gas does not accumulate at levels that would pose a threat to human health or the environment. Phosphine monitoring is necessary for any type of cap placed over areas with elemental phosphorus. Gas monitoring would include the following elements:

- Monitoring the surface of the cap to identify potential phosphine releases to ambient air through the cap
- Monitoring the shallow subsurface around and within the cap to identify potential releases of phosphine from the perimeter of the cap and to assess if concentrations of gases in soil gas change over time
- 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
- Monitoring would continue on a periodic basis (e.g., semiannually) until the first 5-year review, at which time monitoring frequency would be reevaluated, and possibly discontinued. More precise phosphine monitoring details will be developed during the RD phase of remedial action implementation, consistent with the phosphine monitoring program being developed for the RCRA ponds under the 1999 RCRA Consent Decree
- Monitoring for gases other than phosphine on an as-needed basis.

Phosphine, hydrogen sulfide, and hydrofluoric acid were measured at detectable levels in the soil column within the Former Operations Area. Hydrogen cyanide was sampled for, but not detected. No levels of these gases were detected in ambient air. The results of this sampling event are documented in the *Site Wide Gas Assessment Report for the FMC Plant OU* (MWH, 2011). This and other information will be used in developing the gas monitoring program in the RD phase.

7. *Storm water Management*—FMC OU-wide storm water runoff management will minimize cap/cover erosion and infiltration of COCs to groundwater from contaminated fill. Storm water will be addressed by FMC OU-wide grade planning, integration into cap design, and collection of storm water in retention basins. The number of retention basins will be determined during RD.

8. *Fugitive Dust Control*—Generation of fugitive dust will be controlled during the implementation phase of the remedial action by the following activities:

    - Maintenance of existing vegetation wherever possible (undisturbed areas)
    - Application of water and dust control agents to active unpaved roadways
    - Maximized use of paved roadways
    - Application of water, dust control agents, and other practices in areas of active excavation and/or placement
    - Scheduled inspections to ensure that these mitigation measures are effective in controlling fugitive dust.

9. *Groundwater Monitoring*—Long-term groundwater monitoring will be used to evaluate the performance and effectiveness of the soil and groundwater remedial actions. The specific locations and construction details of these wells will be determined during RD. Wells added during construction will be integrated with the existing groundwater monitoring program.

8.2 DESCRIPTION OF LANDFILL CAPS AND SOIL COVERS

A significant element in Alternatives 2 through 6 is the management of waste in place through the installation of surface caps or covers. EPA has specified two types of cover systems. The first

uses soil to block gamma radiation emanating from the waste. The second type is an ET cap designed to comply with RCRA hazardous waste capping requirements and radioactive waste requirements. ET caps block gamma radiation, prevent direct contact with contaminants, and prevent the infiltration of rainwater into the waste and subsequently into groundwater.

8.2.1 Gamma Soil Covers

A gamma soil cover involves placement of at least 1 foot of native soil over fill or soil containing slag or ore to eliminate gamma exposures. Exposure rate measurements at FMC OU test plots have shown that 1 foot of native soil cover is sufficient to reduce exposure to gamma radiation to meet the soil radiological RAOs. This cover, with the appropriate Common Elements (primarily Institutional Controls, Soil/Fill Management, Cap/Cover Monitoring) achieves the RAOs for potential human exposure pathways for: (1) gamma radiation, (2) incidental ingestion, (3) direct dermal exposure, and (4) inhalation of fugitive dust. If a land use redevelopment option is identified during RD that would provide equally protective shielding, it could be incorporated into the RD. For instance, many likely redevelopment projects would include asphalt or concrete parking lots and/or other areas that could be designed to meet the same protective standards as a gamma soil cover.

8.2.2 Evapotranspiration (ET) Cap

ET caps employ the principle of “water balance” to minimize percolation of precipitation. The soil layer will be thick enough to store infiltrated precipitation during winter and early spring, and native vegetation will be placed over the thick soil layer to remove the stored water through evaporation and transpiration (by plants) of infiltrated water during late spring, summer, and fall. ET caps prevent the leaching and migration of COCs in fill and soil by preventing precipitation from infiltrating contaminated fill and soil. Properly maintained ET caps, when combined with institutional controls, achieve the RAOs for protection of human health and the environment with respect to potential soil exposure pathways including: (1) gamma radiation emission, (2) incidental ingestion, (3) direct dermal exposure, (4) the threat of elemental phosphorus fire, and (5) inhalation of fugitive dust. ET caps can be readily implemented because they are constructed of readily available native soil and the establishment of native vegetation.

These common capping elements (as identified in Section 8.1) may vary from one assembled alternative to another and likely will not be fully developed until the RD. EPA evaluated the soil alternatives described in the following section. Table 12 presents the estimated capital cost, estimated annual operations and maintenance (O&M) cost, present worth, estimated construction timeframe, and estimated time to achieve cleanup levels for each of the alternatives described below.

8.3 SOIL ALTERNATIVES

8.3.1 Soil Alternative 1 (No Action)

Soil Alternative 1 includes no actions to control exposures of human receptors to contaminants. Under Soil Alternative 1, no treatment, containment, institutional controls, storm water control, erosion control, or O&M would occur at the FMC OU. There are no costs associated with Soil Alternative 1.

8.3.2 Soil Alternative 2 (Common Elements, Receptor-Initiated Remediation, Gamma Soil Cover and ET Capping, and Clean and Treat Off Site)

As part of the SFS, FMC developed an alternative utilizing receptor-initiated remediation. Under this alternative, FMC proposed that remedial action in some areas would not take place until redevelopment plans for the property were initiated. EPA reviewed this alternative and determined that it would not meet RAOs. Although discussed in detail in the *SFS Report*, Soil Alternative 2 was not considered as a viable alternative and therefore was not included in the evaluation using CERCLA's nine criteria.

8.3.3 Soil Alternative 3/Selected Interim Amended Soil Remedy (Common Elements, Gamma Soil Cover and ET Capping, Excavate and Consolidate RA-J, Clean and Treat Off Site)

Soil Alternative 3 is the selected interim amended soil remedy for this IRODA. The Common Elements along with gamma soil covers and ET caps are the critical elements in Soil Alternative 3. Figure 1 presents the remedial action represented by Soil Alternative 3. Each succeeding soil alternative beginning with this alternative expands or modifies the alternative before it. After grading, ET caps will be installed at RAs B, C, D, E, F1, F2, H, and K. A gamma soil cover will

be installed over the large area represented by the former slag pile (RA-F) and RAs A, A1, and G. The only area that will employ excavation and consolidation is RA-J, which includes Parcel 3 from the FMC-owned Northern Properties. RA-J was not used for elemental phosphorus processing operations. It contains windblown dust primarily from FMC and Simplot ore handling areas, and some slag was applied to the surface for roads and parking. Excavation and consolidation at RA-J will consist of surface scraping to an expected maximum of 6 inches bgs to meet the commercial/industrial cleanup levels and consolidating the excavated material in the Former Operations Area.

Underground process piping that may contain elemental phosphorus, precipitator solids, and/or phossy solids is believed to remain in RAs B, C, D and E. This piping will be contained under an ET cap that meets the RAO for elemental phosphorus by preventing direct exposure under conditions that may spontaneously combust. Potential elemental phosphorus residues in underground 16-inch, reinforced concrete storm/sewer piping in RA-A will be removed. The removal of elemental phosphorus from the underground pipes can be done safely because the material is relatively homogeneous, contained in pipes at known locations, and is a relatively small quantity. Removed sludge will be disposed off site following characterization in an appropriate landfill or be incinerated. The sludge will be removed so this storm/sewer piping may remain in use.

8.3.4 Soil Alternative 4 (Common Elements, Gamma Soil Cover and ET Capping, Excavate and Consolidate RA-A & RA-J, Clean and Treat Off Site)

The Common Elements along with ET caps and gamma soil covers included in Soil Alternative 3 were the main components of Soil Alternative 4 and would have been employed in the same areas. However, where contaminated fill/soils within RAs are generally shallow, are not a threat to groundwater, and do not contain elemental phosphorus, conventional excavation methods would have been employed to rip, scrape, and/or push soils for consolidation or reuse within caps at other RAs. As examples: (1) fill materials consisting primarily of slag on the surface in RA-A which could have been ripped or removed down to native soils (ranging in depth from 1 to 18 feet and averaging 7 feet bgs) and reused in constructing ET caps at other RAs; and (2) shallow soils (0 to 6 inches) from RA-J that would have been either scraped and mixed for reuse in constructing ET caps at other RAs. RA-K, which was shown to contain at least 1,000 ppm of

elemental phosphorus, would also have been excavated and consolidated with other excavated materials placed under an ET cap at any other RA containing elemental phosphorus (e.g., RA-B). Underground process and storm/sewer piping would be addressed as under Soil Alternative 3.

8.3.5 Soil Alternative 5 (Common Elements, Gamma Soil Cover and ET Capping, Excavate and Consolidate RA-A, RA-I, & RA-J, Clean and Treat On Site)

RAs A, D, E, F, F1, F2, G, and H would have been capped similarly to Soil Alternatives 3 and 4 following extensive excavation of soils/fill containing elemental phosphorus to a depth of 10 feet bgs. Excavated elemental phosphorus-contaminated soils/fill would have been treated on site using a caustic hydrolysis treatment process (no viable in situ treatment technology was identified). The only other changes from Soil Alternative 4 were that RA-I and RA-J in the Northern Properties would have been excavated (or tilled in place if feasible and effective) to a depth of 12 inches to meet residential cleanup levels; and hydrocarbon-contaminated soils at RA-A1 would have been treated in place by landfarming as opposed to excavation and placement under an ET cap. All other common/core remedial actions were included.

8.3.6 Soil Alternative 6 (Common Elements, Gamma Soil Cover and ET Capping, Excavate and Consolidate RA-A, RA-I, & RA-J, Clean and Treat On Site, Excavate and Treat Buried Railcars)

Soil Alternative 6 is the same as Soil Alternative 5, except that where elemental phosphorus is known to exist, excavation would continue until: (1) it was not practicable for the specifically approved equipment to safely excavate any deeper; or (2) all the elemental phosphorus-contaminated materials had been removed. The excavated soil containing elemental phosphorus would have been treated on site using caustic hydrolysis. In addition, buried railcars believed to be in RA-F1 would also have been excavated and treated on site. In each instance, the excavated areas would have received ET caps. All other remedial actions from Alternative 5 were included.

8.4 OTHER SOIL ALTERNATIVES

The Tribes requested that EPA provide an estimate of the costs for treatment and disposal of all elemental phosphorus-contaminated wastes at the FMC Facility, including those wastes that are currently managed in the RCRA ponds. The RCRA ponds were closed and capped in accordance with requirements of the 1999 RCRA Consent Decree and are subject to RCRA Post Closure

requirements. They are not part of the FMC OU and are not being considered for CERCLA remedial action. To address Tribal concerns, EPA prepared additional evaluations identified as Soil Alternatives 7 and 8 to evaluate the removal and treatment of elemental phosphorus-containing wastes, including wastes in the RCRA units in addition to the areas covered by the SRI/SFS. These additional evaluations weren't presented in the SFS, but they were presented in the Proposed Plan because they are part of the Administrative Record and informed some comparisons. These additional evaluations can be found in the *Cost Estimates for the Soil and Groundwater Alternatives for the FMC OU Proposed Plan* (BAH, 2011). Soil Alternatives 7 and 8 were developed for informational purposes only and costs were compared against other soil alternatives; they were not compared against other soil alternatives for the other remedy selection criteria. Because these are described for the purpose of providing costs, no discussion on the dangers associated with excavation and treatment of the elemental phosphorus is provided in the descriptions; however, this information can be found in Section 11.5.

8.4.1 Soil Alternative 7 (Common Elements, Gamma Soil Cover and ET Capping, Deep Excavate and Consolidate [including all RCRA Waste Ponds], Clean and Treat On Site)

Soil Alternative 7 evaluated the impact of expanding the remedy for the RAs listed for Soil Alternative 6 (and 5) to all the RAs. In addition, all closed RCRA ponds or units would be excavated and all wastes within those ponds would be treated for elemental phosphorus contaminated soil/fills. Similar to Soil Alternative 6, the excavated wastes containing elemental phosphorus would be treated on site using caustic hydrolysis and then capped consistent with RCRA requirements. All other remedial actions from Alternative 6 would be extended to the RCRA-regulated waste ponds as needed.

8.4.2 Soil Alternative 8 (Deep Excavation and Consolidation [Including all RCRA Waste Ponds], Clean and Treat On Site, Disposal Off Site)

Soil Alternative 8 evaluated the impact of removing all FMC-impacted contamination from the FMC Facility by excavating (or scraping) and treating all contaminated soils/fill in all RAs and RCRA-regulated waste ponds down to native soil. The metals- and elemental phosphorus-contaminated materials would be treated on site prior to disposal off site with caustic hydrolysis

and metals stabilization. The treated fills, wastes, and slag would be disposed off site in a landfill with a gamma soil cover to prevent gamma radiation exposures to landfill workers. The remaining native soil would be graded, contoured, and leveled on site. All other remedial actions from Alternative 7 were included. This remedy would result in the site being remediated to background levels.

8.5 GROUNDWATER ALTERNATIVES

EPA evaluated the groundwater alternatives described in the following section. Table 14 presents the estimated capital cost, estimated annual O&M cost, present worth, estimated construction timeframe, and estimated time to achieve cleanup levels for each of the alternatives described below.

8.5.1 No Action Groundwater Alternative

Under the No Action Groundwater Alternative, no actions to control exposures of human receptors to contaminants, including any institutional controls, containment or treatment, or long-term monitoring would occur at the FMC OU. There are no costs associated with No Action Groundwater Alternative.

8.5.2 Groundwater Alternative 1 (Source Control, Institutional Controls, and Long-Term Monitoring)

Groundwater Alternative 1 was comprised of three primary elements:

1. Source control (i.e., ET capping) to prevent further degradation of the shallow groundwater underlying identified sources
2. Institutional controls in the form of recorded environmental easements or covenants to prevent access to and consumption of impacted shallow groundwater
3. Long-term groundwater monitoring to evaluate the short- and long-term decline of COCs in groundwater resulting from source controls to confirm the efficacy of the remedy.

All of the proposed soil alternatives (with the exception of the “no action” soil alternative) included some type of source control to minimize or prevent further leaching of COCs to groundwater (i.e., capping, or extraction and treatment). In this alternative, it is assumed that

COCs already in the groundwater would naturally attenuate over time from the natural mixing in the aquifer. While no significant biological or chemical degradation of COCs has been observed (or would be expected since the COCs are inorganic), significant attenuation has been observed through mixing of affected groundwater with the Michaud Flats aquifer.

Restrictive environmental easements or covenants will prohibit consumption of impacted groundwater. Long-term monitoring would continue to verify that the soil remedies are working and ensure that concentrations of COCs decrease over time as predicted by groundwater modeling performed during the SRI and SFS. A long-term CERCLA groundwater monitoring program will be designed to monitor the effectiveness of the source control remedial action(s).

8.5.3 Groundwater Alternative 2/Selected Interim Amended Groundwater Remedy (Source Control, Institutional Controls, Long-Term Monitoring, Hydraulic Containment of Contaminated Groundwater at the Former Operations Area Boundary, and Treatment and Disposal of Contaminated Groundwater)

Groundwater Alternative 2, which is the selected interim amended groundwater remedy for this IRODA, includes the source controls described in the Soil Alternatives, institutional controls, and long-term monitoring that comprise Groundwater Alternative 1. It adds groundwater extraction from the shallow aquifer to provide hydraulic containment of the contaminated groundwater, thereby preventing further downgradient migration of FMC OU COCs. Extraction wells will be located in the northeastern corner of the Former Operations Area to capture impacted shallow groundwater before it can flow beyond the Former Operations Area boundary. Although precise specifications will be determined in the RD, groundwater modeling indicates that five extraction wells should be sufficient and a total combined extraction rate of approximately 530 gallons per minute (gpm) should fully capture impacted groundwater migrating beyond the Former Operations Area. Contained groundwater will be treated in one of the following ways:

1. By the Pocatello Publicly Owned Treatment Works (POTW), and then discharged to the Portneuf River according to their NPDES permit. The approximate locations of the proposed extraction wells and piping are presented in Figure 16.

2. By a water treatment facility built within the FMC OU. Water treated to drinking water standards, or risk-based cleanup levels for COCs for which drinking water standards don't exist, would be discharged to an infiltration basin from which it would either percolate down to groundwater (and ultimately discharge to Batiste Springs and the Portneuf River) or evaporate into the atmosphere. Figure 17 presents the preliminary design location of the extraction wells, treatment plant, and infiltration basin.

8.5.4 Groundwater Alternative 3 (Source Controls, Institutional Controls, Long-Term Monitoring, Hydraulic Containment of Contaminated Groundwater at Former Operations Area Boundary, Groundwater Extraction at Source Areas, and Treatment and Disposal of Contaminated Groundwater)

This alternative included: (1) the source controls, institutional controls, and long-term monitoring that comprise Groundwater Alternative 1; and (2) groundwater extraction from the shallow aquifer in the northeastern portion of the Former Operations Area as in the selected interim amended groundwater remedy, Groundwater Alternative 2, to provide hydraulic containment. Groundwater Alternative 3 added groundwater extraction downgradient of specific identified source areas. The three primary areas from west to east were—

- Area A—Former "Phossy" Ponds 3E through 6E (beneath Pond 15S and Phase IV ponds area)
- Area B—Former Pond 8S
- Area C—Northeast Plant area to capture a variety of sources, including Simplot sources in the joint fence line area. Area C is the same shallow aquifer area described in Groundwater Alternative 2; in the context of Groundwater Alternative 3 it is referred to as Area C.

Area A would require approximately four extraction wells with a total groundwater removal rate of 60 gpm. Area B would require five extraction wells with a total extraction rate of 90 gpm. Area C, as noted above, is the same as Groundwater Alternative 2 (five wells at 520 gpm). The combined total projected groundwater removal rate from all zones was approximately 670 gpm. Treatment of extracted groundwater would be in either one of the two means selected for Groundwater Alternative 2.

9. COMPARISON OF SELECTED INTERIM AMENDED REMEDY AND ALTERNATIVES

Nine criteria are used to evaluate the different remedial alternatives individually and against each other to select a remedy. This section compares the relative performance of the selected remedy in the 1998 ROD, the selected interim amended remedy in this IRODA, and the treatment alternatives for soil and groundwater that were not selected against these CERCLA criteria. All were previously described above.

The nine CERCLA remedy selection criteria are categorized in three ways: threshold, primary balancing, and modifying criteria. Threshold criteria must be met by an alternative for it to be eligible for selection. Primary balancing criteria are used to weigh major tradeoffs among eligible alternatives. Modifying criteria are used to incorporate community input on alternatives meeting the threshold and primary balancing criteria as identified in a Proposed Plan. The criteria used to evaluate CERCLA remedies are described in the table below.

EVALUATION CRITERIA FOR SUPERFUND REMEDIAL ALTERNATIVES
Threshold Criteria
Overall Protectiveness of Human Health and the Environment requires that an alternative adequately eliminates, reduces, or controls threats to public health, welfare, or the environment through all the means it selects, including institutional controls.
Compliance with ARARs requires that an alternative meets all federal and stricter state environmental statutes and regulations, or that such requirements be formally waived.
Primary Balancing Criteria
Long-Term Effectiveness and Permanence compares the capacity of alternatives to maintain protection of human health, welfare, and the environment over time.
Reduction of Toxicity, Mobility, or Volume of Contaminants Through Treatment compares the use of treatment to reduce the harmful effects, ability to move in the environment, and quantity of principal COCs.
Short-Term Effectiveness compares the length of time needed to implement alternatives and the risks to workers, residents, and the environment during implementation.
Implementability compares the technical and administrative feasibility of implementing alternatives, including factors such as relative availability of goods and services.
Cost compares estimated capital and annual O&M costs expressed as present-worth costs. Present worth is the total cost of an alternative over time in terms of current value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.
Modifying Criteria
State/Support Agency Acceptance compares state/support agency preferences/views on EPA's remedy selection and analyses as compiled in the Proposed Plan.
Community Acceptance compares affected community preferences/views as reflected in public comments on EPA's remedy selection and analyses as compiled in the Proposed Plan.

9.1 THRESHOLD CRITERIA

9.1.1 Overall Protection of Human Health and Environment

Soil Alternative

The 1998 ROD for the FMC OU is no longer considered protective of human health and the environment because it didn't address contaminated soils and associated groundwater contamination there in the Former Elemental Phosphorus Production Area of the Former Operations Area, particularly under the former furnace building. The remedy selected in the 1998 ROD therefore does not meet this threshold criterion. The 1998 ROD assumed continued operation of the plant, which was closed in 2001 and subsequently demolished. The subsequent SRI identified areas presenting risks to human health and the environment that the 1998 ROD had not contemplated. The "no action" Soil Alternative (which would require no action at all, not even what was selected in the 1998 ROD) and the potential cleanup "paced-to-future-redevelopment" (that might never occur) Soil Alternative 2 were also not protective of human health and the environment and thus did not meet this threshold criteria. The interim amended remedy, Soil Alternative 3, selected in this IRODA is protective of human health and the environment by eliminating, reducing, or controlling risks posed by the FMC OU through containment of contaminated soils using a combination of engineering controls and institutional controls. All other soil alternatives, including those with differing degrees of treatment that were evaluated in the SFS, would also be protective of human health and the environment by eliminating, reducing, or controlling risks posed by the FMC OU through similar containment of consolidated contaminated soils (Soil Alternative 4) and combining containment in varying degrees with increasing degrees of excavation and treatment (Soil Alternatives 5 through 6). The gamma soil covers and ET caps in the selected interim amended soil remedy and Soil Alternatives 4 through 6 reduce direct contact risk and soil ingestion risk to less than 10^{-6}, while Soil Alternatives 4–6 would increasingly have consolidated waste and fill based on final grading plans and potential industrial development at the FMC OU. For all alternatives, perpetual cap/cover maintenance will be required to ensure protectiveness for any containment remedy.

Groundwater Alternative

The remedial action for groundwater identified in the 1998 ROD for the FMC OU is no longer considered protective of human health and the environment because it did not consider phosphorus as a groundwater COC, and was in any case merely contingent and therefore uncertain. Because of the development of the TMDL for the Portneuf River and potential future industrial redevelopment for the FMC OU, greater risks related to phosphorus release from the FMC OU (and Simplot OU) to groundwater thus potentially impacting human health and particularly the environment have been identified subsequent to the 1998 ROD. This contingent groundwater remedy was also not supported by projections that it could restore contaminated groundwater within a reasonable restoration timeframe (including up to 100 years). It therefore does not meet this threshold criterion. The "no action" groundwater remedy does not meet groundwater RAOs and is also not protective of public health and the environment.

To be protective, the groundwater remedy needs to meet the RAOs for groundwater:

1. Preventing the ingestion of contaminated groundwater through an institutional control
2. Reducing/eliminating the release of COCs from identified sources through source control implemented as soil remediation
3. Reducing the release and migration of COCs to surface water from FMC Facility sources that result in concentrations exceeding cleanup levels.

The selected interim amended groundwater remedy and Groundwater Alternative 3 meet the three RAOs. Groundwater Alternative 1 does not meet the third RAO since it primarily relies on monitored natural attenuation. However, while the selected interim amended groundwater remedy in this IRODA is protective of human health and the environment by eliminating, reducing, or controlling risks posed by the FMC OU through institutional controls and the installation of a groundwater extraction system, the timeframe to restore the groundwater resources to the MCLs is not well defined. Modeling of the implementation of the selected interim amended groundwater remedy estimated the complete restoration of contaminated groundwater throughout the plume could well take more than 100 years based on available information. The hydraulic containment wells at the Former Operations Area northern boundary under the selected interim amended groundwater remedy and Groundwater Alternative 3 are

predicted to demonstrate that it is practicable to restore groundwater immediately downgradient from the Former Operations Area and beneath Northern Properties within a 25- to 50-year timeframe, but restoration is predicted to take more than 100 years for the remainder of the OU. In addition, achieving groundwater restoration further downgradient in the area where FMC- and Simplot-impacted groundwater discharges to the Portneuf River is highly dependent on the success of the ongoing Simplot OU groundwater remedial action. Simplot has calculated mass loading and estimates that FMC-impacted groundwater migrating downgradient from the Former Operations Area northern boundary accounts for less than 5 percent of the total arsenic and total phosphorus mass load to EMF-impacted groundwater migrating to the river, as reported in the *Groundwater Extraction and Monitoring System Remedial Design Report* (Simplot, 2010). Although EPA has not approved the Simplot mass loading calculation, EPA's IRODA for the Simplot OU states that EPA believes Simplot is a significantly larger contributor of phosphorus to the Portneuf River than FMC. The selected interim amended groundwater remedy and Groundwater Alternative 3 are predicted to incrementally reduce the areal extent of the groundwater exceeding the arsenic MCL in the Former Operations Area by 2 percent and 9 percent respectively, compared to Groundwater Alternative 1. Groundwater modeling predicts that none of the alternatives, including the selected interim amended groundwater remedy, will achieve groundwater restoration everywhere beneath the Former Operations Area within a reasonable timeframe (within 100 years).

9.1.2 Compliance with ARARs

CERCLA Section 121(d) mandates that upon completion, remedial action must at least attain (or waive) all ARARs of any federal environmental laws, or more stringent promulgated state environmental or –facility-siting laws (which EPA interprets to mean qualifying Tribal requirements on Indian reservations). This IRODA invokes the waiver in Section 121(d)(4)(A) of CERCLA for interim remedial actions. Consistent with Section 121(d)(4)(A) of CERCLA, there is no inconsistency between the interim remedial action and any final remedial action for either the buried waste or any future groundwater remediation. EPA believes this interim action will address immediate human health and environmental risks at the FMC OU and will neither exacerbate conditions at the EMF Site nor interfere with the implementation of any future final remedy. This IRODA will eventually be followed by a Final ROD Amendment that will further

address compliance with all ARARs, consistent with CERCLA, including any waivers. The rest of this section discusses the ARARs that pertain to this decision and how the alternatives considered will or will not comply with them. The ARARs documented in Section 11.2 were used to evaluate these alternatives.

In December 2010, the Tribes promulgated Soil Cleanup Standards for Contaminated Properties (SCS) as regulations under their Waste Management Act, and on December 3, 2010 sent a letter (SBT 2010) to EPA requesting that they be designated as ARARs for the FMC OU.

The Tribes' SCS provide cleanup levels for more than 100 contaminants for both unrestricted and commercial/industrial land use within the Fort Hall Indian Reservation. In some cases, the Tribes' SCS require the development and assessment of a site-specific CSM and risk assessment that considers a Tribal exposure scenario reflecting the Tribal lifestyle. The Final ROD for the FMC OU will include a remedial action that will attain or provide for the formal waiver of all ARARs, or portions thereof, including the Tribes' SCS to the extent they are ARARs, at or before the completion of remedial action. Any and all waivers will be pursuant to Section 121(d)(4) of CERCLA.

The SFS for the FMC OU was completed prior to promulgation of the Tribes' SCS, which appear to require treatment and/or removal of all ignitable/reactive soils and soils above background or applicable SCS. As a result, EPA reevaluated the technical implementability, health and safety issues, and costs associated with the excavation and treatment alternatives considered during the SFS in evaluating potential remedial alternatives and CERCLA's statutory preference for treatment for principal threat waste (PTW) as described in Section 11.5 of this IRODA. Caustic hydrolysis was again identified as the least uncertain and least costly among all potential treatment technologies, and EPA's bases for not selecting it were unchanged. The very significant danger in the projected decades of excavation and subsequent handling common to all excavation and treatment technologies that ultimately caused EPA to reject treatment in spite of the CERCLA statutory preference for treatment, especially for PTW, remains no less an impediment as a result of the SCS. Similarly, after careful reevaluation, EPA concluded, consistent with its prior analyses, that no proven in situ treatment technologies for elemental phosphorus-contaminated soils at sites with far smaller quantities than the FMC OU have been developed or proven to be feasible. The potential hazards associated with the excavation of soils

contaminated with elemental phosphorus are described in detail in the SFS. A concise description of these hazards is given in Section 2.2.1.1 in Appendix A of the *SFS Report*, Identification and Evaluation of P_4 Treatment Technologies.

Soil Alternative

The soil remedy in the 1998 ROD does not comply with ARARs when RCRA is considered an ARAR. Following closure of the plant and subsequent findings of the SRI, it became clear that a portion of the Former Operations Area required controls to prevent or reduce infiltration of contaminants to groundwater, particularly the area beneath the former furnace building. Soils and fill pose a risk to groundwater should contaminants migrate from their existing location. The "no action" alternative similarly does not comply with ARARs and thus does not meet this required threshold criterion; similarly Soil Alternative 2 does not comply with ARARs during what could be a very long pre-redevelopment period, and this additional open-ended noncompliance period is difficult to justify. The selected interim amended soil remedy and Soil Alternative 4 comply with ARARs through the installation of caps and covers, and engineering and institutional controls. Treatment remedies (Soil Alternatives 5 and 6) would also comply with ARARs, through the combination of the installation of caps and covers, engineering and institutional controls, and treatment. Remedies 3 through 6 would not comply with the Tribes' SCS should they be determined to be ARARs.

Groundwater Alternative

The remedial action for groundwater identified in the 1998 ROD for the FMC OU did not meet ARARs because groundwater containment and treatment was merely a contingent remedy, and was not adequately supported by projections that it could restore contaminated groundwater within a reasonable timeframe (including up to 100 years). Given the development of the TMDL for the Portneuf River and reasonably anticipated future industrial land use for the FMC OU, neither the remedy selected in the 1998 ROD nor a "no action" groundwater alternative would comply with the groundwater ARARs. Groundwater Alternatives 1 and 3 and the selected interim amended groundwater remedy in this IRODA are protective of human health and the environment by adding phosphorus and elemental phosphorus as COCs; eliminating, reducing, or controlling risks posed by the FMC OU through institutional controls; continued groundwater

monitoring; and the installation of a groundwater extraction and treatment system. However, the timeframe to restore the groundwater resources to below MCLs is uncertain. Modeling the implementation of the selected interim amended groundwater remedy and Groundwater Alternatives 1 and 3 estimated the restoration of groundwater throughout the FMC OU could take more than 100 years based on available information.

The 1998 ROD set the cleanup standard for arsenic at the MCL, which at the time was 50 ug/L. The selected interim amended groundwater remedy is based on current MCL, which is now 10 ug/L. By meeting the more stringent arsenic MCL, the selected interim amended groundwater remedy ensures that ARARs for other COCs in groundwater and surface water will also be met.

In addition to the ARARs identified above, the *Portneuf River TMDL: Waterbody Assessment and Total Maximum Daily Load and Addendum* developed by the Pocatello Regional Office of the IDEQ (2001) has been identified as a TBC for the selected interim amended groundwater remedy. The TMDL for the Portneuf River developed loading limits for constituents, including phosphorus, discharged to the Portneuf River, which will be considered in developing the final cleanup level for phosphorus. The final surface water cleanup level for phosphorus will be selected in a subsequent decision document(s) for both the Simplot and FMC OUs.

EPA is selecting an interim remedial action for groundwater for the FMC OU that is consistent with the requirement to attain or waive all ARARs at the completion of final remedial action, and invokes the waiver in Section 121(d)(4)(A) of CERCLA for interim remedial actions. The selected interim amended groundwater remedy in this IRODA will neither exacerbate conditions at the FMC OU or any other portion of the EMF Site nor interfere with the implementation of a future final remedy. This IRODA will be followed by a Final ROD Amendment that will further address compliance with all ARARs, including any waivers.

9.2 BALANCING CRITERIA

The remedial actions for soil identified in the 1998 ROD and the “no action” alternative do not meet either threshold criteria for remedy selection and thus they are not evaluated in terms of the balancing criteria. The following summarizes the other soil and groundwater alternatives with respect to the balancing criteria.

9.2.1 Long-Term Effectiveness and Permanence

Soil Alternative

Soil Alternatives 2 to 6 from the SFS proposed capping or covering as the predominant remedial element with increasing degrees of consolidation and/or excavation and treatment, particularly for elemental phosphorus wastes, along with associated institutional controls. There is no treatment for radium-contaminated soil, and so treatment was not evaluated. While EPA believes capping or covering followed by proper maintenance can be a fully protective permanent remedy, treatment (of the elemental phosphorus-containing soils) is a more thoroughly reliable remedy for permanence and long-term effectiveness. This is because ongoing maintenance, monitoring, and repair of ET caps over elemental phosphorus-containing soils are required. Based on this reasoning, alternatives that proposed to cap less and treat more ranked increasingly higher or more favorably for this balancing criterion. Nevertheless, while alternatives utilizing treatment ranked as increasingly more effective in providing long-term effectiveness and permanence, this was inversely at the expense of short-term protectiveness to the safety of remediation workers, workers adjacent to FMC, particularly at the Simplot OU, and the surrounding potentially impacted community. The quality and projected durability of the proposed ET caps is expected to be very high and the residual risk levels after capping are very low. All the proposed caps will be constructed of local earthen materials of specified thicknesses determined during RD on location-specific bases for optimal performance. They will be engineered for generally comparable long-term effectiveness and performance as well as effective storm water drainage. Long-term O&M includes monitoring and repair as necessary to maintain long-term cap integrity. The engineering controls and institutional controls of the caps will ensure the buried wastes are not disturbed and ensure long-term effectiveness. Soil Alternative 4 ranked modestly higher for long-term effectiveness and permanence than the selected interim amended soil remedy because RAs A, J, and K would have been excavated and consolidated rather than capped or covered in place, which would have reduced the capped or covered footprint and thus the area requiring maintenance by 104.3 acres (from 458.8 acres to 354.5 acres). Soil Alternatives 5 and 6 serially ranked higher than Soil Alternative 4 for this criterion because they would have excavated and treated substantially more elemental phosphorus wastes, respectively.

Groundwater Alternative

Groundwater Alternatives 1 and 3 and the selected interim amended groundwater remedy in this IRODA all were projected to eventually provide for long-term effectiveness and permanence through the implementation of engineering and institutional controls, and through the installation of a groundwater extraction system to remove and treat contaminants in groundwater (except for Groundwater Alternative 1). As long as the environmental easements or covenants are complied with or enforced as necessary, they should prevent the ingestion of contaminated groundwater, and source control (soil remedy) should remove future contributions to the groundwater and allow it to attenuate over time. The installation of ET caps and management of storm water through the soils remedy will prevent the migration of COCs to groundwater. The hydraulic containment wells at the Former Operations Area northern boundary under the selected interim amended groundwater remedy and Groundwater Alternative 3 are predicted to demonstrate whether it is practicable to restore groundwater downgradient from the Former Operations Area and beneath FMC's Northern Properties within a 25- to 50-year time period. As noted earlier, achieving groundwater restoration throughout the plume is highly dependent on the success of the Simplot groundwater remedial action. The selected interim amended groundwater remedy and Groundwater Alternative 3 are predicted to incrementally reduce the areal extent of groundwater exceeding the arsenic MCL in the Former Operations Area by 2 percent and 9 percent respectively, compared to Groundwater Alternative 1. However, the timeframe to restore these groundwater resources to the MCLs is not well defined. Modeling the implementation of the selected interim amended groundwater remedy estimated the restoration of groundwater throughout the plume could take 100 years or more based on available information. Groundwater Alternative 3 ranked the highest for this criterion, but only slightly higher than the selected interim amended groundwater remedy, though future data may alter this degree of relative ranking.

9.2.2 Reduction of Toxicity, Mobility, or Volume of Contaminants Through Treatment

Soil Alternative

Alternatives that proposed to treat more wastes (and cap less wastes) through implementation of treatment had greater reductions of toxicity, mobility, and volume of contaminants through

treatment, and therefore ranked higher for this balancing criterion. The selected interim amended soil remedy and Soil Alternative 4 use capping or covering as a predominant element along with associated institutional controls. The remedial action for soils identified in this IRODA, including capping or covering of contaminated soils and institutional controls, does not reduce toxicity, mobility, or volume of contaminants through treatment because no treatment occurs. Active treatment in the selected interim amended soil remedy and Soil Alternative 4 was limited to the sludges in sewer piping in RA-A. They therefore ranked equivalently. Soil Alternative 5 included treatment of elemental phosphorus-contaminated soil down to 10 feet bgs where it is present at a concentration that would present a risk of auto ignition if disturbed. Soil Alternative 5 would have reduced the residual elemental phosphorus-contaminated soil, but greater than 50,000 yd^3 would remain untreated. For this reason, it ranked substantially higher for this criterion than Soil Alternative 4. Soil Alternative 6 would have selected treatment of all phosphorus-contaminated material down to the water table in RA-B. Soil Alternative 6 projected treating approximately 900,000 yd^3 and therefore ranked significantly higher than Soil Alternative 5 with respect to reduction of toxicity, mobility, or volume. Relative rankings for this balancing criterion for the FMC OU depended on the amount of elemental phosphorus-containing waste treated.

Groundwater Alternative

Groundwater Alternative 1 presented in the SFS would have reduced or eliminated release and migration (i.e., mobility) of COCs from source areas to underlying groundwater by implementing source control, but did not include treatment. The selected interim amended groundwater remedy and Groundwater Alternative 3 reduced or eliminated release and migration (i.e., mobility) of COCs from the source areas to underlying groundwater by implementing source control through the soil remedy and hydraulically contained impacted groundwater, thereby preventing it from migrating downgradient from the Former Operations Area northern boundary by pumping. These alternatives also reduce the volume and toxicity of impacted groundwater through treatment. Groundwater Alternative 3 ranked the most preferable of these alternatives for this criterion by achieving groundwater restoration through extraction and treatment to the greatest degree; the selected interim amended groundwater remedy and Groundwater Alternative 1 ranked lower in that order on this basis.

9.2.3 Short-Term Effectiveness

Soil Alternative

The selected interim amended soil remedy ranked highest for this criterion. Capping takes substantially less time to implement than excavation and treatment and therefore provides the most immediate protection. The more treatment an alternative proposed, the longer it would take to implement and become effective. Even more significantly, the longer any treatment alternative takes to implement, the longer risks of casualty (with increasing amounts of treatment of elemental phosphorus wastes) will persist. During excavation and treatment of soils contaminated with elemental phosphorus, there would be significant risks to both workers and the public. No viable in situ treatment technology, which would prevent the need for excavation, was identified. The estimated time to implement the caps (and soil covers in other areas) and institutional controls required by the selected interim amended soil remedy is 2 to 3 years. Soil Alternative 4 was estimated to add another year for the wastes that would have to be removed and consolidated from RAs A, J, and K. It ranked second below the selected interim amended soil remedy for this reason for this criterion. Soil Alternative 5 would have required approximately 20 to 25 years—20 years longer construction time than the selected interim amended soil remedy (if the middle of the estimated range is used) due to the additional amount of elemental phosphorus-impacted material that would have required removal and treatment from RAs B, C, K, and underground piping (up to 10 feet bgs). It ranked far below Soil Alternative 4 for this reason. Soil Alternative 6 would have required at least an estimated 12 years longer than Alternative 5 construction time due to the removal and treatment of all elemental phosphorus-impacted material within RAs B, C, and K (below 10 feet bgs) and ranked lowest.

Groundwater Alternative

Groundwater Alternative 1 would have been effective in the short term at preventing access and exposure to impacted groundwater, principally through institutional controls which cut off the pathway to receptors, and also by reducing or eliminating the mobility of COCs from the source areas to underlying groundwater by implementing source control (soil remedy). The timeframe for implementation of Groundwater Alternative 1 would have been dependent on the selected

interim amended soil (source control) remedy, but the institutional controls and long-term monitoring could have been implemented immediately following EPA approval of the Remedial Design/Remedial Action Work Plan. The selected interim amended groundwater remedy and Groundwater Alternative 3, which include the restoration of groundwater downgradient from the Former Operations Area and beneath FMC's Northern Properties, is predicted to take 25 to 50 years, so they provide no additional short-term effectiveness. The short-term risks associated with Groundwater Alternatives 1 and 3 and the selected interim amended groundwater remedy are essentially the same. The final design of the selected interim amended groundwater remedy (similar to Groundwater Alternative 3) will require additional confirmation of hydrogeologic parameters in the extraction zone and will require either an agreement with the Pocatello POTW to meet discharge permit requirements, or design and approval from EPA for the construction of a treatment system and infiltration ponds.

The selected interim amended groundwater remedy will take a relatively short time (within the same timeframe as source control) to construct and begin operation depending on the complexity of the system than Groundwater 3 would have. Groundwater Alternative 3 would have required a longer timeframe due to the additional design and construction considerations but this additional time would not have made it less effective in the short term. The construction and operation of either the selected interim amended groundwater remedy or Groundwater Alternative 3 presents little risk to the community, remediation workers, Simplot workers, or the environment and therefore would be comparable to Groundwater Alternative 1 in this respect. For all of these reasons, Groundwater 1 and 3 and the selected interim amended groundwater remedy rank essentially equally for this criterion. The additional benefits of the selected interim amended groundwater remedy and especially Groundwater Alternative 3 as compared to Groundwater Alternative 1 would at least arguably not occur soon enough to impact the ranking for short-term effectiveness.

9.2.4 Implementability

Soil Alternative

Capping (and covering) is a well-understood technology that is commonly applied to the remediation of large mining and mineral processing sites with metals and radionuclides, and has

essentially uniformly been used for elemental phosphorus-contaminated soils both nationally and internationally. Sources of clean soil are readily available for cap or cover construction. Engineering and construction services are also generally readily available. As with short-term effectiveness, as excavation and treatment are added by degrees, implementability clearly becomes more difficult. Soil Alternatives 4, 5, and 6 present increasingly significant technical challenges and would be increasingly more difficult to implement than the selected interim amended soil remedy for the following specific reasons.

- Soil Alternative 4: The excavation/consolidation of RA-K requires the removal, storage, transport, and placement of soil/fill adjacent to the northern Former Operations Area boundary in an area that has been demonstrated (during the SRI) to contain some elemental phosphorus. The excavation and handling of heterogeneously distributed elemental phosphorus-contaminated material has not been successfully demonstrated. Spontaneous combustion of elemental phosphorus-contaminated wastes must be minimized if not eliminated. This would likely require some type of wet excavation as well as temporary enclosures to manage phosphorus pentoxide (P_2O_5) and other gases that may be generated. Lastly, a significant amount of clean fill would be needed to contour this area for storm water management and/or future land use.
- Soil Alternative 5: In addition to exacerbating the challenges presented by Soil Alternative 4, because of significantly increased quantities of elemental phosphorus wastes to be excavated and handled, on site treatment of excavated elemental phosphorus wastes would require the design and construction of a treatment plant. While FMC did construct a treatment plant to treat elemental phosphorus wastes generated by the FMC plant or managed in surface impoundments just before it ceased elemental phosphorus manufacturing operations, the treatment plant was never operated and successful operation was never proven. The treatment plant was designed to treat a homogenous waste stream from the FMC process operations and a significant amount of material sizing and handling would be required prior to treatment of FMC OU elemental phosphorus-contaminated soils. Wet excavation and on site treatment of large volumes of elemental phosphorus-impacted soils have never been demonstrated.

- Soil Alternative 6 presents the same challenges as Soil Alternatives 4 and 5, compounded by a substantially larger volume of elemental phosphorus-impacted material to be excavated and treated on site (i.e., greater uncertainty in technical implementability).

The selected interim amended soil remedy clearly ranked highest for this criterion followed by Soil Alternatives 4, 5, and 6 in that order.

Groundwater Alternative

Groundwater Alternative 1 would have been relatively easy to implement, both administratively and technically, consistent with the relative implementability of the selected interim amended soil (source control) remedy. The selected interim amended groundwater remedy and Groundwater Alternative 3 pose no significant additional technical or administrative implementability issues, but are necessarily somewhat more difficult to implement both technically and administratively because of uncertainties regarding the required treatment system and the disposal options for the treated water. Groundwater Alternative 1 therefore ranked highest, with the selected interim amended groundwater remedy and Groundwater Alternative 3 ranked only nominally lower.

9.2.5 Costs

Soil Alternative

Costs, like implementability challenges, progressively escalate from the selected interim amended soil remedy to Soil Alternative 8 (costs for Soil Alternatives 7 and 8, which were described earlier for information purposes only, are part of this section for the same limited purposes, though they were not compared for the other remedy selection criteria). The following are the net present value costs (at a 7 percent discount rate, 30 years for the selected interim amended soil remedy and Soil Alternatives 4 and 5, 37 years for Soil Alternative 6, and 44 years for Soil Alternative 7 and 8) for the Soil Alternatives. The key features, capital costs, and O&M costs for each of the Soil Alternatives are summarized in Table 12. Table 13 lists the estimated area that will be capped, excavated and consolidated, or disposed off site for each soil alternative.

Costs for Soil Alternative 1 through 5 (and Groundwater Alternatives 1 through 3 and the "no action alternative") were developed by FMC and reported in the *SFS Report*. Costs for Soil Alternatives 6 through 8 were developed by EPA and are presented in the *Cost Estimates for the Soil and Groundwater Alternatives for the FMC OU Proposed Plan* (BAH, 2011).

Costs for the selected interim amended soil remedy are estimated at $47 million for design, construction, and 30 years of operations costs with a future interest rate of 7 percent. The costs for the treatment alternatives evaluated in the SFS and independently by EPA during the development of the Proposed Plan were on the order of 10 to 100 times more expensive than the selected interim amended soil remedy because they would require the design, construction, and operation of a treatment plant and would require an estimated 20 to 44 years to complete. In addition, because treatment of this type of waste has never before been attempted on a scale of this magnitude, there are significant uncertainties associated with the total estimated cost (i.e., treatment efficacy and means for addressing significant health and safety issues). These are order-of-magnitude engineering cost estimates that are expected to be within +50 to -30 percent of the actual project cost.

Groundwater Alternative

Groundwater Alternatives 1 and 3 and the selected interim amended groundwater remedy include source control (i.e., the soil remediation alternative [costs not included in the groundwater alternative estimates] and institutional controls). Groundwater Alternative 3 had a significantly higher estimated cost to implement than the selected interim amended groundwater remedy, in the range of approximately 2.5 times. The selected interim amended groundwater remedy similarly has an estimated approximate order of magnitude greater cost compared to Groundwater Alternative 1. There would also be less steeply graduated annual O&M costs associated with long-term monitoring of groundwater trends for each of these alternatives. The range of net present value (NPV) costs of the selected interim amended groundwater remedy and Groundwater Alternative 3 reflect the capital costs associated with construction of an on site groundwater treatment facility and an on site infiltration basin or treatment and discharge at the Pocatello POTW. The key features, capital costs, and O&M costs for each of the groundwater alternatives are summarized in Table 14.

The selected interim amended groundwater remedy is expected to cost approximately $10 million for the design, construction, operation, and monitoring the groundwater extraction system for 30 years with a future interest rate of 7 percent. These are order-of-magnitude engineering cost estimates that are expected to be within +50 to -30 percent of the actual project cost.

9.3 MODIFYING CRITERIA

9.3.1 State and Tribal Acceptance

Most of the FMC OU is on fee land within the boundaries of the Fort Hall Reservation. The Tribes have expressed vigorous opposition to the selected interim amended soil remedy. The Tribes oppose capping elemental phosphorus-contaminated wastes in place at the FMC OU, and want removal and/or treatment of all such wastes or materials instead. The Tribes also oppose any groundwater alternative that will not achieve groundwater restoration within 100 years throughout the FMC OU. IDEQ has expressed support for the selection of Soil Alternative 3 and Groundwater Alternative 2 as interim remedies.

9.3.2 Community Acceptance

Community acceptance was evaluated after the public comment period for the Proposed Plan. The input from public meetings and written comments were carefully reviewed and a Responsiveness Summary is presented in Section 13 below. Based on the comments received, the selected interim amended remedy has not changed materially from the Preferred Alternative presented in the Proposed Plan.

9.3.3 State and Tribal Comments

Comments from the Tribes are included in the Responsiveness Summary, Section 13. As stated above, the Tribes vigorously oppose the selected interim amended remedy. The State of Idaho declined to submit comments on the Proposed Plan.

10. THE SELECTED INTERIM AMENDED REMEDY

10.1 SUMMARY OF THE RATIONALE FOR THE SELECTED INTERIM AMENDED REMEDY

The selected interim amended remedy is necessary to reduce risks to both human health and the environment under current and future land use scenarios. The key factors that led to selection of this remedy include the need to address human exposure within the Former Operations Areas without causing greater risks to humans and to prevent or reduce infiltration of surface water into elemental phosphorus-contaminated soils and subsequent migration of contaminants beyond the FMC OU boundary, onto the Simplot OU, potentially impacting that remedy, and toward the adjoining springs, or the Portneuf River.

The selected interim amended remedy for soils (Soil Alternative 3) will protect human health and the environment, complies with ARARs (except the Tribes' SCS should they be determined to be ARARs, in whole or in part), provides the best balance of tradeoffs with respect to the balancing and modifying criteria, and is cost-effective. Similarly, the selected interim amended remedy for groundwater (Groundwater Alternative 2) was selected because it is protective of human health and the environment, complies with ARARs that are applicable or relevant and appropriate to this selected interim amended remedy, provides the best balance of tradeoffs with respect to the balancing and modifying criteria, and is cost-effective. The selected interim amended remedy will utilize permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

If EPA were at some future time to select a remedy that would employ treatment of buried phosphorus wastes, the selected interim amended soil remedy is necessary to reduce risks to both human health and the environment under current and future land use scenarios. EPA estimates that any of the possible treatment technologies for the volume of buried phosphorus wastes in the FMC OU would take two to four decades of intensive risk-laden work (*Cost Estimate Addendum for Soil and Groundwater Alternatives for the Proposed Plan for the FMC Operable Unit* (BAH, 2011)). Infiltration and subsequent migration of contaminated groundwater would need to be addressed during any such treatment period to prevent further migration of contaminants and potential exposure. For this reason, the interim soil remedy is wholly consistent with Section

121(d)(4)(A) of CERCLA. Nothing related to the installation of ET caps prevents or inhibits EPA from selecting any future treatment of the underlying wastes as the Tribes have urged. These caps could be removed with minimal effort and cost, and even though the installation costs are considerable, cost of their installation is negligible compared to any known excavation and treatment option. Installation of ET caps does not prevent EPA from meeting (or waiving as may be necessary on or before completion of remedial action) any ARAR.

10.2 DETAILED DESCRIPTION OF THE SELECTED INTERIM AMENDED REMEDY

The selected interim amended remedy for the FMC OU is comprised of the preferred soil and groundwater remedies identified in the Proposed Plan, specifically Soil Alternative 3 and Groundwater Alternative 2. It addresses metals, radionuclides, and other COCs identified in soils, fill, and groundwater at the FMC OU. No significant changes to the remedy, as originally identified in the Proposed Plan, were deemed necessary or appropriate. This IRODA replaces the remedy selected in the 1998 ROD. Specifically, the remedy includes the following components:

- Place 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 RAs: RA-B, RA-C, RA-D, RA-E, RA-F1, RA-F2, RA-H, and RA-K, as shown in Figure 1 and described in Table 1
- Place approximately 12 inches of soil cover over areas containing slag fill, ore stockpiles, and the former Bannock Paving areas to prevent the exposure to gamma radiation and fugitive dust of potential future workers. Gamma radiation–protective soil covers will be placed over RA-A, RA-A1, RA-F, and RA-G as shown in Figure 1 and Table 1
- Excavate contaminated soil from Parcel 3 of FMC's Northern Properties, also known as RA-J, and consolidate onto the Former Operations Area to prevent exposure to 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 prevent contaminated groundwater from migrating beyond the FMC OU and into the Simplot OU, and/or adjoining springs or the Portneuf River. Extracted groundwater will either be treated within the FMC OU to drinking water standards and/or risk-based cleanup levels and discharged to an infiltration basin within the FMC OU where it would percolate down to recharge groundwater or evaporate into the atmosphere, or pumped to a municipal treatment facility in Pocatello for treatment and released in accordance with a NPDES permit. The treatment option for groundwater will be selected during design
- 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 described in Section 7.2), 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 that prohibit activities that may disturb 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
- Conduct operations and maintenance of implemented remedial actions.

Other actions, including closure and compliance actions under RCRA, have been and continue to be performed at RCRA-regulated units of the FMC Facility. These actions are not part of the FMC OU since they are under RCRA regulatory authority. The work performed under RCRA jurisdiction remains regulated under RCRA and is not part of this IRODA.

The revised RAOs and cleanup levels for the FMC OU are detailed in Section 7 of this document. The remedy addresses the RAOs through a combination of actions. Gamma soil covers and ET caps, gas monitoring, and institutional controls will address current human exposure risks. ET caps will reduce the release and migration of COCs to groundwater and by controlling these FMC OU releases to groundwater, the groundwater extraction and treatment remedy will work with the Simplot OU remedy to prevent downgradient releases to the Portneuf River and restore groundwater to levels protective of beneficial uses to the extent practicable within a reasonable timeframe. In the meantime institutional controls (ICs) will be implemented, monitored, and enforced to prevent human ingestion of contaminated groundwater.

Design and implementation of the soil remedy is expected to take 2–3 years and design and installation of the groundwater remedy is expected to take 1–4 years. The cost to implement the soil remedy is estimated to be $47 million and the cost to implement the groundwater remedy is estimated to be approximately $10 million. The groundwater extraction and treatment design will be developed to address all COCs in groundwater.

Attainment of the RAOs and associated cleanup levels will be measured through the monitoring of COC levels in groundwater, surface water, soil gas, and ambient air measurements, and other long-term monitoring activities, and comparison of monitoring results with the cleanup levels documented in Section 7.2. A groundwater and surface water monitoring plan and a gas

monitoring plan will be developed and implemented as part of the selected interim amended remedy to ensure RAOs and cleanup levels are met.

10.2.1 Institutional Controls

The selected interim amended remedy requires implementation, monitoring, and enforcement of institutional controls on the FMC OU property so long as groundwater remains contaminated above cleanup levels and waste remains in place above levels that allow for unrestricted use and unlimited exposure. The specific institutional controls to be implemented at the FMC OU are expected to include enforceable proprietary controls in the form of environmental easements or covenants that remain in place regardless of any changes of ownership. EPA and FMC are expected to have primary responsibility for implementation, monitoring, and enforcement of these controls; there may also be roles for the Tribe and/or state and local governments. Either an Institutional Controls Implementation and Assurance Plan, or the equivalent of one that is incorporated into the overall O&M Plan will be developed and will specify all aspects of IC implementation, monitoring, and compliance.

The objectives of the Institutional Controls element of the selected interim amended remedy are to ensure protectiveness and achieve RAOs, and more specifically to—

- Prohibit or appropriately restrict activities that may disturb remedies (such as digging in capped/covered areas)
- Restrict use of the FMC OU to commercial/industrial uses
- Prevent human consumption of impacted groundwater.

10.3 COST ESTIMATE FOR THE SELECTED INTERIM AMENDED REMEDY

Costs for the selected interim amended remedy are estimated at $57 million for design, construction, and 30 years of O&M costs using a future interest rate of 7 percent in accordance with EPA Guidance. The cost to implement the soil remedy is estimated to be approximately $47 million and the cost to implement the groundwater remedy is estimated to be approximately $10 million. The key features, capital costs, and costs of O&M for the interim amended remedy are listed in Table 15.

This cost estimate is based on the best available information regarding the selected interim amended remedy. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

10.4 ESTIMATED OUTCOMES OF THE SELECTED INTERIM AMENDED REMEDY

The selected interim amended remedy addresses risks to future workers from exposure to soils and waste being contained in place and significant portions of the surface areas of the FMC OU is expected to be available for commercial or industrial use in 2 to 4 years, after implementation of the soil remedy, subject to provisions of the institutional controls to ensure the integrity of the remedy (caps, covers, and treatment components). Portions of the FMC OU (SUA, WUA, and Northern Properties) are currently available for a commercial industrial use.

The timeframe to achieve groundwater cleanup levels at this OU (and throughout the Site) cannot reliably be estimated at this time. The ET cap will reduce or eliminate infiltration of rainwater and migration of contamination to groundwater, and the hydraulic containment wells at the Former Operations Area northern boundary are predicted to demonstrate whether it is practicable to restore groundwater downgradient from the Former Operations Area and beneath FMC's Northern Properties within a 25- to 50-year timeframe. Achieving groundwater restoration further downgradient in the area where FMC and Simplot-impacted groundwater discharges to the Portneuf River is highly dependent on the success of the Simplot groundwater remedial action. The selected interim amended remedy is predicted to incrementally reduce the areal extent of groundwater COCs. However the timeframe to restore these groundwater resources to RAOs is not well defined. These uncertainties are among the main reasons why this is an interim remedy, to be followed at a later date by a final remedy. Use of groundwater for drinking will continue to be prohibited so long as groundwater contamination remains above MCLs and other risk-based cleanup levels.

The cleanup levels for COCs selected in this IRODA and the basis for them are documented in Tables 8 and 9. These cleanup levels will remain in effect and be used to evaluate the performance of the remedy and progress toward the RAOs until such time as they are confirmed or replaced in a Final Remedy or other subsequent CERCLA decision document.

11. STATUTORY DETERMINATIONS

Pursuant to Section 121 of CERCLA and the NCP, the lead Agency must select remedies that are protective of human health and the environment, comply with ARARs, are cost-effective, and utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off site disposal of untreated wastes. The following sections discuss how the selected interim amended remedy meets these statutory requirements.

11.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected interim amended remedy is protective of human health and the environment by eliminating, reducing, or controlling risks posed by the FMC OU through containment of contaminated soils, engineering controls, and institutional controls; installation and operation of a groundwater extraction and treatment system; and long-term groundwater monitoring and gas monitoring. The unacceptable risks associated with COCs, including phosphorus, in groundwater will be reduced to acceptable levels by preventing COC releases into groundwater and through the capture and treatment of contaminated groundwater at the Former Operations Area northern boundary. Unacceptable risks posed by COCs in soil will be reduced through the containment and management of contaminated soils and wastes through the construction of ET caps and gamma soil covers.

11.2 COMPLIANCE WITH ARARS

The selected interim amended remedy will comply with all the ARARs identified in this IRODA:

- **Safe Drinking Water Act Maximum Contaminant Levels (MCLs), 40 CFR Part 141.** MCLs and nonzero maximum contaminant level goals (MCLG) are relevant and appropriate requirements for the groundwater and naturally potable surface water. The

groundwater beneath the FMC OU and the surface water into which it flows, including springs and the Portneuf River, are naturally potable waters, and therefore at least potential drinking water sources. MCLs and nonzero MCLGs shall be met for all COCs for which there are such standards, and also provide concentration limits for any extracted or treated groundwater to be injected or discharged back to groundwater.

- **Clean Water Act Section 304(a) Ambient Water Quality Criteria, 40 CFR Part 131 (or updated EPA recommended criteria for state water quality standard promulgation at http://www.epa.gov/ost/criteria/wqctable/).** Fresh water federal ambient water quality criteria (AWQC) are relevant and appropriate for surface water such as springs and the Portneuf River that FMC OU groundwater flows into, as specified in Section 121(d)(2)(A)(ii) (last sentence) of CERCLA.
- **Clean Water Act Section 402 National Pollutant Discharge Elimination System (NPDES) 40 CFR Parts 122, 124, 136.** These regulations will be applicable if extracted groundwater is discharged to surface water. They require discharge limits to surface water and best management practices (BMPs) within specified required parameters, among other specified procedures, to minimize pollutants in discharges to surface water.
- **Resource Conservation and Recovery Act (RCRA) Hazardous Waste Regulations, 40 CFR Parts 261–264.** These regulations are not applicable because they are not retroactive to hazardous waste disposed of prior to their promulgation, for example, to former FMC OU waste ponds containing ignitable/reactive wastes. They are relevant and appropriate to these wastes to the extent that based on the facts of the situation, they produce a rational outcome when applied. For example, if rules requiring the lining of surface impoundments were not complied with because they were not promulgated when such impoundments went into service, rules requiring a matching lining to close such impoundments cannot be complied with because the matching requirement is dependent on the implementation of the initial lining. ET caps selected for the former FMC OU waste ponds containing ignitable/reactive wastes therefore meet these relevant and appropriate requirements.
- **Resource Conservation and Recovery Act (RCRA) Land Disposal Restrictions (LDRs), 40 CFR Part 268.** While these regulations are neither applicable nor relevant

and appropriate to hazardous waste disposed of prior to their promulgation, they would be applicable to any new land disposal of previously disposed of wastes in a new location outside of specified parameters.

- **Resource Conservation and Recovery Act (RCRA) Solid Waste Regulations, 40 CFR Parts 257-258.** These regulations set forth solid waste handling, management, and disposal requirements for remedy implementation at the FMC OU.
- **Clean Air Act Regulations for Fugitive Dust Emissions, 40 CFR 50.7 and Part 61.** These regulations establish applicable standards for the release of fugitive air emissions of particulate matter and radionuclides, respectively, which could occur during remedy implementation at the FMC OU.

In addition to the ARARs identified above, the Portneuf River TMDL: Waterbody Assessment and Total Maximum Daily Load and Addendum, Pocatello Regional Office, Idaho Department of Environmental Quality Pocatello 2001 has been identified as a TBC for the Selected Remedy. The TMDL for the Portneuf River developed loading limits for constituents discharged to the Portneuf River, which will be considered in developing the final cleanup level for phosphorus. The final surface water cleanup level for phosphorus will be selected in a subsequent decision document(s) for both the Simplot and FMC OUs.

When a final remedy is implemented, any additional ARARs, including the Tribes' SCS (to the extent SCS are determined to be ARARs), will be fully complied with or a formal waiver will be invoked at or before the completion of all remedial actions. Any and all waivers will be pursuant to Section 121(d)(4) of CERCLA. This IRODA invokes the waiver in Section 121(d)(4)(A) of CERCLA for interim remedial action.

11.3 COST-EFFECTIVENESS

The selected interim amended remedy is cost-effective. A remedy shall be cost-effective if costs are proportional to its overall effectiveness (NCP §300.430(f)(1)(ii)(D)). The estimated NPV of the amended selected interim amended remedy is $57 million, which is 10 to 100 times less than the treatment alternatives that were evaluated. With proper monitoring and maintenance of the caps and covers, the selected interim amended remedy will provide the same level of protection

of human health and the environment as the alternatives providing treatment of elemental phosphorus waste treatment within the FMC OU.

11.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

Based on the Administrative Record, the selected interim amended remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the FMC OU. It provides the best balance of tradeoffs in terms of the five balancing criteria while also considering the statutory preference for treatment as a principal element and bias against off site disposal. Implementation of engineering and source control actions will reduce the levels of risks to human health and the environment and can be implemented in 2 to 3 years. Implementation of groundwater extraction will eliminate releases potentially impacting surface water and should reduce the overall contamination levels in groundwater to cleanup levels protective of both groundwater and surface water, within approximately 100 years. Groundwater monitoring is currently being performed and will continue to be performed to assess the performance of the extraction system and source control actions. Groundwater data will be evaluated at least annually to assure that the expected reduction in release and migration of FMC OU COCs to the groundwater from Facility sources is occurring. The intent of ongoing groundwater and surface water monitoring is to ensure that RAOs are met.

11.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The selected interim amended remedy satisfies the statutory preference for remedies that employ treatment as a principal element because contaminated groundwater will be extracted and treated to levels that are protective and meet ARARs. The selected interim amended remedy does not include treatment of elemental phosphorus and other co-located COCs throughout the FMC OU because of the chemical and physical nature of elemental phosphorus and the potential risks and uncertainties associated with the excavation and treatment of elemental phosphorus-contaminated wastes.

The preference for treatment was established in Section 121(b) of CERCLA, which states, "Remedial actions in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants is a principal element, are to be preferred over remedial actions not involving such treatment." As part of the selection of a proposed or preferred alternative, EPA balances the preference for treatment within the nine criteria in accordance with the NCP. In addition whether excavation is practicable was considered, consistent with EPA's response to comments on NCP Section 40 CFR 300.430(a)(1) (55 FR at 8703) beginning with:

"Treatment is less likely to be practicable when sites have large volumes of low concentrations of material, or when the waste is very difficult to handle and treat; specific situations that may limit the use of treatment includes sites where: (1) Treatment technologies are not technically feasible or are not available within a reasonable timeframe; (2) the extraordinary size or complexity of a site makes implementation of treatment technologies impracticable; (3) implementation of a treatment-based remedy would result in greater overall risk to human health and the environment due to risks posed to workers or the surrounding community during implementation…. "

The principal threat waste at the FMC OU is elemental phosphorus (P_4). It is a RCRA ignitable and reactive waste that has physical properties that are unlike most COCs encountered in environmental response actions. Its general properties include:

- It is pyrophoric, or spontaneously ignitable in air; it oxidizes with exposure to atmospheric oxygen at normal temperatures.
- The reaction in air produces phosphorus pentoxide (P_2O_5), phosphorus trioxide, plus lower oxides and hydrolysis products, including phosphine. Clouds of combustion obscure visibility (a problem for adjacent highways and the Pocatello Airport).
- The smoke and other by-products further react to form a phosphoric acid aerosol (a severe eye, throat, and lung irritant).
- P_4 slowly reacts with water to produce phosphine gas (PH_3). Phosphine is the active ingredient in certain rodenticides and insecticides.

- Managing it requires implementation of special health and safety practices to protect workers.
- P_4 is highly toxic by ingestion, inhalation, and skin absorption and may be fatal at high concentrations; is corrosive to skin and other living tissue; and is likely to cause skin burns upon contact.

Managing elemental phosphorus requires special handling techniques not only for routine handling, but also for emergency response. These handling requirements were examined in the SFS.

EPA also considered the following issues when evaluating potential treatment alternatives for the principal threats posed at the FMC OU:

- The limited availability of reliable proven treatment technologies for the volume of dispersed elemental phosphorus in soils as found at the FMC OU
- The very large volume of elemental phosphorus-contaminated soil (estimated between 5,050 to 16,380 tons of elemental phosphorus and 780,000 yd^3 of contaminated soil), much of it at significant depth (up to 85 feet bgs) and unevenly distributed throughout the soil column
- The significant risks posed to workers and the surrounding community during implementation of any treatment alternative over a prolonged (20 to 40 years) treatment period. Risks include exposure to spontaneous oxidation or burning of elemental phosphorus for workers, and the potential for incidental/accidental air emissions even in the most careful long-term operations.

EPA evaluated remedial alternatives in detail in the SFS and during the development of the selected interim amended remedy. The evaluation included analyzing the utilization of treatment technologies versus capping and management of wastes in place. Both standard and innovative technologies were considered that would allow the elemental phosphorus-contaminated soil to be excavated, processed, and treated. Capping and management in place was selected over treatment for the following reasons:

- EPA concluded that capping and management in place is implementable and is protective and cost-effective.
- EPA concluded that there were no technologies that could reliably, safely, and effectively be utilized to excavate and treat the elemental phosphorus-contaminated wastes at the FMC OU.
- Based on its experience at this and other sites and research done for the SFS, EPA determined excavation and treatment of elemental phosphorus-contaminated wastes at the FMC OU would be extremely challenging from an engineering and safety perspective.
- In addition, costs for treatment were estimated to be one to two orders of magnitude higher than costs to manage the wastes in place without any assurance that the engineering challenges related to excavation and treatment could be overcome.
- EPA further believes that implementing a treatment alternative would pose greater risks to workers, adjacent Simplot employees, and residents than risks posed by managing the wastes in place. Significant human health risks arise for remedial workers, workers at nearby facilities, and any emergency responders from excavating, transporting, and treating large volumes of elemental phosphorus-contaminated waste.

These risks also exist to a lesser degree for the public at large that might be exposed during remedial activities at the FMC OU. However, despite all of these challenges, and in deference to vigorous opposition by the Tribes, in parallel with implementing this interim remedial action, to address concerns raised by the Tribes, EPA has committed to working with the Tribes to facilitate another independent review of technologies and approaches to excavate and/or treat elemental phosphorus within the subsurface of the FMC OU. However, the proposed review will not delay implementation of this IRODA.

11.6 FIVE-YEAR REVIEW REQUIREMENT

Because the selected interim amended remedy will result in hazardous substances, pollutants, or contaminants remaining on the site above levels that allow for unrestricted use and unlimited exposure, a statutory review will be conducted within 5 years after initiation of the remedial action to ensure the remedy is and will protect human health and the environment. The first 5-year review will begin 5 years after the start of the remedial action, and formal reviews will be

conducted a minimum of every 5 years thereafter as long as contamination remains in place above levels that allow for unrestricted use and unlimited exposure.

12. RESPONSIVENESS SUMMARY

The selected interim amended remedy in this IRODA is the same as the Preferred Alternative identified in the Proposed Plan. It differs from the remedy selected in the 1998 ROD in that it modifies the RAOs and cleanup levels, calls for the design, construction, and operation of a groundwater extraction system, provides for capping and long-term management of contaminated soils and fill throughout the FMC OU, and adds phosphorus and elemental phosphorus as COCs for the FMC OU.

In accordance with 40 CFR §300.45(c)(2)(ii)(D), four public meetings were held during the public comment period and public comment was taken both in writing and verbally at each of those public meetings. Dates and locations of the public meetings were:

- October 12, 2011, Fort Hall Tribal Council Chambers
- October 13, 2011, Chubbuck City Council Chambers
- November 15, 2011, Chubbuck City Council Chambers
- November 16, 2011, Fort Hall Tribal Council Chambers and Auditorium

The public meetings were advertised in fact sheets distributed to more than 150 individuals and other interested parties. EPA issued a press release prior to each meeting that was publicized in the *Idaho State Journal*, *Shoshone-Bannock News*, *Power County Press*, *Blackfoot Morning News* for the October and November meetings, and *Aberdeen Times* for the November meetings. During the public comment period, approximately 352 individuals submitted either written comments and/or provided oral testimony, testimony was heard from 56 individuals at the public meetings held in Chubbuck and Fort Hall, and approximately 942 comments were compiled from written comments and testimony. These comments and testimony, and EPA's response to the comments and testimony, is included in the following section.

13. RESPONSE TO COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD

13.1 COMPILED COMMENTS FROM THE PUBLIC

The following section addresses the comments received from all parties with the exception of four letters; two letters received from the Shoshone-Bannock Tribes, and one each from FMC Corporation and J.R Simplot Company. In cases where multiple comments were received raising the same issue or concern, comments were grouped and a single EPA response is provided. If several comments were received from one individual or organization, the comments were separated by issue or concern. Groups of comments related to specific issues or concerns are summarized to provide the reader context for EPA's response. The full text of comments received may be found in Section 20.12.4 of the Administrative Record for the IRODA.

13.1.1 SUPPORT OF THE PREFERRED ALTERNATIVE

Comment Summary: EPA received approximately 300 comments generally supporting the Proposed Plan and Preferred Alternative. Some comments noted that novel technologies, such as the "Archuleta" Plan to do not take into account the safety of remediation personnel or adjacent Simplot employees.

EPA Response: EPA acknowledges support for the Preferred Alternative. Protection of human health and the environment, including the health and safety of the workers implementing the remedy and workers adjacent to any site, are primary objectives of any EPA remedy.

13.1.2 OPPOSITION TO THE PREFERRED ALTERNATIVE

Comment Summary: EPA received 118 comments generally opposed to the Preferred Alternative. Most comments opposing the Preferred Alternative were in favor of excavation and treatment or removal of subsurface elemental phosphorus.

EPA Response: After evaluating all the data, analysis, and reports contained in the Administrative Record in terms of the nine criteria for CERCLA remedy selection, EPA believes the record not only strongly supports the Preferred Alternative presented in the Proposed Plan, it does not support any alternative that would excavate subsurface ignitable elemental phosphorus waste-containing soils. EPA is implementing an Interim Record of Decision Amendment

(Interim ROD Amendment) for the FMC OU to promptly address storm water infiltration and resulting contaminated groundwater migration from the FMC OU to the adjoining Simplot OU, potentially impacting that remedy, and the Portneuf River. However, EPA and the Tribes will be participating in an additional independent assessment of treatment options, the results of which EPA will ultimately have to consider within the context of the National Contingency Plan (NCP) remedy selection criteria. The nine evaluation criteria used to compare remedial alternatives are: 1) overall protection of human health and environment; 2) compliance with applicable or relevant and appropriate requirements (ARARs); 3) long-term effectiveness and permanence; 4) reduction of toxicity, mobility, or volume; 5) short-term effectiveness; 6) implementability; 7) cost; 8) State acceptance; and 9) community acceptance.

In December 2010, the Shoshone Bannock Tribes (the Tribes) promulgated stringent soil cleanup standards (SCS), which require, among other things, excavation and/or treatment of all buried elemental phosphorus on the Fort Hall Reservation. Among the Tribes' stated goals in promulgating the SCS is to restore all land within the Reservation to its original state, prior to the contamination that the standards are designed to address. This selected interim amended remedy does not meet these standards. However, due to the interim nature of this action, Applicable or Relevant and Appropriate Requirements (ARARs) do not have to be met at this time. EPA is evaluating the Tribes' standards to determine whether these regulations may be ARARs. This evaluation will require careful federal review in order that these unique and potentially precedential SCS be fully evaluated prior to a decision as to whether all or a part of the SCS are ARARs. CERCLA requires that ARARs must be met or waived upon completion of remedial action. At the time that EPA selects a final remedy, EPA will more definitively address groundwater restoration within a reasonable restoration timeframe, will determine whether all or a part of the Tribal SCS are ARARs, and will if necessary determine the applicability of the ARAR waiver provisions in §121(d)(4) of CERCLA. EPA will consult with the Tribes on the selection of the final remedy including consideration of any proposed waiver or waivers.

EPA believes technologies currently available cannot address the volume and nature of subsurface elemental phosphorus-containing soils at the FMC OU. Implementation of any excavation and treatment technology must consider the pyrophoric nature (it can burn spontaneously when it comes in contact with air) and the high toxicity of elemental phosphorus

and its gaseous products (such as phosphine and sub-oxides of phosphorus). The FMC Pocatello facility was the largest elemental phosphorus manufacturing facility in North America. FMC has estimated that there are 5,050 to 16,380 tons of elemental phosphorus in approximately 780,000 cubic yards of contaminated material within the FMC OU alone. This volume does not include elemental phosphorus-contaminated wastes associated with the RCRA units (see Comment 13.1.21). There are significant unknowns beyond the actual volume of contaminated soils, including the horizontal and vertical gradients in the concentrations of elemental phosphorus, the total mass of elemental phosphorus, and the form of elemental phosphorus in the soil.

Further uncertainties associated with elemental phosphorus waste retrieval include unknown debris in the soils that would have to be separated, feed stock preparation (typing, sizing, elemental phosphorus concentration), rate of phosphine gas generation, and design of the toxic gas management system. Any excavation and treatment process typically requires substantial amounts of water to control elemental phosphorus combustion, and that water could drive contaminants further into the soil column. All of this handling would create significant hazards to remediation workers and the environment, and it is not clear that known treatment technologies would ultimately be effective on all or even most of the elemental phosphorus contaminated soils that may be excavated from the FMC OU. The elemental phosphorus contamination within the FMC OU alone is at a scale unprecedented anywhere in the United States and would therefore require the use of unproven technologies if the elemental phosphorus wastes are to be removed.

Given the following three factors: 1) the hazards associated with ex-situ treatment and with elemental phosphorus waste retrieval (or removal more generally); 2) the limited and negative experience with in-situ treatment; and 3) based on actual experience at other sites, these elemental phosphorus wastes can be managed in place in a manner that is fully protective of human health and the environment, from a wholly technical perspective, EPA is left with a strong preference for containment, notwithstanding the CERCLA statutory preference for treatment where it may be safe and effective. Containment is the current industry standard for managing these wastes and has been thoroughly reviewed, approved and utilized by EPA at other elemental phosphorus sites.

EPA also evaluated the costs of treating some or all of the wastes. The costs for treating a relatively small portion of the elemental phosphorus-containing waste was approximately 10 times the cost of managing all the waste in the FMC OU in place, and would still require leaving significant quantities of untreated waste in place. EPA estimated the costs of treating all the waste at the FMC OU at approximately 100 times the cost of managing this waste in place. Given the technical uncertainties, health and safety risks to remediation workers and the community, along with the very high cost of treating the waste, EPA was led to the conclusion that containment is the best technological option for protecting human health and the environment from potential risks associated with these elemental phosphorus wastes at this time. If a technology or remedial alternative is developed in the future that better addresses the nine CERCLA criteria for remedy selection outlined in the NCP at 40 CFR 300.430(e)(9)(iii) and CERCLA's general preference for treatment, particularly for principal threat waste, a final remedy for the FMC OU could include treatment for all or a portion of the hazardous substances identified. In addition, if during a future CERCLA 5-year review (which is mandated for as long as wastes above cleanup standards for unrestricted use remain on site) or ongoing monitoring show containment of the waste in place proves not to be protective of human health or the environment, EPA will require additional action as appropriate.

13.1.3 CHARACTERIZATION OF THE FMC OU

Comment Summary: EPA received 18 comments requesting further study of the FMC OU before implementing a remedy. 286 comments noted extensive study has been performed at the FMC OU and no further study is required before implementing a remedy.

EPA Response: EPA does not agree that additional study is needed or warranted to implement an interim remedy that is protective of human health and the environment. EPA also believes that needed and significant human health and environmental protection can be achieved without foreclosing other options in the future.

Extensive studies have been performed over the course of 20 years to characterize the extent and nature of contamination within the FMC OU. The primary studies are summarized in the:

- Remedial Investigation for the Eastern Michaud Flats Site *(EMF RI Report;* BEI, 1996);

- Feasibility Study Report FMC Subarea *(1997 FMC Subarea FS;* BEI, 1997);
- Supplemental Remedial Investigation Report *(SRI Report;* MWH, 2009a);
- Supplemental Remedial Investigation Addendum Report (*SRI Addendum Report;* MWH, 2010a);
- Groundwater Current Conditions Report (*GWCCR;* MWH, 2009b);
- Supplemental Feasibility Study Report for the FMC Plant Operable Unit (*SFS Report;* MWH, 2010b); and
- Site-Wide Gas Assessment Report (*Gas Assessment Report;* MWH, 2011).

A thorough and complete record of all studies can be found in the Administrative Record for the FMC OU at the following location:

EPA Region 10 Superfund Records Center

1200 Sixth Avenue, Suite 900, ECL-076 (7th Floor)

Seattle, WA 98101

206-553-4494 (call for an appointment)

After considering extensive input from technical experts from EPA, IDEQ, FMC, and the Shoshone Bannock Tribes throughout the Remedial Investigation and Feasibility Study process, EPA has determined that the investigations and studies support the proposed interim remedy. After reviewing comments submitted by FMC, the Shoshone Bannock Tribes, and the public on the Proposed Plan, EPA has concluded that the proposed remedial action is protective of human health and environment.

EPA will continue to oversee groundwater monitoring and sampling of surface water, soil gas, and visual inspections, and other data after the remedy is implemented. EPA will perform ongoing monitoring and oversight and data will be formally reviewed every 5 years to ensure the interim remedy continues to protect human health and the environment. If data collected from ongoing monitoring or if data evaluated during 5-year reviews indicate the interim remedy is not protective of human health and the environment, EPA will require additional action as appropriate. In addition, EPA and the Shoshone Bannock Tribes are participating in an independent review of potential treatment technologies for elemental phosphorus in soil at the FMC OU. If a technology or remedial alternative is developed in the future that better addresses

the nine CERCLA criteria for remedy selection outlined in 40 CFR 300.430(e)(9)(iii) and CERCLA's general preference for treatment, a final remedy for the FMC OU could include treatment for all or a portion of the hazardous substances identified.

13.1.4 FUTURE DEVELOPMENT AND LAND USE AT THE FMC OU

Comment Summary: 289 comments were received supporting redevelopment of the FMC OU for commercial and/or industrial purposes after the remedy has been implemented. 9 comments stated redevelopment is unlikely at a Superfund site with subsurface elemental phosphorus contamination.

EPA Response: As the property owner interested in selling land it has no plans to use, FMC is motivated to work with interested parties to pursue potential commercial or industrial redevelopment at the FMC OU. FMC has publicly taken this position with all interested governmental entities. The FMC OU covers approximately 1,450 acres; approximately 480 acres will have either a gamma or evapotranspiration cap and the capped RCRA ponds cover approximately 62 additional acres.

Market forces will likely most strongly influence future land development. Areas with caps are likely more difficult to develop because they will have more future use restraints than areas that have been less impacted by operations. Additionally, rail spurs and energy infrastructure will likely influence development depending on the needs of prospective users. Environmental easements (or possibly covenants) will be placed on the property to prevent the disturbance of the implemented remedy and exposures to subsurface contamination. These use restrictions and/or obligations will be part of ownership of the land and cannot be terminated if a subject property (the FMC OU consists of numerous separate land parcels, most of which are within the Fort Hall Indian Reservation) is transferred. They will remain in effect from owner to owner for as long as they may be needed.

While EPA will continue to provide oversight after the remedy is implemented, it will be up to FMC, commercial interests, and the government with jurisdiction to develop the property to the extent the market will support in a manner consistent with the remedy.

13.1.5 SUPPORT AND OPPOSITION FOR A PILOT STUDY FOR TREATMENT AND EXCAVATION OF ELEMENTAL PHOSPHORUS

Comment Summary: EPA received comments from 66 individuals requesting a pilot study be performed to treat and/or excavate subsurface elemental phosphorus beneath the furnace building, while comments were received from 277 individuals opposing a pilot study for the excavation and/or treatment of subsurface elemental phosphorus.

EPA Response: EPA evaluated multiple proposed treatment methods for elemental phosphorus, including in-situ and ex-situ methods. No methods were identified to successfully treat elemental phosphorus contaminated wastes in place (in-situ). EPA did identify two potential ex-situ technologies that could potentially treat elemental phosphorus waste. These two methods are thermal treatment (incineration) and anoxic caustic hydrolysis. While both technologies have been shown to be effective on a small scale, there are no examples where these (or any other treatment technologies) have been used on a scale posed by contamination within the FMC OU. A pilot study, even if successful, would only provide a third potential unproven technology and would not address the risks posed to remediation workers, the public, and adjacent property employees associated with excavation and treatment of elemental phosphorus wastes.

EPA has determined that capping the elemental phosphorus and implementing land use controls is the safest and most practicable method for protecting human health and the environment while balancing implementability, risk to remediation workers, the public, and Simplot employees, and cost. Despite EPA's multiple excavation and treatment technology reviews, in deference to the Tribes' continuing advocacy for excavation and treatment, EPA has offered to further explore these issues by facilitating an independent review of excavation and treatment technologies. The final remedy could include excavation and treatment of elemental phosphorus if such a remedy were to rate higher than the selected interim capping remedy in terms of the nine evaluation criteria for CERCLA remedy selection. The nine evaluation criteria used to compare remedial alternatives are: 1) overall protection of human health and environment; 2) compliance with applicable or relevant and appropriate requirements (ARARs); 3) long-term effectiveness and permanence; 4) reduction of toxicity, mobility, or volume; 5) short-term effectiveness; 6) implementability; 7) cost; 8) State acceptance; and 9) community acceptance.

13.1.6 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Comment Summary: EPA received 63 comments expressing concern that the Preferred Alternative is not protective of human health or the environment. Specifically, there were comments stating that EPA is covering waste and is not performing a cleanup or remedial action through capping. 5 comments expressed that the Preferred Alternative was protective.

EPA Response: The selected interim remedy will be protective of 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. Evapotranspiration caps, caps to protect against gamma radiation, land-use restrictions, and a groundwater pump and treat system are projected by EPA to provide full protection of human health and the environment. Evapotranspiration caps prevent the leaching and migration of COCs (such as arsenic and phosphorus constituents) in fill and soil to groundwater by preventing precipitation from infiltrating contaminated fill and soil. Properly maintained evapotranspiration caps, when combined with institutional controls, achieve all remedial action objectives for protection of human health and the environment with respect to potential soil exposure pathways including: 1) gamma radiation emission; 2) incidental ingestion; 3) direct dermal exposure; 4) the threat of elemental phosphorus fire; and 5) inhalation of fugitive dust.

Soil caps eliminate exposure to gamma radiation ("gamma caps"). Properly maintained gamma caps, when combined with institutional controls, achieve all remedial action objectives for potential human exposure pathways for: 1) gamma radiation; 2) incidental ingestion; 3) direct dermal exposure; and 4) inhalation of fugitive dust.

Land-use restrictions limit activities to commercial/industrial uses, prohibit activities that may disturb the selected remedial alternative, and restrict use of groundwater. Land-use restrictions would also strictly manage when, where, and how excavation could occur (for example, digging to access utility lines).

Groundwater extraction from the shallow aquifer will provide hydraulic containment of contaminated groundwater thereby preventing further downgradient migration of FMC OU COCs. Extraction wells will capture impacted shallow groundwater before it can migrate downgradient beyond the former operations area boundary toward the Portneuf River.

Contained groundwater will be treated to drinking water standards (maximum contaminant levels, MCLs) and either discharged to the Portneuf River or discharged to an infiltration basin on the FMC facility where it would percolate down to recharge groundwater or evaporate into the atmosphere.

In summary, the remedy will utilize institutional controls, engineering controls (i.e., evapotranspiration caps and gamma caps), and a groundwater pump and treat system to provide protection of human health and the environment.

13.1.7 DESIGN OF THE GROUNDWATER EXTRACTION SYSTEM

Comment Summary: EPA received 67 comments expressing concern that contaminated groundwater from the FMC OU will be allowed to discharge into the Portneuf River, the Bottoms Area, and the American Falls Reservoir, and that only a portion of the contaminated groundwater will be captured by the groundwater containment system. Some comments expressed concern that radionuclides within the groundwater cannot be treated and will be released into groundwater or the Portneuf River. Questions were also received inquiring why arsenic and orthophosphate are the primary contaminants of concern (COCs). 1 comment was received supporting the groundwater remedy.

EPA Response: The groundwater pump and treat system will be designed to capture all contaminated groundwater prior to that groundwater exiting the FMC OU and thus provide total hydraulic containment of all contaminated groundwater.

Extraction wells will be located in the northeastern corner of the former operations area to capture impacted shallow groundwater before it can migrate downgradient beyond the former operations area boundary. Although precise specifications will be developed in the Remedial Design, groundwater modeling indicates that 5 extraction wells would be sufficient and a total combined extraction rate of approximately 530 gallons per minute (gpm) would fully capture contaminated groundwater migrating beyond the former operations area. Extracted groundwater will either be treated within the FMC OU to drinking water standards and/or risk-based cleanup levels and discharged to an infiltration basin within the FMC OU where it would percolate down to recharge groundwater or evaporate into the atmosphere, or pumped to a municipal treatment facility in Pocatello for treatment and released in accordance with a National Pollution Discharge

Elimination System (NPDES) permit. The treatment option for groundwater will be selected during design.

Additional monitoring wells will be installed beyond the capture area of the extraction wells to measure and confirm the hydraulic capture from the extraction wells. Additional groundwater monitoring will be performed to determine the quality of the groundwater prior to flowing into the Portneuf River.

Arsenic, fluoride, nitrate, radium-226, selenium, thallium, elemental phosphorus, gross alpha, and gross beta have been detected in FMC OU groundwater at concentrations that exceed the groundwater MCLs (drinking water standards) and are the COCs for this Interim ROD Amendment.

While the treatment system will be designed to treat all contaminants of concern, for the following reasons, EPA considers arsenic and phosphorus to be the primary groundwater COCs for this OU and the primary groundwater COCs for the EMF Site. Arsenic is the only groundwater COC that has been shown to be migrating beyond the FMC OU boundary in concentrations that would be a concern to human health. Arsenic is responsible for most of the human health risks associated with groundwater ingestion. Only phosphorus has been shown to be migrating beyond the FMC OU boundary in concentrations that would be a concern for the environment. Phosphorus is responsible for most of the calculated ecological risks associated with groundwater at the FMC OU and EMF Site.

Gross alpha and gross beta levels will be addressed by precipitating and filtering radioactive metals from the groundwater within the treatment system. Extracted groundwater must be treated to meet MCLs for all COCs, and groundwater monitoring will monitor for all COCs.

13.1.8 GROUNDWATER MODELING

Comment Summary: EPA received 4 comments expressing concern that the groundwater model produced by EPA and FMC does not accurately reflect the groundwater flow and further study is required to fully understand the groundwater flow beneath the site.

EPA Response: The groundwater flow conditions are well understood and allow EPA to move into the remedial design phase with installation of extraction wells and observation wells, and to

conduct aquifer testing for the design of the final extraction system. The groundwater transport modeling does not support the prediction of a groundwater cleanup timeframe, i.e., how groundwater flow will react to the installation and operation of a groundwater extraction system. Installing and operating such a system will allow collection of data that will be used as input to versions of the model that are expected to improve the ability to make predictions and monitor results in the future.

13.1.9 GROUNDWATER COMPLIANCE ZONE

Comment Summary: EPA received 10 comments requesting the groundwater compliance zone for the groundwater monitoring program to be within the FMC OU instead of where groundwater discharges as surface water in the Portneuf River.

EPA Response: The 1998 ROD required that groundwater ultimately meet groundwater restoration cleanup goals throughout the plume (without specifying how beyond controlling contamination sources to groundwater), and this requirement remains unchanged. The Interim ROD Amendment requires immediate containment of contaminated groundwater by requiring that these groundwater cleanup goals be met for all COCs at the line of extraction wells within the FMC OU (their precise locations to be fixed during remedial design). The interim groundwater pump and treat system will prevent contaminated groundwater from migrating beyond FMC OU boundary, into the Simplot OU, potentially impacting that remedy, and to nearby springs or the Portneuf River.

EPA has selected an interim rather than final groundwater remedy because of uncertainty as to whether groundwater restoration can be achieved within 100 years. In addition to stopping contaminated groundwater migration beyond the FMC OU boundary, the interim remedy allows for the collection of more site specific data (to avoid relying only on modeling) to determine with greater confidence if groundwater restoration can be achieved within a reasonable timeframe. It also avoids any further delay in initiating a pump and treat system in an area which EPA now believes will likely require a pump and treat system as part of the final groundwater remedy.

A groundwater monitoring program will be developed for the FMC OU to monitor the performance of the pump and treat system using the EPA *Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems*. Monitoring wells for this monitoring program will

be placed near the former FMC operations area as well as beyond the FMC OU boundary. Groundwater will continue to be monitored along the flow paths toward the Portneuf River and groundwater quality will also be monitored prior to flowing into the Portneuf River.

13.1.10 EVAPOTRANSPIRATION CAP AND GAMMA CAP DESIGN

Comment Summary: EPA received 26 comments inquiring how evapotranspiration caps reduce elemental phosphorus or metals contamination in groundwater, and how gamma caps are protective. Many comments expressed concern regarding maintenance of the caps due to erosion and the long-term protectiveness of the remedy due to cap erosion.

EPA Response: An evapotranspiration cap reduces seeping of rainwater into contaminated fill and soil by allowing native vegetation planted on top of the cap to uptake infiltrated rainwater preventing it from coming into contact with contamination below. Evapotranspiration caps employ the principle of "water balance" to minimize percolation of precipitation into and through contamination. A clean soil layer is designed to be thick enough to store infiltrated precipitation during winter and early spring, and native vegetation is planted in the thick soil layer to remove the stored water through evaporation and transpiration (by plants) of infiltrated water during late spring, summer, and fall. ET caps prevent the leaching and migration of COCs in fill and soil by preventing precipitation from infiltrating into contaminated fill and soil and carrying contamination down into the groundwater.

A "gamma cap" involves placement of at least one foot of clean native soil over fill or soil containing radionuclides to eliminate the pathway for gamma exposure. Exposure rate measurements at FMC OU test plots have shown that one foot of native soil cover is sufficient to reduce exposure to gamma radiation to meet the soil radiological Remedial Action Objectives (RAOs). A topsoil cover with the appropriate institutional controls, monitoring, and maintenance achieves RAOs for potential human exposure pathways for: 1) gamma radiation, 2) incidental ingestion, 3) direct dermal exposure, and 4) inhalation of fugitive dust. If a redevelopment option is identified during remedial design that would provide equal protection from radiation exposure, this could be incorporated into the remedial design. For instance, many likely redevelopment projects would include asphalt or concrete parking lots and/or other areas that could be designed to meet the same protective standards as a gamma cap.

Evapotranspiration and gamma caps will require monitoring and maintenance to ensure proper soil depth and vegetation cover is maintained. The monitoring and maintenance plan will be developed during the Remedial Design and will be enforced after implementation. Land-use restrictions will also be implemented to ensure future on-site activities do not disturb the caps.

Due to the projected durability of the proposed caps, the residual risk levels after capping are expected to be very low. All the proposed caps will be constructed of clean local earthen materials of varying thicknesses. Caps will be engineered for long-term effectiveness and performance as well as effective storm water drainage, therefore no significant deterioration is expected to occur. Long-term operation and maintenance (O&M) includes monitoring of cap thickness and repair as necessary to maintain long-term cap integrity. O&M of the caps, in addition to the groundwater extraction system, will be required as long as wastes are managed in place.

As required by law at sites where hazardous substances remain on site above levels that allow for unlimited use and unrestricted exposure to ensure the site remains protective of human health and the environment, EPA will oversee ongoing monitoring and maintenance activities and data will be formally reviewed at least every five years to ensure the interim remedy continues to protect human health and the environment. If data collected from ongoing monitoring or if data evaluated during 5-year reviews indicate the interim remedy is not protective of human health and the environment, EPA will re-evaluate the interim remedy and select further remedial action as appropriate to ensure protectiveness. The five year review requirement in CERCLA requires these reviews without regard to whether a remedy is interim or final.

13.1.11 HUMAN HEALTH AND ECOLOGICAL RISK DRIVERS

Comment Summary: EPA received 3 comments requesting the identification of the contaminants that pose the greatest health risks at the FMC OU, and identification of what those risks are.

EPA Response: The remedy will address several risk-creating contaminants associated with specific receptors and exposure pathways. Although the remedy addresses all contaminants of concern (COCs) identified in the risk assessments and Supplemental Feasibility Study (SFS), a subset of the COCs are identified as presenting the highest concern to human health and

ecological receptors, and are referred to as "risk drivers." The remedy consists of Soil Alternative 3 and Groundwater Alternative 2 from the Proposed Plan. The remedy reduces risks to both human and ecological receptors by reducing their exposures to COCs at the FMC OU. The COCs for human health risks are radionuclides, radon, several metals (specifically arsenic), and elemental phosphorus. Orthophosphate is identified as the COC for ecological receptors in the aquatic environment of the Portneuf River. No COCs were identified for ecological exposures in the terrestrial environment.

Radionuclides in surface soils and fill material within the FMC OU pose a risk to human health through direct gamma radiation exposure, inhalation, and ingestion which pose a cancer risk. In areas where there is no elemental phosphorous, the risk driver COC is radium-226, which also produces radon gas, another COC. The primary human receptors are current and future workers. Current and future workers can be exposed to gamma radiation through the following pathways:

- Direct gamma exposure from slag and other waste materials (includes: phossy solids, precipitator solids, kiln scrubber solids, industrial waste water sediments, baghouse dusts, and plant/construction landfill debris);
- Incidental inhalation of slag dust; and
- Incidental ingestion of slag dust.

To reduce exposure to gamma radiation, the soil remedy will consist of soil covers or caps (composed of at least 12 inches of soil) to prevent exposure to gamma radiation and inhalation and ingestion of slag dust and other waste.

Elemental phosphorus in the subsurface of the FMC OU is also a risk driver for human health. The primary human receptors are current and future workers. The pathways for exposure of these workers to elemental phosphorus are:

- Dermal contact with elemental phosphorus;
- Ingestion of soil contaminated with elemental phosphorus; and
- Inhalation of combustion gases of elemental phosphorus.

Elemental phosphorus also burns spontaneously upon contact with air. To prevent direct exposure to elemental phosphorus and inhalation of combustion gases, the soil remedy will

include enforceable land use restrictions to prevent excavation and consequent exposure to elemental phosphorus.

Various metals in groundwater are COCs for human health risks. Metals in groundwater can also migrate to surface water in the Portneuf River. Arsenic is the risk driver for groundwater because it presents the highest health risks. Treatment of arsenic in extracted groundwater will also address other contaminants.

Extraction wells will capture contaminated groundwater before leaving the FMC OU. The extracted water will be treated to national drinking water standards for all COCs. The treated water will either be placed in a constructed infiltration basin within the FMC OU where treated water will infiltrate into groundwater and evaporate or extracted water will be sent to the Pocatello water treatment plant for treatment. The groundwater pump and treat system will be designed to capture all contaminated groundwater prior to that groundwater exiting the FMC OU and thus eliminate risks posed by ingesting groundwater or surface water between the FMC OU boundary and the Portneuf River.

Phosphorus in groundwater is a risk driver for ecological receptors. Phosphorus in groundwater can migrate to surface water (Portneuf River). Phosphorus poses a risk to aquatic organisms in surface water by promoting the growth of plant life within the Portneuf River, which consumes oxygen when decomposed by bacteria. Reduced levels of dissolved oxygen in the Portneuf River can impact the health of fish and other wildlife. Phosphorus in groundwater at the FMC OU originates from elemental phosphorus and other phosphorus constituents within subsurface soils coming in contact with infiltrated precipitation. To reduce the transport of phosphorus to the Portneuf River and subsequent exposures of fish and aquatic wildlife, the remedy consists of two remedial components:

Contaminated groundwater will be captured by extraction wells prior to exiting the FMC OU boundary thereby eliminating the ecological risks to aquatic receptors in the Portneuf River. Phosphorus in extracted water will be treated to protective levels. The treated water will either be placed in a constructed infiltration basin within the FMC where the treated water will infiltrate into groundwater, or alternatively extracted water will be sent to the Pocatello water

treatment plant for treatment and discharge in compliance with that facility's National Pollution Elimination System (NPDES) permit.

Evapotranspiration caps will be constructed over soils which contain elemental phosphorus and other phosphorus constituents, in order to reduce infiltration of precipitation, which could otherwise leach elemental phosphorus and phosphorus constituents into groundwater. Precipitation can also infiltrate soils contaminated with metals, which can leach into groundwater. Evapotranspiration caps will reduce the concentration of phosphorus and metals in groundwater.

Evapotranspiration caps will also be constructed over soils which contain metal COCs, in order to reduce infiltration of precipitation, which could otherwise leach soil metals into groundwater. Evapotranspiration caps will reduce the concentrations of metals in groundwater.

In summary, this capping and groundwater extraction and treatment remedy addresses human health risks posed by radionuclides, radon, metals (specifically arsenic) and elemental phosphorus and also addresses ecological risks posed by phosphorus.

13.1.12 HEALTH AND SAFETY OF HANDLING ELEMENTAL PHOSPHORUS

Comment Summary: EPA received 62 comments stating FMC and members of the surrounding community have extensive experience safely handling elemental phosphorus. They questioned why EPA considers the excavation of elemental phosphorus too dangerous to perform, given the extensive experience of individual former FMC employees, and FMC as a corporation. Several comments suggested employing KASE/Warbonnet to perform excavation of elemental phosphorus due to their extensive experience handling elemental phosphorus wastes. 5 comments were received agreeing with EPA regarding the risks posed by handling elemental phosphorous.

EPA Response: Although FMC has experience excavating and managing small quantities of elemental phosphorus-contaminated soils and wastes within its former facility, FMC never attempted to excavate large quantities of elemental phosphorus-contaminated soils, or soil with high concentrations of elemental phosphorus. While operating, FMC developed techniques to excavate comparatively small quantities of elemental phosphorus-contaminated soil and waste, which were drummed and transported for off-site treatment and disposal, placed in one of the

operating ponds or sumps, or transported and buried at an alternate on-site location. FMC also developed techniques for controlled aeration of elemental phosphorus-contaminated soils and wastes. The smoke and gases that were generated and the fires that at times resulted from FMC's handling of these comparatively small quantities, and from FMC operations more generally, posed potentially significant risks to human health. EPA is neither willing nor able to allow handling even such small quantities of elemental phosphorus-contaminated soils in a manner similar to the way FMC handled them, much less attempt the vastly larger quantities buried at the FMC OU, in these ways. To do so, particularly in significantly larger quantities, would expose cleanup workers, adjacent facility employees, and nearby residents to what EPA considers unacceptable risks. No one nationally or internationally, including FMC, has ever attempted to excavate large quantities of elemental phosphorus-contaminated soils.

The *Identification and Evaluation of P4 Treatment Technologies* report (MWH, 2009c), examines the additional risks and mitigation procedures which would be required if large volumes of elemental phosphorus-contaminated soils were excavated. This report discusses the known significant challenges and safety issues associated with excavating large volumes of soil contaminated with elemental phosphorus, above and beyond what FMC had experience with. Section 2.2.1.1 of this report discusses how conventional excavation might be used and the extensive adjustments that would have to be put into place to prevent fire, smoke, and gas generation. These potential adjustments are based on a combination of knowledge of the physical properties of the materials and previous experience managing smaller volumes.

As far as EPA has been able to determine, only very limited excavation of soil containing elemental phosphorus has occurred at the FMC OU or at any other elemental phosphorus production site both nationally and internationally. As reported in the *RI Update Memo* (BEI, 2004), Appendix A, Tables A-1 and A-12, there were two instances of limited removal of soil containing elemental phosphorus during excavation related to construction activities at the former FMC plant.

In the first instance in 2000, during slag ladling foundation upgrades, elemental phosphorus was encountered in soil adjacent to the Furnace #3 elemental phosphorus product sump. Operators wearing flame-retardant suits sprayed water onto the soil and shoveled the elemental phosphorus

and soil into open head drums containing water. Approximately a dozen drums were filled with elemental phosphorus, soil and water and were shipped off-site for incineration.

In the second instance, smoking soil and elemental phosphorus were encountered during excavation to lay some utility lines at the LDR facility in 2000. The backhoe operator placed dirt back in the excavated area to smother the fire/smoke and work was stopped. Operators wearing flame-retardant suits sprayed water to wet the soil, shoveled up the mixture, and placed the soil into open head drums containing water. The work was in a very limited area and generated approximately a dozen drums of the soil/water/elemental phosphorus mix. The drums were shipped off-site for incineration. In both cases, the drums were shipped pursuant to a Department of Transportation (DOT) exemption allowing transport in open head drums.

EPA evaluated an excavation cleanup alternative and determined that a large scale excavation would pose significant risks to workers and nearby residents. As mentioned earlier, for safety reasons elemental phosphorus is usually handled under water. Therefore, any hydraulic or wet-dredging excavation would require saturating a significant area with large quantities of water to prevent combustion. Adding significant quantities of water to contaminated soils will produce enough hydraulic head to drive additional contaminants down to groundwater. Once the contaminants are in groundwater, they mix with regional groundwater before migrating toward to the Portneuf River. The significant volume of additional contaminated water generated would have to be contained and extracted. Designing a groundwater containment system to capture all of the additional groundwater contamination that extracting a significant quantity of buried elemental phosphorus-containing waste underwater would generate would be difficult. As a result, it is likely that additional contaminants would be released into the environment via the groundwater pathway.

Although FMC used inert gas blankets during operations (within controlled and engineered environments) to prevent liquid elemental phosphorus from coming in contact with air, no current technologies have shown an inert gas blanket could be used to excavate large quantities of elemental phosphorus-contaminated soils. In addition to uncertainties associated with the implementability of constructing an inert gas blanket enclosure, there are significant worker-related risks associated with storing and using large quantities of asphyxiant gases, such as nitrogen or argon.

In comments on the Proposed Plan, KASE/Warbonnet noted that it performed decommissioning and decontamination at the FMC facility, and that based on its extensive knowledge and experience handling elemental phosphorus wastes, it would be reluctant to perform excavation of elemental phosphorus contaminated soils within the FMC OU. The following is an excerpt from the KASE/Warbonnet comments on the FMC OU Proposed Plan: "So, in conclusion, based on KASE/Warbonnet's extensive experience with phosphorus, any attempts of excavating the area underneath and around the former furnace building is fraught with peril and would be very dangerous. Any attempts would put workers at significant risk and would create significant environmental air emissions. The highly experienced work force of KASE/Warbonnet would be reluctant to put themselves at risk to attempt such work. KASE/Warbonnet supports EPA's proposed plan to contain the phosphorus by capping this area of the plant site. We believe that the plan protects the environment and will not unnecessarily expose personnel to the inherently unsafe working conditions."

13.1.13 RISKS POSED BY SUBSURFACE ELEMENTAL PHOSPHORUS

Comment Summary: EPA received 10 comments expressing concern over the risks posed to human health and the environment by subsurface elemental phosphorus. Some comments questioned why elemental phosphorus within the storm drain pipes are proposed to be excavated while elemental phosphorus in subsurface soils and within the slag pile are proposed to be capped. 1 individual commented that there are no risks associated with elemental phosphorus in the subsurface.

EPA Response: Subsurface elemental phosphorus does not pose a risk to human health if left undisturbed. Subsurface elemental phosphorus is present beneath the furnace building, within the CERCLA ponds, within storm drain pipes, and potentially in railcars buried within the slag pile.

Elemental phosphorus is pyrophoric and thus burns spontaneously upon contact with air. Burning elemental phosphorus generates a dense white smoke called phosphorus pentoxide which is a powerful irritant which can react with water in the atmosphere or within body tissues (eyes, nose, throat, and lungs) to form corrosive phosphoric acid. Because of its pyrophoric properties, excavation of elemental phosphorus creates the immediate hazard of auto-ignition and generation of highly irritating and corrosive gases. The largely uncontrolled conditions during

excavation would expose workers to risks from fire, dermal, and respiratory hazards. Respiratory hazards could also affect downwind residents, adjacent facility employees, and travelers on Highways 30 and 86.

The remedial action targets removal of a limited amount of elemental phosphorus that is contained in storm water piping and can be managed utilizing techniques similar to those used in limited excavations in the past at FMC. The removal of elemental phosphorus from the underground pipes can be done with significantly less risk to workers than removal of all FMC OU elemental phosphorus-containing soils generally, because the material is contained in pipes, the specific location of the subsurface elemental phosphorus is known, and it is in relatively small quantities. Even for this limited excavation however, elaborate preparation and safety measures would be necessary to protect site workers and the public.

The *SFS Report* documented that there are railcars buried approximately 80 to 100 feet below ground surface in the slag pile although the exact number and contents are not known. As part of the risk assessment and feasibility study process, EPA reviewed all pertinent information and concluded that the slag pile could be safely and effectively managed on site utilizing a soil cap and associated monitoring to detect any future migration of contaminants. EPA is not aware of any unacceptable risks that would be posed by managing these wastes in place as outlined in the Proposed Plan and selected in the IRODA.

13.1.14 LONG-TERM REACTIVITY OF SUBSURFACE ELEMENTAL PHOSPHORUS

Comment Summary: EPA received 4 comments expressing concern that elemental phosphorus will remain reactive for 10,000 years. Concerns were expressed that wastes left in place will contaminate the surrounding community if EPA is no longer acting as a regulatory authority.

EPA Response: Post-remedy implementation management is a necessary component of any remedial action and FMC will be required to implement an EPA-approved operations, monitoring, and maintenance plan. This plan will require regular monitoring of all components of the remedy and will include plans for maintenance and repairs as needed. EPA will provide oversight of ongoing regular monitoring and will review overall protectiveness of the remedy during 5-year reviews as required by CERCLA. Further, any Consent Decree (CD) or Unilateral Order (UAO) implementing the IRODA would also require FMC to provide financial assurance

(such as a performance bond, letter of credit, trust account, etc.) to ensure the obligations outlined in the CD or UAO are fulfilled.

Subsurface elemental phosphorus does not pose a risk to human health if left undisturbed beneath properly maintained caps, and ET caps and the other soil covers selected for the FMC OU in the IRODA can be maintained indefinitely at relatively modest cost. Placing ET caps over the areas of known subsurface elemental phosphorus within the FMC OU is completely consistent with how EPA has addressed other elemental phosphorus-contaminated sites across the country. Further, engineered containment of wastes is a very common technique employed at many Superfund sites and solid and hazardous waste landfills throughout the country. When designed, implemented, and monitored properly, containment or closures of this kind are considered protective of human health and the environment.

However, even if subsurface soils were treated to eliminate elemental phosphorus, due to other contaminants in the soil, much of the FMC OU would continue to require long-term management such as cap maintenance, institutional controls, monitoring, and a groundwater extraction and treatment system. Eliminating risks posed by elemental phosphorus does not eliminate risks posed by other COCs in the subsurface or surface soils, such as metals or radionuclides.

13.1.15 FATE AND TRANSPORT OF ELEMENTAL PHOSPHORUS IN CONTACT WITH GROUNDWATER

Comment Summary: EPA received 3 comments expressing concern that elemental phosphorus in contact with groundwater would continue to move downgradient toward the Portneuf River.

EPA Response: During FMC operations, the ground and groundwater were heated above 44^{o}C, the melting point of the elemental phosphorus, causing liquid elemental phosphorus to move down through the soil column. Since operations have ceased, the ground and groundwater have cooled, and elemental phosphorus has solidified. Elemental phosphorus that is in contact with groundwater reacts to form phosphate very rapidly. Elemental phosphorus has not been detected in downgradient wells beyond 50 feet of where it is known to be in contact with groundwater. Long-term groundwater monitoring will include elemental phosphorus, as well as phosphorus, as COCs.

Solid elemental phosphorus is a soft waxy substance with low solubility in water, less than 3 mg/L. The maximum detected level of elemental phosphorus in groundwater at the FMC OU is 0.258 mg/L. These results are consistent with the current conceptual site model.

Elemental phosphorus dissolved within groundwater would eventually turn into a very small amount of phosphoric acid and finally orthophosphate, indistinguishable from phosphorus already found in groundwater all of which will be addressed with the groundwater extraction and treatment system. The groundwater extraction and treatment system will address phosphorus contamination originating from all parts of the OU, including the former CERCLA ponds and groundwater in contact with elemental phosphorus under the furnace building.

13.1.16 LONG-TERM EFFECTIVENESS OF CAPPING VERSUS SHORT-TERM EFFECTIVENESS OF EXCAVATION

Comment Summary: EPA received 60 comments stating that the long-term risks of capping subsurface elemental phosphorus outweigh the short-term risks of excavating subsurface elemental phosphorus.

EPA Response: Through the RI/FS process, EPA has determined that risks associated with disturbing subsurface elemental phosphorus outweigh risks associated with capping subsurface elemental phosphorus. EPA compared the **long-** and **short-term effectiveness** of capping with the long- and short-term effectiveness of excavating subsurface elemental phosphorus as part of the remedy selection process. The comparison of these criteria for the different soil alternatives can be found in Sections 8.1.3 and 8.1.5 and in Table 4 of the *FMC OU Proposed Plan* while additional details are provided in the *SFS Report* (MWH, 2010b).

Pursuant to CERCLA, criteria used to evaluate **long-term effectiveness** included comparing the reliability of the overall remedy, adequacy of controls, and the magnitude of residual risk. Capping subsurface elemental phosphorus met the long-term effectiveness criteria and was ranked “moderate to high” because:

- Residual risk levels after capping are very low;
- Elemental phosphorus in subsurface soil is solid, largely insoluble, and immobile;
- Capping creates a barrier to exposure and reduces surface water infiltration to increase stability and containment;

- Caps would be engineered for generally comparable long-term effectiveness and performance as well as storm water drainage, therefore no significant cap deterioration is expected to occur; and
- Long-term operation and maintenance includes monitoring and repair as necessary to maintain long-term cap integrity, and can readily be provided at modest cost.

Excavating subsurface elemental phosphorus met the long-term effectiveness criteria and was ranked "high" because residual risk levels after excavation are essentially eliminated.

Criteria used to evaluate **short-term effectiveness** include comparing time to achieve overall protection of human health and the environment and the protection of the community, workers, and the environment during remedial actions. Capping subsurface elemental phosphorus met the short-term effectiveness criteria and was ranked "high" because:

- Capping takes substantially less time to implement than excavation and treatment;
- Capping is anticipated to take 2-3 years to achieve; and
- The longer any treatment alternative takes to implement, the longer increasing risks of casualty will persist.

Excavating subsurface elemental phosphorus did not meet the short-term effectiveness criteria and was ranked as "low" because:

- Excavation and treatment takes substantially more time to implement than capping. Excavation and treatment is estimated to require 20-40 years to implement compared to capping which is estimated to require 3-5 years to implement; and
- During excavation and treatment of soils there would be significant risks to both onsite workers, adjacent facility employees, and the public.

In summary, EPA determined the short-term risks associated with excavating subsurface elemental phosphorus outweigh the long-term risks associated with capping subsurface elemental phosphorus.

13.1.17 BURIED MATERIALS WITHIN THE SLAG PILE

Comment Summary: EPA received 55 comments expressing concern that the contents of buried railcars and drums within the slag pile remain unknown. Some comments suggested excavation of the railcars and drums; some comments suggested sampling railcar contents.

EPA Response: EPA does not have data indicating any burial of drums within the slag pile.

EPA acknowledges that approximately 30 railcars are buried 80 to 100 feet below the surface of the slag pile. The contents, condition, and number of buried railcars are unknown. However, based on information gathered during the RI/FS process, it is highly likely that the railcars contain one or more types of waste well documented at the facility. As reported in the *SFS Report* (MWH, 2010b) Appendix B, it is expected that the railcars may contain about 10 to 25% of their total capacity as elemental phosphorus sludge.

It is not known if the railcars were filled with water or nitrogen prior to burial within the slag pile. The use of water would increase the likelihood that phosphoric acid would be formed, resulting in an increased rate of internal corrosion. If the railcars have deteriorated through corrosion, any attempt at removing the entire railcar in one piece is likely to result in exposure of the elemental phosphorus sludge to air and an uncontrolled elemental phosphorus fire.

The elemental phosphorus sludge in the railcars would have been, and has remained, at subsurface soil temperatures since burial. These temperatures are below the melting point of elemental phosphorus (44^{o}C, 111^{o}F). If elemental phosphorus has leaked into soils at subsurface soil temperatures, it would be assumed to have migrated no more than a foot from the point of the release and may have oxidized.

Downgradient groundwater monitoring does not indicate there is phosphate-containing groundwater contamination from the railcars or potentially buried drums. Groundwater monitoring will continue to determine if the railcar or potentially buried drum contents are leaking and causing contamination to migrate downgradient.

Given the depth of burial beneath 80-100 feet of slag, the railcars and potentially buried drums do not pose a human health or ecological risk. Capping the slag pile, augmented by institutional controls prohibiting intrusive activities within the slag pile, would protect against potential

human health or ecological risks and is consistent with the remedy for other areas within the FMC OU that are known to contain the similar wastes.

13.1.18 PHOSPHINE GAS GENERATION

Comment Summary: 40 comments were received expressing concern over the generation of phosphine gas within areas where subsurface elemental phosphorus is present. Inquiries were made regarding the generation rate of phosphine within the soil, characterization and location of phosphine within the soil, and migration of phosphine within the soil.

EPA Response: Studies from the FMC OU indicate that phosphine is not present in ambient air above levels that cause a health concern. In 2010, EPA directed FMC to investigate the RCRA-regulated ponds and CERCLA areas containing elemental phosphorus processing waste to evaluate the concentrations of phosphine and other gases in ambient air and in the soil column. This investigation was conducted during the summer of 2010 and the findings were presented in the *Gas Assessment Report* (MWH, 2011). Soil gas samples were collected within areas of the former FMC operations area that, as a result of historical elemental phosphorus releases, have the potential to generate phosphine gas. The sampling encompassed both the FMC OU areas and areas where closed RCRA-regulated waste management units are located that are not part of the FMC OU. In general, soil gas samples were collected at locations 18 – 24 inches below ground surface.

The phosphine surface flux (or generation) rates were measured in areas where significant quantities of elemental phosphorus in the subsurface were present, such as the furnace building, the slag pit, and the former railroad swale. The gas assessment showed the area with the most generation was under the furnace building with a generation rate of 4.01×10^{-7} mg/cm^2 per hour (or 1.314×10^{-8} ounces/ft^2 per hour). These results revealed that although low levels of phosphine gas, and to a lesser extent other gases, are generated in the subsurface as a result of the presence of elemental phosphorus within the FMC OU, levels in soil gas were all below 1 ppm. The permissible exposure limit (PEL) for phosphine (PH_3) is 1 ppm for 15 minutes or 0.3 ppm averaged over eight hours. Of the 420 total recorded soil gas readings, only 37 (9%) were non-zero (>0.00 ppm) and individual readings ranged from 0.02 to 0.15 ppm PH_3. All phosphine gas measurements within soil gas were below the permissible exposure limit. No phosphine or other

gases were shown to have migrated to the ambient air at measureable levels where a complete exposure pathway could occur.

The overall conclusion of the *Gas Assessment Report* (MWH, 2011) is that phosphine generation does not pose a risk to human health or the environment in the FMC OU. Regardless of those findings, to ensure human health and environmental protection, long-term phosphine monitoring is part of the CERCLA selected remedy.

13.1.19 PHOSPHINE GAS MONITORING

Comment Summary: EPA received 4 comments requesting monthly monitoring of phosphine gas rather than bi-annual monitoring of phosphine gas, as selected in the IRODA.

EPA Response: To ensure continued protectiveness, as part of this remedy EPA is requiring a robust phosphine and other gas monitoring program that will monitor both the soil column and ambient air. A combination of soil gas, flux measurements, and ambient air samples will be collected on a bi-annual basis. Should the sampling results show that gas is being generated at a rate or level that may pose a threat to human health or the environment, EPA will require additional action at the FMC OU.

Based on the *Gas Assessment Report* (MWH, 2011) discussed in response to Comment 13.1.18, EPA is confident that bi-annual monitoring of phosphine gas will be sufficient to monitor risk. The site-wide gas assessment showed there were no detections of phosphine gas in the ambient air in the FMC OU. Phosphine gas levels measured in the subsurface were below any health based levels of concern and have not been detected in ambient air within the FMC OU.

13.1.20 OTHER GASES OF CONCERN

Comment Summary: EPA received 2 comments expressing concern that other gases, such as hydrogen cyanide, should be monitored in addition to phosphine gas.

EPA Response: As stated in the response to Comments 13.1.18 and 13.1.19, other gases will be monitored, including hydrogen sulfide, hydrogen cyanide and hydrofluoric acid, which were measured during the 2010 site-wide gas assessment, though none were present within the FMC OU at levels that pose a threat to human health or the environment. All of the hydrogen cyanide measurements were non-detects, and hydrofluoric acid was detected once below risk-based

levels. There were consistent detections for hydrogen sulfide where measured, however the concentrations were also all below risk-based levels. The precise detailed parameters of the gas monitoring program for phosphine and other gases of concern required by the IRODA will be finalized as part of the Remedial Design.

13.1.21 CERCLA PONDS VERSUS RCRA PONDS

Comment Summary: EPA received 9 comments inquiring whether EPA was selecting capping of elemental phosphorus containing wastes in the FMC OU because the 1999 RCRA Consent Decree required capping the RCRA-regulated ponds. Some comments stated capping would not be protective in the FMC OU because of risks associated with the RCRA ponds.

EPA Response: Placing ET caps over the areas of known subsurface elemental phosphorus within the FMC OU is completely consistent with how EPA has addressed other elemental phosphorus-contaminated sites across the country. Further, engineered containment of wastes is a very common technique employed at many Superfund sites and solid and hazardous waste landfills throughout the country. When designed, implemented, and monitored properly, containment or closures of this kind are fully protective of human health and the environment.

In 1980, when RCRA hazardous waste permitting and associated waste management regulations were promulgated, most elemental phosphorus production and associated waste generation, including storing these wastes in ponds or surface impoundments, was exempted from RCRA permitting and waste management standards by what is commonly referred to as the Bevill Amendment or "Bevill exemption." In 1990, the "Bevill exemption" for wastes from elemental phosphorus production was revised making elemental phosphorus mineral processing subject to RCRA permitting and waste management standards, but not retroactively (just as RCRA management standards were not retroactive to wastes disposed of before 1980). By 1990, the elemental phosphorus containing wastes addressed in the IRODA for the FMC OU had already been disposed of. They would therefore not have been subject to RCRA waste management standards as part of any RCRA permitting.

In 1999, a Consent Decree entered in Federal District Court required FMC to cap waste ponds subject to RCRA regulation. These ponds have commonly been called the "RCRA ponds," and are what EPA has presumed these comments referred to. The purpose of capping the RCRA

ponds was to contain wastes that contained elemental phosphorus, metals, lime, and acid within a closed system. Wastes in the RCRA ponds are significantly different than wastes within the older CERCLA FMC OU former ponds. This is primarily because the FMC OU ponds were substantially smaller in size, the ponds were not lined and thus did not retain as much moisture, and these wastes were also much older. Primarily for these reasons, there is no evidence of phosphine gas generation above levels of concern in these smaller, older FMC OU former ponds. There is also no evidence that phosphine gas will spread from the "RCRA ponds" to the FMC OU former ponds. The RCRA ponds are not part of the FMC OU and this Interim ROD Amendment for the FMC OU is unrelated to the RCRA Consent Decree.

13.1.22 LAND DISPOSAL RESTRICTION TREATMENT SYSTEM

Comment Summary: EPA received 2 comments asking whether EPA would have required the excavation and treatment of the elemental phosphorus-containing soils in the FMC OU if the Land Disposal Restriction (LDR) treatment plant FMC built (but never used) pursuant to the RCRA Consent Decree to treat elemental phosphorus-containing wastes generated after the Decree was entered, were operational.

EPA Response: The same hazards associated with the excavation and handling of elemental phosphorus in the subsurface would be present if the LDR Treatment system still existed and was operational. Further, the LDR Treatment system was designed and intended to treat relatively uniformly generated wastes within Pond 18 and waste from ongoing facility operations. The projected effectiveness of the LDR Treatment system technology depended on the homogeneity and concentration of the feed which was controlled during FMC operations. The procedures for feed stock preparation from Pond 18 were not finalized at the time the treatment plant was decommissioned and uncertainty about the ability to control and manage the feedstock remained unresolved.

EPA evaluated changes that would have been required to retrofit such a facility to treat excavated elemental phosphorus-contaminated soils throughout the FMC OU. These changes were included in the cost estimates developed as part of the SFS and reported in the *Cost Estimate Addendum* (BAH, 2011). Due primarily to risks to site workers and the community from excavation and waste handling, along with very challenging technical implementabilty uncertainties, as well as the very significant costs (see Comment 13.1.12), a treatment remedy

(regardless of specific treatment system) was not selected. If the LDR Treatment system existed and had been successful, its operating history and costs, along with its potential adaptability to the wastes at the FMC OU would have been considered when developing the SFS. See Comment 13.1.12 for more information about the hazards of excavating and treating elemental phosphorus-contaminated soils.

13.1.23 NOVEL REMEDIAL APPROACHES

Comment Summary: EPA received 12 comments expressing a desire for other remedial and novel technologies to be considered as viable excavation and treatment plans. Comments specifically requested EPA review the "Archuleta Plan."

EPA Response: EPA has reviewed all known potentially viable technologies for excavation and treatment of the elemental phosphorus contaminated wastes at the FMC OU. EPA reviewed the "Archuleta Plan" that consists of two distinct strategies: one to excavate elemental phosphorus contaminated waste under an inert gas; and a second to grind slag and use it to manufacture bricks. The excavation strategy proposed in the plan consists of building a large domed structure over the area to be excavated. The air within the dome would be purged with nitrogen and argon to remove the oxygen and thus prevent ignition of elemental phosphorus. Excavation would be completed with unmanned robotic equipment.

Beyond being considerably more suitable to smaller quantities of wastes to be extracted from a smaller geographical area, the excavation strategy does not address how the material would be treated after it has been extracted, or how difficulties with operating excavation equipment in an oxygen-depleted environment would be overcome. Further, the treatment plant would either need to be built in an oxygen deficient environment or the transfer of the waste from the dome to the treatment facility, and subsequent treatment of the waste would be subject to the same short term risks to site workers that have already been identified. It also introduces significant concerns regarding the health and safety of site workers working around large quantities of inert, confined gases. Although inert gas blankets were used during FMC operations to inhibit the oxidation of liquid elemental phosphorus within a controlled and engineered environment, there are no current technologies that have shown an inert gas blanket could be used to excavate large quantities of elemental phosphorus-contaminated soils. In addition to uncertainties associated with the implementability of constructing an inert gas blanket enclosure, there are significant

worker-related risks associated with storing and using large quantities of asphyxiant gases. Despite these concerns, EPA has committed to working with the Tribes to commission another independent review of potential soil excavation and/or treatment technologies (in-situ or ex-situ), which could include something similar to the "Archuleta Plan," to ensure no promising technology was missed during the Supplemental Feasibility Study process. The details of this review are currently under discussion between EPA and the Tribes.

The second strategy proposed by Mr. Archuleta for slag at the FMC OU consists of grinding the slag and mixing it with cement to make bricks which would be stored on site. EPA agrees that slag can be safely stored on site and in fact, this is a fundamental component of the selected remedy. However, taking slag in its existing form and making it into bricks would not reduce the risks the slag presents, or otherwise increase the level of protectiveness of the slag portion of the remedy. It would also result in significantly higher costs for no apparent benefit. Should a safe use for the slag be identified in the future, the soil cover could be removed to allow for excavation of the slag for such use. FMC is a party to RCRA Consent Orders issued by EPA in 1992 and 1996 (entitled In the Matter of Elemental Phosphorus Slag) in which FMC and Monsanto, which operates the only remaining elemental phosphorus manufacturing facility in the United States in Soda Springs, Idaho, agreed not to sell or otherwise make their slag available as construction material due to risks to human health from its gamma radiation.

13.1.24 IDAHO NATIONAL LABORATORY

Comment Summary: EPA received 15 comments suggesting technologies used to address radioactive and pyrophoric material at Idaho National Laboratory (INL) should be used to excavate subsurface elemental phosphorus at the FMC OU.

EPA Response: EPA has reviewed all known potentially viable technologies for excavation and treatment of the elemental phosphorus-contaminated wastes and radioactive wastes at the FMC OU, which are extensively documented in the *SFS Report* (MWH, 2010b). Each Superfund site is unique and remedial technologies cannot be implemented universally across all Superfund sites. Elemental phosphorus and associated wastes are unique to elemental phosphorus production facilities.

Contamination at the INL site is different in nature than elemental phosphorus-contaminated soils at FMC. Wastes at INL are heavily contaminated with radionuclides, primarily cesium-137, cobalt-60, tritium, strontium-90, iodine-129, and technetium-99. These radioactive wastes at INL require excavation equipment and personal protective equipment that protect workers from radiation. The pyrophoric elemental phosphorus-contaminated wastes at FMC would require entirely different kinds of excavation techniques and personal protective measures than those used at INL because the hazards posed to workers by direct radiation exposure are not analogous to the fire and explosion hazards posed to workers by excavating subsurface elemental phosphorus (see Comment 13.1.12). In general, technologies used to safely excavate radionuclide-contaminated wastes generated at INL are not applicable or viable for elemental phosphorus-contaminated wastes present at the FMC OU.

13.1.25 NATURAL DISASTER CONTINGENCIES

Comment Summary: EPA received 7 comments expressing concern that the Preferred Alternative does not address natural disasters, particularly seismic activity.

EPA Response: The detailed Remedial Design will address the technical specifications required for implementation of the remedy. The Remedial Design phase typically begins after the Interim ROD Amendment is issued and either a Consent Decree with FMC for remedy implementation is entered in Federal District Court, or a Unilateral Administrative Order is issued by EPA. Similar to building and other construction designs, such as for roads, bridges and other infrastructure, Remedial Designs typically address natural disasters that might reasonably be expected in a particular area such as flooding and seismic activity. EPA will provide oversight and will review and approve all Remedial Design documents. EPA expects the Tribes to be fully involved in the review and comment on all Remedial Design documents.

If a disaster event (natural or man-made) occurs that was not anticipated during the design process, the FMC OU would be evaluated to ensure the remedy is still protective of human health and the environment. If maintenance must be performed to ensure long-term protectiveness, EPA would oversee, or conduct if necessary, those actions. This process is similar to what is done for all major infrastructures throughout the United States (e.g., highways, bridges, dams, etc.) and Superfund cleanup actions around the country.

13.1.26 CLEAN CLOSURE OF FMC OU

Comment Summary: EPA received 23 comments requesting the clean closure of the FMC site including the complete removal of all FMC waste and by-products. One comment noted that the environmental benefit from a clean closure scenario is not justified due to the expense and worker risk that would be presented by a clean closure effort.

EPA Response: EPA evaluated a "clean closure" alternative at the request of the Shoshone-Bannock Tribes. A summary of the evaluation is presented in the Proposed Plan (Alternative 8). EPA selected a containment remedy after reviewing and carefully evaluating all eight remedial alternatives. EPA cannot select a remedy which it does not believe is supported under the CERCLA remedy selection criteria, as those criteria have been interpreted by the agency and the courts. After all factors were considered, including the significant danger to workers and the community, including adjacent facility workers, in trying to remove buried waste that is ignitable upon exposure to ambient air, its cost, and the extended duration associated with implementing a clean closure strategy, EPA determined that the selected interim containment remedy is the best available option consistent with CERCLA remedy selection criteria. The need to promptly prevent infiltration of contaminants to groundwater and subsequent migration of contaminants to surface water is critical to protecting human health and the environment. This conclusion was reached after careful analyses by EPA staff in consultation with experts inside and outside the EPA, including the EPA's National Remedy Review Board and is supported by the Administrative Record for the FMC OU.

13.1.27 GAMMA RADIATION AND RADON-222

Comment Summary: EPA received 3 comments expressing that gamma radiation should be the primary risk driver and that airborne radiological emissions should be considered in the remedy. Concerns were expressed that radon-222, a daughter product of radium-226, could become airborne contaminating the surrounding community.

EPA Response: The contaminant of concern (COC) which poses the greatest potential health risks in soil is radium-226 (as long as elemental phosphorus is not exposed and does not migrate in any significant quantity). Cleanup levels for radionuclides like radium-226 are based primarily on radiological preliminary remediation goals, including federal regulatory requirements which specify media concentrations, formulae, or risk levels to be met unless they are more stringent

than natural background levels. The Uranium Mill Tailing Radiation Control Act (UMTRCA) standard for radon flux is among these requirements.

The main objective of the selected remedial action with respect to radionuclides is to mitigate risks posed to human health or the environment to levels all Superfund site remedies are required to achieve. The presence of radium-226 could pose a risk to air quality by emitting radon-222 gas and alpha, beta, and gamma radiation. Persons traversing the FMC OU could inhale or ingest contamination as slag dust.

The site-specific background mean for radium-226 is 1 pCi/g. The risk-based value, representing a 2 in 10,000 excess cancer risk, is 1.5pCi/g. Therefore, EPA proposes a cleanup level of 2.5 pCi/g (which is 1.5 pCi/g above the radium-226 background concentration of 1.0 pCi/g) and corresponds to an acceptable risk of 2 $x10^{-4}$ for the residential scenario and 6 $x10^{-5}$ for the industrial scenario. This site-specific cleanup level applies to all radiation emitting areas of concern at the FMC OU. It has been selected because it is distinguishable from background and therefore measurable in the field, and is within the acceptable EPA excess cancer risk range.

The pathways for human exposure to radiation include windblown fugitive slag dust and direct exposures. Particulates from slag dust will be covered by gamma caps which will prevent or substantially inhibit windblown fugitive dust from coming in contact with future workers or surrounding residents. These caps, and the caps over elemental phosphorus contaminated soils, will also prevent direct exposure of radiation to workers or people traversing the FMC OU.

Radon-222 flux emissions were measured and are reported in the *SRI Report* (MWH, 2009a). The radon-222 flux measurements within the slag pile, the largest contributor of radon at the FMC OU, indicated that radon flux exposures were far below the acceptable levels defined by the UMTRCA. Since the radon-222 contribution from the slag pile is below acceptable levels, a topsoil cap that will block gamma radiation is expected to be protective of any radon that could otherwise be emitted to ambient air. Further, radon-222 has a half-life of 3.8 days and it eventually decays into lead-206 (a stable solid). Radon-222 is heavier than air and is not likely to be emitted through the topsoil cover. As a result, a gamma cap is protective.

13.1.28 HEALTH OF DOWNSTREAM FISH AND WILDLIFE

Comment Summary: EPA received 15 comments expressing concern over the health of downstream fish and wildlife. Specifically there were concerns regarding fish and game consumption and the use of the Portneuf River and the American Falls Reservoir for recreational purposes. Some comments stated there has been a reduction in migratory birds at the American Fall Reservoir.

EPA Response:

Fish-consumption advisories issued by the state of Idaho Department of Health are currently in place regarding fish from the Portneuf River due to mercury bioaccumulation in the fish. A statewide advisory has been issued for bass due to mercury contamination as follows:

- Women who are pregnant, planning to become pregnant, nursing and children under age 15 should not eat more than 2 meals per month of bass;
- The general population (women not of child bearing age, those older than age 15) should not eat more than 8 meals per month of bass; and
- No one should eat any other fish during a month they eat these amounts of bass caught in Idaho.

For more information, visit the Idaho at http://www.healthandwelfare.idaho.gov.

After evaluating data related to mercury and the Portneuf River, it does not appear that mercury present in the fish, water, sediment, and soil are from the EMF Superfund Site. Mercury detected in ore used by FMC and Simplot is near background levels and as such, does not contribute significantly over background to mercury in soil or sediment associated with the Portneuf River and American Falls Reservoir.

To date, no known studies have been performed to specifically assess the quantity of heavy metals in deer and elk in the vicinity of Pocatello. Therefore, it is unknown if ingesting meat from deer and elk pose a risk to human health. However, EPA, IDEQ, the Tribes, Simplot, and FMC are currently re-evaluating potential risks posed to wildlife and the environment in the area most likely to support deer and elk populations as part of the EMF Off-Plant OU.

The American Falls Reservoir is impacted by phosphorus contamination from the EMF Superfund Site. Phosphorus is primarily an environmental concern because it promotes the growth of aquatic plant life like algae within a water body, such as the Portneuf River or American Falls Reservoir. Decaying aquatic plants are consumed by bacteria which consume dissolved oxygen in the water body. Dissolved oxygen concentrations within the water body can drop too low for fish to breathe which can lead to reduced fish populations. The Human Health Risk Assessment performed in 1996 for the EMF Site demonstrated that no significant risk to human health would be incurred by swimming in the American Falls Reservoir. While the full extent of ecological effects in the American Falls Reservoir was not documented, the groundwater extraction and treatment system will prevent all FMC OU-related contamination from reaching the Portneuf River and the American Falls Reservoir.

Anyone swimming in open water in Idaho should regularly check for the latest information and updates on waterborne advisories through the Idaho Department of Health at http://healthandwelfare.idaho.gov/health/DiseasesConditions/WaterborneIllness/tabid/113/Default.aspx

13.1.29 PUBLIC HEALTH CONCERNS

Comment Summary: EPA received 23 comments expressing concerns that perceived declining health effects in the surrounding community are related to FMC and Simplot facility operations. Some comments requested epidemiological studies be performed on the surrounding community and former employees of the FMC plant.

EPA Response: The purpose of CERCLA remedial action is to address current and future risks posed by sites to protect human health and the environment. Health effects from past exposures are not assessed by EPA unless they may reasonably be expected to provide information to be used in remedy selection to address current and future risks at a site.

Implementation of the selected remedial action should eliminate all future exposures at or from the FMC OU above established EPA risk ranges and regulatory requirements for Superfund cleanups, which is the extent of EPA authority. It is generally challenging for epidemiological studies to relate specific exposures at Superfund sites to community health outcomes because there are many risk factors that contribute to cancer and other diseases in our society. As part of

the 1999 RCRA FMC Consent Decree, FMC agreed to conduct a limited health study known as Supplemental Environmental Project #14. Its results will not have any impact on FMC OU decision making or remedy implementation.

13.1.30 FINANCIAL RESPONSIBILITY OF FMC

Comment Summary: EPA received 54 comments stating that taxpayers should not be held accountable for cleanup actions. Other comments suggested that Simplot, other federal agencies, or the State of Idaho should contribute financially to remedial actions at the FMC OU. Other comments suggested Superfund monies should be used to supplement remedial actions.

EPA Response: EPA has an "enforcement first" policy under which all Superfund cleanup costs, including all investigations, studies, remediation and monitoring, along with EPA oversight costs for all these activities, and all related EPA decision making, are sought from legally responsible parties before any other entities or potential sources of response costs are considered. FMC has to date consensually paid all of the costs for the FMC OU, and is anticipated to continue to pay them.

13.1.31 EPA INVOLVEMENT DURING FMC OPERATIONS

Comment Summary: EPA received 11 comments noting that EPA should have enforced regulations during FMC operations to prevent contamination. Some comments stated that criminal proceedings should be investigated against FMC for burying materials within the slag pile. 1 comment stated that FMC complied with all environmental regulations.

EPA Response: In 1980, when RCRA hazardous waste permitting and associated waste management regulations were promulgated, most elemental phosphorus production and associated waste generation, including storing these wastes in ponds or surface impoundments, was exempted from RCRA permitting and waste management standards by what is commonly referred to as the Bevill Amendment (an act of Congress) or "Bevill exemption." In 1990, the "Bevill exemption" for wastes from elemental phosphorus production was revised making elemental phosphorus mineral processing subject to RCRA permitting and waste management standards, but not retroactively (just as RCRA management standards were not retroactive to wastes disposed of before 1980). By 1990, the elemental phosphorus containing wastes addressed in the IRODA for the FMC OU had already been disposed of. They would therefore

not have been subject to RCRA waste management standards as part of any RCRA permitting. RCRA criminal penalty provisions (in Section 3008, which was added to RCRA by the 1984 Hazardous and Solid Waste Amendments) were similarly not retroactive, and were exempted by the Bevill Amendment until 1990.

The 1999 RCRA Consent Decree was premised on post-1990 RCRA regulatory violations. No wastes in the FMC OU, no waste material addressed by the IRODA, were subject to enforceable regulation when they were disposed of. EPA is an administrative agency created in 1970, when the era of environmental regulation in the United States meaningfully began, to enforce environmental laws passed by Congress (and usually the President), and to make and enforce environmental regulations these laws grant it authority to make which typically reflect policy choices of Executive administrations and relevant opinions of the Judiciary, as well as those of Congress. All federal agency regulation or rule making is subject to a public comment process similar to the public comment process on Proposed Plans for Superfund sites

13.1.32 EPA COMMUNITY OUTREACH

Comment Summary: EPA received 10 comments stating EPA had not adequately informed the public of the Public Meetings for the FMC Proposed Plan. Some comments requested funds for community members to attend and participate in stakeholder meetings.

EPA Response: EPA held four public meetings at the end of calendar year 2011; two at Fort Hall Tribal Council Chambers and two at the Chubbuck Council Chambers. Dates and locations of the public meetings were:

- October 12, 2011, Fort Hall Tribal Council Chambers
- October 13, 2011, Chubbuck City Council Chambers
- November 15, 2011, Chubbuck City Council Chambers
- November 16, 2011, Fort Hall Tribal Council Chambers and Auditorium

EPA issued a press release prior to each meeting which was publicized in the Idaho State Journal, Shoshone-Bannock News, Power County Press, and Blackfoot Morning News for the October and November meetings, and in the Aberdeen Times for November meetings. In addition, mailers were sent out and the meetings were announced by the local television stations. These announcements were available to the general public, including those within a 3 mile radius

of the facility. The Administrative Record which contains the supporting documents for all decisions made to date can be found at 3 locations in the Pocatello area:

- *Idaho State University Library*
  Government Documents
  850 South 9th Avenue
  Pocatello, Idaho 83209
  (208) 282-3152
- *Shoshone-Bannock Library*
  Tribal Business Center
  Pima Drive and Bannock Avenue
  Fort Hall, Idaho 83203
  (208) 478-3882
- *American Falls Library*
  Roosevelt Street
  American Falls, Idaho 83211

EPA is unable to contribute monetary support for individuals to attend stakeholder meetings. However, EPA provides community support and opportunities for involvement through a variety of methods, including:

- Posting significant documents and updates on the website [http://go.usa.gov/iTC];
- Providing access to a Community Involvement Coordinator who can answer questions and provide suggestions for involvement. Kay Morrison is the Community Involvement Coordinator for the EMF Superfund Site. She can be reached at: morrison.kay@epa.gov or 206-553-8321/800-424-4372;
- Mailing factsheets and other informational documents to the surrounding community;
- Hosting public meetings and informational sessions as new information becomes available for public input;
- Providing support through the Technical Assistance Services for Communities (TASC) program which offers technical assistance to help communities better understand and become involved in the cleanup process for hazardous waste. Visit http://www.epa.gov/superfund/community/tasc/ for more information; and

- providing Technical Assistance Grants (TAGs) for activities that help communities participate in decision making at eligible Superfund sites. An initial grant up to $50,000 is available to qualified community groups so they can contract with independent technical advisors to interpret and help the community understand technical information about their site. Visit http://www.epa.gov/superfund/community/tag/index.htm for more information.

13.1.33 EPA'S COORDINATION WITH FMC CORPORATION

Comment Summary: EPA received seven comments expressing concern that the FMC Corporation performed a majority of the investigations at the FMC OU potentially biasing data. Comments were received stating that FMC developed the remedial alternatives presented in the Supplemental Feasibility Study which did not reflect all available treatment technologies.

EPA Response: FMC developed nearly all project related data and documents under an enforceable Administrative Order on Consent issued by EPA, under which EPA reviewed, commented upon and ultimately approved every significant FMC submittal, including the *Final SFS Report* and the extent to which treatment technologies were evaluated in that Report. EPA also provided oversight pursuant to the Order for all investigations, and independently reviewed voluminous additional data and related information for the treatment technologies that were considered throughout the evaluation process. The Shoshone-Bannock Tribes were provided funding by EPA to participate as a support agency under the Administrative Order on Consent and as a result, had the opportunity to review and comment on all documentation produced as part of the environmental investigations at the FMC OU.

This way of managing Superfund sites is often called "Potentially Responsible Party-lead." Responsible parties perform remedial problem solving and remedy implementation under EPA oversight and enforcement authority. This reflects the way the Superfund law is written and is the way the Superfund program is funded by Congress and the President in the federal budget process. When EPA approves documents under this process, it is not approving every word, idea, or opinion that may be included in often very lengthy documents, but it is approving documents (e.g., investigation and feasibility study submittals) as adequate to support EPA remedy decision making. In post-remedy decision making remedial design/remedial action

submittals, documents are approved as adequate to support remedial action construction and operation in the field.

EPA reviewed provided detailed comments and eventually approved all work plans and field sampling plans prior to investigations at the FMC OU, including Quality Assurance Project Plans (QAPPs) that describe the quality assurance procedures, quality control specifications, and other technical activities that must be implemented to ensure that the results of the project or task, including data collection meet project specifications. Field Sampling Plans (FSPs) are also developed and approved for all sampling and they describe in detail how and where environmental samples will be collected and handled.

Investigation results were carefully examined by EPA throughout the process. If data gaps were found, EPA required further study. The primary investigations performed to characterize the FMC OU were reported in the following EPA-approved documents:

- *EMF RI Report* (BEI, 1996);
- *1997 FMC Subarea FS* (BEI, 1997);
- *RI Update Memo* (BEI, 2004);
- *SRI Report* (MWH, 2009a);
- *SRI Addendum Report* (MWH, 2010a); and
- *GWCCR* (MWH, 2009b).

Full citations for these reports are provided in Section 14 of this IRODA; these reports are available in the Administrative Record.

EPA emphasizes that remedial alternatives evaluated in the *SFS Report* (MWH, 2010b) were scrutinized before the Supplemental Feasibility Study was approved. EPA ensured that the SFS conformed to the National Contingency Plan and was consistent with current EPA policy and guidance related to the development of CERCLA Feasibility Studies. EPA determined the treatment technologies presented in the *SFS Report* (MWH, 2010b) represent the most feasible technologies for cleanup at the FMC OU.

13.1.34 CERCLA REGULATIONS

Comment Summary: EPA received four comments questioning how the CERCLA regulations were developed, when they were developed, and who developed the regulations. Some of those comments suggested that FMC understands these regulations and is able to exploit the vulnerabilities within EPA regulations for their best interest.

EPA Response: The Superfund law is called the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). It was enacted in by Congress in 1980, and significantly amended in 1986. Later 2001 amendments have had no effect on the FMC OU. Superfund regulations (also called rules) are known as the National Contingency Plan (NCP), which are published with all other federal rules in the Code of Federal Regulation (CFR). Federal regulations are written by the agency with primary responsibility for implementing the regulations, and are subject to a substantial public review and comment process. The NCP can be found at 40 CFR Part 300 and it was last amended in 1990.

CERCLA also requires Superfund remedial actions to meet (or waive) substantive requirements in all other federal environmental laws and regulations, as well as any more stringent requirements in state environmental laws and regulations (which EPA interprets to mean qualifying tribal requirements on Indian reservations). These requirements are called applicable or relevant and appropriate requirements (ARARs) in CERCLA. Generally, these other laws and regulations, the ARARs, provide many of the environmental levels Superfund cleanups must achieve, such as Safe Drinking Water Act standards for naturally drinkable water. The NCP provides direction to implementing agencies on Superfund processes, including the roles and responsibilities among EPA, states and tribes, among others. See also the response to Comment 13.1.31 above for EPA's role generally with respect to RCRA hazardous waste laws and regulations.

EPA has no basis or reason to believe that FMC knows or understands or can exploit CERCLA, the NCP, or ARARs, any better than any other corporation EPA oversees at Superfund sites.

13.1.35 SELECTION OF AN INTERIM ROD AMENDMENT

Comment Summary: EPA received 7 comments questioning the decision to issue an Interim Record of Decision Amendment versus a Final Record of Decision Amendment. Some of those

comments stated that the Preferred Alternative does not comply with ARARs and federal requirements. 2 comments agreed with selecting an interim remedy.

EPA Response: This comment is addressed in the IRODA with the language that follows:

There are two primary reasons an IRODA has been issued rather than a Final ROD Amendment:

- Elemental phosphorus within the FMC OU cannot be easily and safely excavated. The Tribes recently promulgated soil cleanup standards (SCS) that, among other things, require excavation and/or treatment of all buried elemental phosphorus within the FMC OU. Although the Tribes' SCSs may be ARARs for future actions, EPA is continuing to evaluate them. Further, given the stringency of these standards and their implications for addressing buried elemental phosphorus contaminated material, among other COCs, EPA cannot predict when a final determination regarding their status as ARARs will be made.
- The groundwater remedy calls for extraction and treatment of groundwater beneath the FMC OU. Based on the current groundwater modeling simulations, achieving groundwater restoration (i.e., meeting drinking water standards, which are ARARs, and/or risk-based groundwater cleanup levels) is predicted to take longer than 100 years. However, the conclusion is highly uncertain, because groundwater flow conditions will change significantly during implementation of the interim remedy. Data collected during the design and implementation will improve EPA's understanding of the timeframe for groundwater cleanup.

EPA believes that the selected interim amended remedy in this IRODA is protective of human health and the environment. EPA anticipates a final remedy decision for the FMC OU within 5 to 10 years after the completion of implementation of this IRODA.

Shoshone-Bannock Tribes' Soil Cleanup Standards

In December 2010, the Tribes promulgated stringent SCS that require, among other things, excavation and/or treatment of all buried elemental phosphorus on the Fort Hall Reservation. Among the Tribes' stated goals in promulgating the SCS is restoring all land within the Reservation to its original state prior to the contamination that the standards are designed to address. This selected interim amended remedy does not meet these standards. However, because

of the interim nature of this action, ARARs do not have to be met at this time. EPA is evaluating the Tribes' standards to determine whether these regulations may be ARARs. This evaluation will require careful federal review to determine whether these unique and potentially precedential SCS should be fully evaluated prior to a decision as to whether all or a part of the SCS are ARARs. CERCLA requires that ARARs must be met or waived upon completion of remedial action. At the time that EPA selects a final remedy, EPA will more definitively address groundwater restoration within a reasonable restoration timeframe, will determine whether all or a part of the Tribal SCS are ARARs, and will if necessary determine the applicability of the ARAR waiver provisions in §121(d)(4) of CERCLA. EPA will consult with the Tribes on the selection of the final remedy, including consideration of any proposed waiver or waivers.

It is important to note that even if EPA concludes that excavation and/or treatment of contaminated soil and waste in accordance with the new Tribal regulations (or otherwise) should and could be implemented, the ET capping and groundwater treatment selected in this IRODA is necessary to address the continued FMC OU groundwater contributions to Simplot OU groundwater and to surface water contamination. This remains true even if EPA concluded that excavation and/or treatment of contaminated soil and waste were warranted. Contaminated groundwater would continue to migrate off site during the 20 to 40 years estimated to complete such an action.

This IRODA for the FMC OU allows the prompt implementation of the selected interim amended remedy and eliminates current potential exposures while the Tribal SCSs undergo evaluation and analyses. Prompt implementation of the selected interim amended remedy is necessary to prevent infiltration of surface water into elemental phosphorus-contaminated soils and subsequent migration of contaminants toward adjoining springs or discharging to the Portneuf River. Even if EPA were to select an excavation and treatment remedy in the future, the interim remedial action is necessary to stop this infiltration during a 2–4-decade-long treatment process. The selected interim amended remedy is also necessary to promptly eliminate direct contact, inhalation, and ingestion risks associated with other COCs within the FMC OU.

Groundwater Remedy Timeframe

The second reason for an interim rather than final remedy relates to groundwater. The groundwater remedy calls for extraction and treatment of groundwater beneath the FMC OU. Based on the current groundwater modeling simulations, achieving groundwater restoration (i.e., meeting drinking water standards, which are ARARs, and/or risk-based groundwater cleanup levels) is predicted to take longer than 100 years. However, many of the simulation inputs require assumptions such as hydraulic conductivity, transmissivity, and sorption coefficients that may not be accurate, and groundwater flow conditions will change significantly after implementation of the remedy, thus making total time to meet cleanup levels exceedingly difficult to predict at this time. The final ROD Amendment will more definitively address groundwater restoration within a reasonable restoration timeframe.

Simplot OU contributions to surface water and groundwater are being addressed pursuant to the Simplot OU Consent Decree, as amended. The groundwater remedy for the FMC OU has been designed to be consistent with the remedy for the Simplot OU."

13.1.36 TRIBAL SOIL CLEANUP STANDARDS AS AN ARAR

Comment Summary: EPA received 16 comments stating that EPA is not meeting Trust responsibilities nor recognizing Tribal sovereignty because the Tribal Cleanup Standards were not incorporated as ARARs for this Interim ROD Amendment.

EPA Response: Consultation, as the EPA in Region 10 use the term, means "the process of seeking, discussing, and considering the views of federally recognized tribal governments in a respectful, meaningful two-way communication that works toward consensus reflecting the concerns of the potentially affected federally recognized tribes before EPA makes its final decision or moves forward with its action." EPA has provided the Shoshone-Bannock Tribes funding throughout the development of the FMC OU Supplemental Remedial Investigation and Feasibility Study process to ensure full engagement in all activities. In addition, EPA arranged for a facilitated meeting between EPA and the Shoshone-Bannock Tribes to discuss tribal concerns related to the FMC OU on January 26 and 27, 2010, a government to government consultation on our proposed actions at the FMC OU on August 25th, 2010, and a meeting between senior EPA management and the Fort Hall Tribal Business Council on October 11th,

2011, just prior to first public hearing regarding the EPA's Proposed Plan for the FMC OU. Senior EPA officials again consulted with the Shoshone Bannock Tribes on the interim ROD Amendment on April 12, 2012.

In December 2010, the Shoshone- Bannock Tribes promulgated Soil Cleanup Standards for Contaminated Properties (SCS) as regulations under their Waste Management Act, and on December 3, 2010, sent a letter to EPA requesting that they be considered ARARs for the FMC OU. According to the SCS, the Tribes' goal in promulgating the SCS is to restore all land within the Reservation to its original state, that is, prior to the contamination that the standards are designed to address. In addition, the SCS provide cleanup levels for more than 100 contaminants for both unrestricted and commercial/industrial land use within the Fort Hall Indian Reservation. In some cases, the SCS requires the development and assessment of a site-specific conceptual site model and risk assessment that considers a Tribal exposure scenario reflecting the lifestyle which some tribes have argued treaties (and other agreements) were designed to protect, including environmental conditions or contaminant concentrations in various media reflecting the often pristine environmental conditions at the time the treaties were executed. However, since the Tribal Soil Cleanup Standards were promulgated after completion of most of the investigation and feasibility study work was conducted at the FMC OU, they were not taken into account in any of the data collection or remedy evaluations.

Section 121(d) of CERCLA mandates that upon completion, remedial actions must at least attain (or waive) all applicable or relevant and appropriate requirements (ARARs) of any Federal environmental laws, or more stringent promulgated State environmental or facility-siting laws (which EPA interprets to mean qualifying tribal requirements on Indian reservations). EPA is evaluating the Tribes' standards to determine whether these regulations may be ARARs. This evaluation will require careful federal review in order that these unique and potentially precedential SCS be fully evaluated prior to a decision as to whether all or a part of the SCS are ARARs. When EPA selects a final remedy, EPA will more definitively address groundwater restoration within a reasonable restoration timeframe, will determine whether all or a part of the Tribal SCS are ARARs, and will if necessary determine the applicability of the ARAR waiver provisions in §121(d)(4) of CERCLA. EPA will consult with the Tribes on the selection of the final remedy including consideration of any proposed waiver or waivers.

13.1.37 MANAGEMENT INVOLVEMENT

Comment Summary: EPA received 5 comments inquiring into Lisa Jackson's role in the Eastern Michaud Flats Superfund site.

EPA Response: The Superfund program's primary remedy selection authority has been formally delegated from the President to the Administrator of EPA, Lisa P. Jackson. The Administrator has further delegated this remedy selection authority to the senior Superfund program managers in each of the ten EPA regional offices.

Administrator Jackson manages a staff of more than 18,000 professionals working across the nation to address health threats from pollution in our air, water, and land, and enhance the public's trust in EPA's work. As such, she is briefed periodically on high profile sites, including the EMF Superfund Site. She provides insight and direction, as appropriate, to Program managers and works to provide adequate congressional funding for all EPA programs to better protect human health and the environment, and address the concerns of communities and stakeholders to the extent possible. Ms. Jackson is aware of the remedial actions outlined in this interim ROD Amendment and is supportive of Region's desire to immediately address the threats posed to human health and the environment by the contamination at the FMC OU.

13.1.38 TRANSPORTING WASTE TO GAY MINE

Comment Summary: EPA received 8 comments suggesting the slag and fill within the FMC OU be transported to Gay Mine or made comparisons between the FMC OU and the Gay Mine.

EPA Response: The Gay Mine site and the Eastern Michaud Flats Superfund Site are wholly separate geographically (though ore for the Gay Mine was processed at the EMF site) and are being addressed independently based on the risks present at each site. While off-site disposal was considered for slag during the Feasibility Study, it was demonstrated that the slag could be protectively managed in place within the FMC OU.

13.1.39 SLAG AS A COMMODITY

Comment Summary: EPA received 6 comments inquiring the value of slag as a commodity due to its uranium content. Some comments suggested the slag be crushed and grouted into bricks for storing before disposal or sale. Some comments inquired as to why the slag is considered too dangerous by EPA to relocate.

EPA Response: See the last paragraph of response 1-23 above, regarding the risks associated with slag as a component of construction materials, and FMC's agreement in two EPA Orders from the 1990s not to sell or allow slag to be used for these purposes. While slag could be relocated, it would still pose the same risks to human health after the relocation. As part of the Supplemental Feasibility Study, EPA determined that the slag could best be managed safely in its existing location beneath engineered soil covers. There are no known safe commercial uses of FMC OU slag.

13.1.40 EPA REPRESENTATION IN POCATELLO

Comment Summary: EPA received **a** comment requesting the reason for relocating EPA's Community Involvement Coordinator position from Pocatello, Idaho to Seattle, WA.

EPA Response: While comment is not related to the FMC OU Proposed Plan, due to budget limitations, EPA consolidated two place-based positions back to the Seattle office, including the position in Pocatello, Idaho. EPA's new Community Involvement Coordinator assigned to the EMF Superfund Site is located in the EPA Region 10 offices in Seattle. Kay Morrison can be reached at morrison.kay@epa.gov or 206-553-8321/800-424-4372.

13.1.41 COST ESTIMATES FOR EXCAVATION AND TREAT ELEMENTAL PHOSPHORUS

Comment Summary: EPA received **a** comment inquiring how EPA determined treatment and removal of elemental phosphorus would cost more than $1 billion and take more than 40 years to perform.

EPA Response: EPA performed an independent review of the cost estimates of the 6 remedial alternatives presented in the *Supplemental Feasibility Study* developed by FMC. Two additional remedial alternatives were evaluated at the request of the Shoshone-Bannock Tribes and were also reviewed for cost.

The two additional alternatives were:

- Alternative 7 – Excavation and treatment of all elemental phosphorus contaminated soils within the FMC OU, including the RCRA Ponds.

- Alternative 8 – Excavation and treatment of all elemental phosphorus contaminated soils within the FMC OU, including the RCRA Ponds, and removal of all operational by-products and wastes from the FMC OU (clean closure).

EPA used cost estimating software called Remedial Action Cost Engineering and Requirements (RACER) Version 10.3 to develop and verify the cost estimates for all the soil and groundwater alternatives, including these additional alternatives addressing removal and/or treatment of elemental phosphorus-contaminated soils.

FMC built a Land Disposal Treatment facility in 2001 which was intended to treat ongoing production wastes contaminated with elemental phosphorus, however it was never operational. The specifications from the Land Disposal Treatment facility were used in EPA's cost estimates for treatment of elemental-phosphorus contaminated soil in Alternatives 7 and 8.

For the purposes of the cost estimate, the hypothetical treatment facility was assumed to process 18% solid slurry at 82 gallons per minute, which is double the capacity of the Land Disposal Treatment facility that was built. For the purposes of the cost estimate, the total volume of known or suspected elemental phosphorus-contaminated soils onsite was calculated to be 2,400,239 cubic yards. The time to treat the volume of elemental phosphorus-contaminated soil, assuming that 18% solid slurry was processed at 82 gallons per minute, was calculated to be 44 years of continuous operations.

Using a variety of default parameters established by RACER and also site-specific inputs, the cost of Alternative 7 was calculated at $949,600,000 and the cost of Alternative 8 was calculated at $3,499,700,000. The *Cost Estimate Addendum* (BAH, 2011) contains all the information used to evaluate and calculate the cost of excavation and treatment of elemental phosphorus-contaminated materials at the FMC OU.

13.1.42 BACKGROUND CALCULATION OF GAMMA RADIATION

Comment Summary: EPA received **a** comment questioning how EPA calculated the background concentrations of radionuclides and if alpha and beta emitters were included in reducing radioactive emissions to background through the use of gamma caps.

EPA Response: A background study was performed as part of the *Supplemental Remedial Investigation Addendum* to determine the background concentration of contaminants near the Eastern Michaud Flats site. The background study included a suite of metals, inorganics, and radionuclides.

A complete discussion of how background levels were developed can be found in Section 2.1 of the *SRI Addendum Report* (MWH, 2010a).

13.1.43 AMERICAN INDIAN ENVIRONMENTAL OFFICE REPRESENTATION

Comment Summary: EPA received **a** comment inquiring whether representation from the American Indian Environmental Office is involved in the EMF Superfund site.

EPA Response: EPA provides briefings for AIEO and provides the Office with periodic updates, upon request.

13.1.44 NASA CONSULTATION

Comment Summary: EPA received **a** comment inquiring if NASA has been consulted for technologies that could be used in remediation at the FMC OU.

EPA Response: EPA has not consulted with NASA regarding remedial technologies potentially applicable at the FMC OU. NASA does not have expertise nor a mission related to environmental cleanup.

13.1.45 LAND USE DESIGNATION

Comment Summary: EPA received **a** comment requesting the cleanup goals for the FMC OU be changed from industrial use to long-term unrestricted use by people therefore "restoring the site to host vegetation which served as sustenance for the Native American people."

EPA Response: EPA sees no basis for projecting other than industrial uses for the former operations area of the FMC OU, and has overseen the development of the supporting Administrative Record and issuance of the IRODA accordingly. Similarly, residential or unrestricted use is not anticipated for any portion of the FMC OU south of I-86. Any proposed changes in future land use would be evaluated at that time or as part of the five-year review process and addressed, as appropriate, at that time. However, for the Northern Properties portion

of the FMC OU, estimated risks associated with potential future residential exposures to COCs in soil were evaluated and found to be very low.

A tribal subsistence user or Tribal Risk Scenario would be based on an exposure area that is much larger than the Northern Properties, and located further from FMC OU contamination sources than the residential use exposure area EPA used. Evaluation of a larger exposure area further removed from contamination sources typically results in lower average levels of COCs in vegetation and soil than concentrations associated with the smaller, closer to sources residential or unrestricted use scenario. For this reason, an evaluation using a future residential land use scenario was considered by EPA to be more protective of tribal members than a Tribal Risk Scenario. The residential scenario evaluated a protective garden produce consumption rate (95th percentile) over a smaller land area closer to contamination sources. EPA did not and could not conduct a Human Health Risk Assessment using a Tribal Risk Scenario because although EPA requested the information from the Tribes needed to develop such a scenario for risk assessment, it was never received.

EPA reviewed, provided comments on, and ultimately approved the Human Health Risk Assessments that are presented in the *SRI Report* (MWH, 2009a) and *SRI Addendum Report* (MWH, 2010a). EPA believes these risk assessments adequately reflect anticipated land use within the FMC OU for the foreseeable future.

13.1.46 CONSTRUCTION AND DEBRIS LANDFILL

Comment Summary: EPA received **a** comment requesting the contents of the construction and debris landfill within Remediation Area H (RA-H).

EPA Response: 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-H is identified as a potential source of COC releases to groundwater, although actual groundwater impacts have not been identified. RA-H includes Remediation Units (RUs) 17 and 18.

13.1.47 REMEDY MANAGEMENT SYSTEM

Comment Summary: EPA received **a** comment expressing concern that the installation of utility lines and extraction wells could disturb subsurface elemental phosphorus causing

hazardous air releases and could risk worker health. The comment stated that utility lines should be above ground or buried within shallow depths, and that once clean-up is complete, these utility lines should be removed by FMC.

EPA Response: The existing RCRA pond caps will be integrated with the development of new CERCLA-required caps, access roads, groundwater extraction system, and utility lines. The engineering details related to this integration will be developed during Remedial Design. Upon completion of the construction of the interim remedial action, management and maintenance requirements and procedures for as long as the caps are in place will be documented in an EPA-approved Operation Management and Monitoring Plan (OMMP). The OMMP will describe how any future excavation activities, including any possible work related to buried utilities, would be conducted to ensure to protection of workers.

If, during the installation of groundwater monitoring or extraction wells, or any utility lines or any other activity, elemental phosphorus is encountered at levels that present risks to human health or the environment, such wastes would be managed and disposed of as RCRA investigation derived wastes. Further, EPA will require submittal of a facility Health and Safety Plan that will describe all required personal air monitoring during excavation work and associated actions to prevent unacceptable exposures to workers, and a Fugitive Dust Mitigation Plan which will require, among other things, perimeter air monitoring to protect nearby residents and others in the vicinity of the FMC OU. EPA does not have the authority to require FMC to remove utility lines after a remedial action has been implemented since the purpose of the CERCLA remedy is to protect human health and the environment by preventing contaminants of concern from entering pathways which could reach receptors. Utility lines do not pose a threat to human health and the environment. EPA expects the Tribes to review and comment on documents generated as part of the Remedial Design phase and the Operations Management and Monitoring Plan.

13.2 RESPONSES TO THE DECEMBER 2, 2011 COMMENTS FROM THE SHOSHONE-BANNOCK TRIBES REGARDING THE FMC OPERABLE UNIT PROPOSED PLAN

13.2.1 EPA FAILED TO PERFORM AN ECOLOGICAL RISK ASSESSMENT

EPA Response: EPA completed an ecological risk assessment (ERA) in July 1995 for all three operable units (OUs) of the Eastern Michaud Flats Superfund Site, including the FMC OU (*Ecological Risk Assessment, Eastern Michaud Flats, Pocatello, Idaho, Ecology and Environment for EPA Region 10*). The ERA followed the EPA "Ecological Risk Assessment Guidelines for Superfund: Process for Designing and Conducting Ecological Risk Assessments (EPA 540-R-97-006)." The goal of any Superfund ERA is to help determine which areas of a site or OU may need remediation to address exposure risks from releases of hazardous substances or pollutants and contaminants to ecological receptors. The 1995 ERA for the EMF Site concluded that there was a potential for marginal risks due to fluoride within the Off-Plant OU and suggested that a fluoride monitoring program be developed and implemented as part of the remedy for the Off-Plant OU. The ERA did not identify any unacceptable risks for the FMC OU. However, consistent with EPA guidance, because the FMC operations area and the older non-RCRA regulated ponds were not found to be suitable habitat for wildlife in the area, the focus of the ERA was on ecosystems in the Off-Plant OU (known as the Off-Plant area at the time).

In order to assess whether the 1995 ERA needed to be updated or amended as part of the supplemental remedial investigation/feasibility study (SRI/SFS) for the FMC OU following the closure of the FMC elemental phosphorus manufacturing facility in December 2001, EPA conducted a site tour and ecological risk assessment meeting with FMC, IDEQ, and the Shoshone Bannock Tribes in May 2003. At this meeting, consistent with EPA ERA methodology and guidance, the group identified and assessed areas of the FMC OU that were developed and/or disturbed and therefore unlikely to provide suitable habitat for ecological receptors, as well as the undeveloped areas that were more to provide habitat for ecological receptors. Based on this assessment and fully consistent with Section 300.430 of the NCP, EPA concluded that the 1995 ERA did not need to be formally amended. Further, these areas did not

in 1995, and do not now, in whole or in part, consist of or comprise either "especially sensitive habitats (or) critical habitats of species protected under the Endangered Species Act."

As discussed in the 2004 *RI Update Memorandum*, access by large mammalian species (e.g., mule deer) to disturbed/developed areas of the FMC OU is restricted by migration barriers (e.g., Highway 30, Interstate 86 and the Targhee Canal to the north of the FMC OU, the Simplot facility to the east of the FMC OU, the steep terrain within the Bannock Hills to the south of the FMC OU, in addition to the wire fencing surrounding the former FMC operations area, and the cyclone fencing surrounding the RCRA pond closure area). There is also a lack of readily available drinking water. With respect to avian species, developed/disturbed areas are limited in size compared to the home range of most species that can access these areas. Each of these factors limits the extent to which potential wildlife receptors could be exposed to hazardous substances within developed/disturbed areas of the FMC OU now or in the future.

An appropriate remedial investigation (RI) to characterize any site (EPA's obligation pursuant to Section 300.430(d) of the National Contingency Plan (NCP)), including the baseline risk assessment, does not require a complete analysis of impacts to microorganisms in the soil regardless of whether EPA ultimately decides that these areas require remediation. Further, when designed, implemented, and monitored properly, effective containment is fully protective of human health and the environment without regard to risks posed to underlying soil biota by gases generated from the waste. Similarly, general populations of terrestrial mammalian and avian species would also be fully protected by any effective containment remedial action that eliminates all pathways to exposure to underlying material.

In June 2008, FMC submitted the *Draft Supplemental Remedial Investigation (SRI) Report* that included the results of the 2007 field investigations conducted within the FMC OU. In August 2008, based on discussions with the Tribes and regulatory review and comment on the Draft SRI Report, EPA determined that additional investigations were required in the Southern and Western Undeveloped Areas (SUA and WUA) and the FMC Northern Properties to gather data to further assess ecological and human health risks in these areas. As a result, these areas were extensively sampled in 2008. The *Supplemental Ecological Risk Assessment Addendum* was included as *Appendix E of the SRI Addendum Report* (November 2009) and presents the analysis and findings of the 2008 study.

The supplemental ecological risk assessment for the FMC Undeveloped Areas (WUA and SUA) and Northern Properties (NP) evaluated risks to two types of plants, soil invertebrates, four types of birds including the red-tailed hawk and bald eagle, and small and large mammals, including mice, pygmy rabbit, Townsends big-eared bat, and mule deer. These receptors may be exposed to contaminants in soils through uptake into plants, and by transfer into items in the food chain, followed by ingestion of the food items. The contaminants that were considered in the quantitative risk evaluation as contaminants of concern (COCs) were cadmium, chromium, fluoride, lead, mercury, selenium, vanadium, and zinc. Of these COCs, only fluoride was found to present unacceptable risks to ecological receptors in one or more of the study areas. Specifically, fluoride was found to present uncertain risks (i.e., exposures exceeded the no-observed-adverse-effects level, NOAEL, but not the lowest-observed-adverse-effects level, LOAEL) for plants and four bird receptors at Northern Property Parcels 2, 3, 4, and 6. At Parcel 3, fluoride was found to present risks to the red-tailed hawk by exceeding the LOAEL, based on concentrations in soil and modeled concentrations in deer mice. However, the ecological risk assessment concluded that risks are likely over-estimated since hawks will feed from the parcels much less frequently than was assumed in the risk assessment. There was a marginal potential risk to the horned lark due to fluoride.

In summary, the sampling results and supplemental ecological risk assessment for the FMC Undeveloped Areas and Northern Properties generally showed that although slightly elevated levels of contamination associated with the FMC OU were detected in surface soils due to air deposition, the levels of contaminants were generally below ecological levels of concern. These findings were consistent with the 1995 ERA.

With respect to ecological risks associated with phosphine gas exposure, in 2010, EPA directed FMC to investigate the RCRA-regulated ponds and those portions of the FMC OU containing elemental phosphorus (P4) processing waste to evaluate the concentrations of phosphine and other gases in ambient air and in the soil column. This investigation was conducted during the summer of 2010 and the findings were presented in the *Site-Wide Gas Assessment Report for the FMC Operable Unit (MWH, 2011)*. Gas samples were collected within areas of the former FMC operations area that have the potential to generate phosphine gas (PH3) due to known P4

contamination. The sampling encompassed both the FMC OU areas and areas where closed RCRA-regulated waste management units that are not part of the FMC OU are located.

These results revealed that although low levels of phosphine gas, and to a lesser extent other gases, are generated in the subsurface as a result of the presence of elemental phosphorus within the FMC OU, levels in soil gas were all below 1 ppm. The permissible exposure limit (PEL) for humans of phosphine is 1 ppm for 15 minutes or 0.3 ppm averaged over eight hours. Of the 420 total recorded soil gas readings, 37 (only 9%) were non-zero (>0.00 ppm) and individual readings ranged from 0.02 to 0.15 ppm PH_3. Soil gas samples are collected from the small spaces between soil particles below the ground surface. Further, no phosphine or other gases were found to be migrating to the ambient breathable air at measureable levels where a complete exposure pathway could occur.

As set forth in greater detail in later responses to comments from the Shoshone Bannock Tribes and elsewhere in this *IRODA Responsiveness Summary*, phosphine gas has only been detected in any significant quantity in the RCRA units, which are not part of the FMC OU and to a much lesser extent in the former operations area of the FMC OU. Phosphine concentrations found in ambient, breathable air during the site-wide gas assessment pose no risks to human health or roaming mammalian or avian species. Phosphine can only be produced in areas where there is subsurface elemental phosphorus, therefore within the SUA, WUA and Northern Properties, areas where there may be suitable ecological habitat, there is no risk of exposure to any elemental phosphorus or phosphine gas.

Based on all available information, EPA believes that the updated 2009 ecological conceptual site model contained in *SRI Report* is fully representative of current conditions at the FMC OU. Furthermore, EPA believes that the *FMC OU Site-Wide Gas Assessment Report* accurately characterizes the generation of phosphine and other gases, and shows that provided buried elemental phosphorus-containing material is not disturbed, phosphine and other gases pose no risk to human health and the environment in the FMC OU. Despite this finding, as part of the Selected Remedy, EPA is requiring long-term gas monitoring within the FMC OU. Should this monitoring reveal changes in gas generation rates or that gas is migrating in any way that may pose a threat to human health or the environment, EPA will consider additional action at that time.

13.2.2 THE PROPOSED INTERIM GROUNDWATER REMEDY DOES NOT MEET CERCLA WAIVER REQUIREMENTS

EPA Response: The interim remedial action cites Section 121(d)(4)(A) of CERCLA, the provision for waiving applicable or relevant and appropriate requirements (ARARs) when "the remedial action selected is only part of a total remedial action" that will meet (or waive with another of the six waiver categories in Section 121(d)(4)) all ARARs "when completed." Most significantly, by installing evapo-transpiration (ET) soil caps, the interim remedial action will prevent continued infiltration of precipitation into buried phosphorus and other hazardous substance-containing waste thereby minimizing further migration of hazardous substances into the groundwater. The remedy also selects extraction and treatment of contaminated groundwater before it leaves the FMC OU. This interim remedial action will prevent the migration of contaminated groundwater from the FMC OU into the Portneuf River. This primary objective, along with safely isolating and containing the buried elemental phosphorus containing wastes beneath the ET caps, is wholly consistent with all the elemental phosphorus related remedial action objectives for the FMC OU, including the objective of restoring FMC OU groundwater within a reasonable restoration time frame.

Groundwater data from the extraction and treatment system will allow EPA to better assess the degree of improvement the interim remedial action, particularly with the major reduction of infiltration, makes to residual groundwater quality throughout the FMC OU. This will allow EPA to far more accurately assess the degree to which any subsequent groundwater remediation will meet restoration objectives. The 20 years of prior groundwater data for the FMC OU referred to in the comment does not reflect the extent to which the significantly reduced or eliminated infiltration as a result of the interim remedial action will impact groundwater migrating from the buried waste in terms of water quality. The post interim remedial action groundwater data will allow EPA to analyze the very different post remediation groundwater conditions at the FMC OU. Evaluating pre-remediation data would not allow EPA to do this.

Similarly, consistent with Section 121(d)(4)(A) of CERCLA, there is no inconsistency between the interim remedial action and any final remedial action for either the buried waste (as further explained in response to Comment 13.2.5) or any future groundwater remediation. Nothing in the selected interim action in any way compromises or exacerbates groundwater conditions or otherwise prevents or inhibits EPA from meeting (or waiving as may be necessary on or before

completion of remedial action) any applicable or relevant and appropriate requirement, including meeting drinking water standards throughout FMC OU groundwater.

13.2.3 OTHER CONCERNS WITH THE PROPOSED GROUNDWATER REMEDY

EPA Response: In the first paragraph of the comments under this heading, the Tribes point out that capping certain areas within the FMC OU is proposed, in part, to help prevent infiltration and percolation of storm water through soils containing contaminants of concern (COCs) and into groundwater. The comments then go on to question whether capping is justified and will significantly reduce infiltration of stormwater. While caps may not necessarily be required to prevent infiltration and percolation of storm water through soils containing COCs and into groundwater in all areas, placement of the ET caps selected in the IRODA is a common engineered method used to ensure reduction in infiltration. In addition, the caps also provide the following benefits in order to meet the remedial action objectives (RAOs) for the FMC OU:

- Capping is a key element in preventing exposure via other potential pathways including preventing exposure to gamma radiation, incidental soil ingestion, dermal absorption, and fugitive dust inhalation.
- Capping will help prevent the direct exposure to elemental phosphorus under conditions that may cause it to spontaneously combust, posing a fire hazard or result in air emissions that present a threat to human health or the environment.

The comments express concern that the Proposed Plan didn't fully disclose for the public all contaminants of concern in the groundwater. However, the comments also state that "EPA has listed arsenic, fluoride, manganese, nitrate, selenium, vanadium and elemental phosphorus as contaminants of concern at the site" (presumably meaning the FMC OU). Further, page 34 of the Proposed Plan states that "arsenic, fluoride, nitrate, radium-226, selenium, thallium, gross alpha, and gross beta exceed groundwater MCLs" which is an accurate statement based on the extensive data collected for the FMC OU. In addition, all of the groundwater data collected since the original Remedial Investigation (RI) has been summarized in the *Groundwater Current Conditions Report (GWCCR)* which was reviewed and commented on by the Tribes and available in the Administrative Record.

EPA considers arsenic and phosphorus to be the most significant groundwater COCs within the FMC OU and the primary groundwater COCs at the EMF Site. Arsenic is the only groundwater

COC that has been shown to be migrating beyond the FMC OU boundary in concentrations that would be a concern to human health (i.e., above the drinking water MCL). Arsenic is responsible for most of the human health risks associated with groundwater ingestion. Only phosphorus has been shown to be migrating beyond the FMC OU boundary in concentrations that would be a concern for the environment.

In response to this comment however, EPA has expanded its discussion of groundwater COCs in the IRODA fully listing all COCs for the FMC OU, and expressly clarifying that: 1) arsenic and orthophosphate are not the only groundwater COCs; 2) treatment of extracted groundwater must meet MCLs for all COCs; and 3) groundwater monitoring will be conducted for all COCs. As noted in the preceding paragraph, arsenic in particular was emphasized in the RI/FS for the Site and the SRI/SFS and Proposed Plan for the FMC OU in the context of groundwater remediation because it is the COC with the highest risk to human health and the only groundwater COC above its MCL in groundwater prior to discharge into the Portneuf River.

The comments under this heading also express concern that the conceptual model does not adequately explain the movement of elemental phosphorus in the vicinity of the former furnace building through the soil column to groundwater. EPA has re-reviewed the data collected during the SRI and presented in the *SRI Report*, which EPA had reviewed and commented on extensively prior to approving the *SRI Report*, and disagrees with this conclusion. During the SRI, soil borings were collected surrounding the former furnace building area, and step-out borings were collected down gradient until no further "smoking" soil boring samples could be located. "Smoking" boring soil samples are indicative of elemental phosphorus contamination. Elemental phosphorus was found in the step-out soil borings at a depth of 80 feet below ground surface (bgs), but not in soils above 80 feet bgs, indicating that the elemental phosphorus found in the step-out borings migrated from up gradient sources rather than directly above-ground sources.

Elemental phosphorus produces smoke in soil samples when concentrations are at or above approximately 1,000 ppm. Based on the physical and chemical properties of elemental phosphorus, it could only be in those concentrations and at a depth of 80 feet bgs if it migrated as a liquid with groundwater. In order for the groundwater to carry the elemental phosphorus as a liquid, the groundwater would need to be heated to 112^{o}F or above. Based on the historical

information related to FMC's operation, we know that there was significant heat generated by 60 years of furnace building operations (which operated at approximately 2300^{o}F), including slag tapping directly onto the ground, which imparted significant heat to the soil column. Liquid elemental phosphorus spills from the furnace building, phos dock, secondary condenser, and slag pit seeped into the heated ground until they reached groundwater. The original EMF Remedial Investigation conducted while FMC was in operation showed a peak temperature at Well 108 (which is approximately 200 feet down gradient of the furnace building) of approximately 83^{o}F (or 28.2^{o}C as reported in the *EMF RI Report*) providing further evidence of the accuracy of the conceptual site model in this area. Additionally, detections of elemental phosphorus, as reported in the *Groundwater Current Conditions Report (GWCCR),* in Wells 108 and 122 are in very low concentrations (which is discussed below) indicating that the subsurface elemental phosphorus is now in a solid state, not a liquid state. Further, the data reported in the *EMF RI Report, SRI Report,* and the *GWCCR* support the conceptual model that liquid elemental phosphorus from operation spills seeped into heated soils and down to groundwater and was swept down gradient 200 to 325 feet until it cooled and solidified. EPA is satisfied that the conceptual model presented in the *SRI Report* is accurate and describes conditions sufficiently at the FMC OU to design and implement the selected interim remedial action in the IRODA.

Lastly, the comments express concern over the low solubility of elemental phosphorus in groundwater and groundwater monitoring results that have detected elemental phosphorus in groundwater down gradient of the former furnace building. Elemental phosphorus has a maximum solubility in water of 3 mg/L and the maximum detected level of elemental phosphorus in groundwater at the FMC OU is 0.258 mg/L at monitoring Well 108. Measureable levels of element phosphorus have only been detected in groundwater monitoring wells approximately 200 – 325 feet down gradient of the furnace building area in Wells 108 and 122 respectively. These results are consistent with the current conceptual site model.

13.2.4 THE TRIBES PREFERRED GROUNDWATER ALTERNATIVE

EPA Response: The Tribes express preference for implementation of groundwater Alternative 3 over Alternative 2. EPA thoroughly evaluated the differences between Alternatives 2 and 3 during the SFS and development of the Proposed Plan. Both remedies would provide hydraulic containment by providing extraction wells at the northeastern portion of the former operations

area. However, based on the currently available data and groundwater modeling, it is not clear that the additional groundwater extraction wells proposed in Alternative 3 in the vicinity of source areas would allow RAOs at the FMC OU to be achieved more quickly than implementation of Alternative 2. In addition, due to the aquifer characteristics in this area, EPA is concerned that the area would dewater very quickly and design and implementation of an efficient extraction well network would be very challenging. As a result, EPA selected Alternative 2. Following implementation of Alternative 2, additional required groundwater monitoring will provide data that will be used to improve the accuracy of the groundwater model. Should refined modeling results indicate that RAOs would be achieved much more quickly with the installation of additional extraction wells, EPA may require modifications to the extraction system at that time. EPA expects the Tribes to be fully involved in the ongoing evaluation of the groundwater extraction system performance.

The Tribes also request that any institutional control expected to prevent risk at the FMC OU be filed with specified tribal offices. While this is generally an enforcement rather than remedy selection matter, EPA assures the Tribes that to the extent an institutional control is a proprietary private land use control, such as an environmental easement or covenant, that would normally be filed where real property transactions or notices are recorded, EPA will require that recordation and/or filing occur at multiple locations to ensure notification to tribal officials where such records are normally filed and available on the Fort Hall Reservation and/or at the Bureau of Indian Affairs.

Lastly, the comments request "an expanded list of monitoring parameters to identify and assess the effectiveness of the extraction for all contaminants measured at levels above the MCLs." As typically occurs at Superfund groundwater remediation sites, detailed groundwater monitoring parameters for all contaminants will be finalized during the Remedial Design phase for the FMC OU. EPA welcomes the Tribes involvement and comments on the groundwater monitoring plan and on other aspects of the Remedial Design.

13.2.5 THE PROPOSED INTERIM SOIL REMEDY DOES NOT MEET CERCLA WAIVER REQUIREMENTS

EPA Response: As emphasized in the response to Comment 13.2.2, the proposed interim remedial action will prevent infiltration of precipitation into buried elemental phosphorus

contaminated soils by installing ET soil caps. In addition, a groundwater pump and treat system will prevent migration of contaminants beyond the FMC property boundary and thus protect the Portneuf River. The selected interim remedial action, by preventing contaminated groundwater migration, while safely isolating and containing the buried elemental phosphorus-containing wastes beneath the ET caps, achieves all of the elemental phosphorus related remedial action objectives for the FMC OU.

Even if EPA were at some future time to select a treatment regime for any portion of the buried phosphorus wastes, preventing infiltration as quickly as possible is critical to protection of human health and the environment. Any possible treatment of the significant volumes of buried phosphorus wastes in the FMC OU would likely take two to four decades of intensive risk-laden work according to EPA estimates (*Cost Estimate Addendum for Soil and Groundwater Alternatives for the Proposed Plan for the FMC Operable Unit, BAH 2011).* As such, infiltration and subsequent migration of contaminated groundwater could not reasonably be allowed to continue unabated during any such treatment period. In addition, soil caps and institutional controls are necessary to provide immediate protection from any direct contact, ingestion, or inhalation risks to human health or the environment. For these reasons, the interim soil remedy is wholly consistent with Section 121(d)(4)(A) of CERCLA. Nothing related to the installation of ET caps prevents or inhibits EPA from selecting any future treatment of the underlying wastes as the Tribes have urged. ET cap removal costs, should that be necessary, would represent a small percentage of the total cost of treatment and from a technical perspective, would be relatively straight-forward to implement. Nothing therefore in the installation of ET caps in any way prevents or inhibits EPA from meeting (or waiving as may be necessary on or before completion of remedial action) any applicable or relevant and appropriate requirement.

It is important in this regard to emphasize, as stated in formal consultation with the Tribes, that based on the Administrative Record including the SRI/SFS and all studies done to date, EPA does not believe there is a safe, cost effective, and implementable method to treat these buried phosphorus wastes in FMC OU soils. However, EPA and the Tribes will be participating in an additional independent assessment of treatment options, the results of which EPA will ultimately consider within the context of the National Contingency Plan (NCP) remedy selection criteria with respect to the FMC OU.

13.2.6 THE PROPOSED INTERIM SOIL REMEDY DOES NOT MEET THE THRESHOLD CRITERION OF PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

EPA Response: As EPA understands the Tribes' concerns expressed in this comment, the Tribes do not believe the soil remedy meets the threshold criterion of protectiveness because:

> 1) "EPA does not discuss protection from phosphine in soils because EPA neglects to address the migration of phosphine as a remedial action objective."
>
> 2) "EPA fails to consider the impacts of phosphine on soils and soil biota," particularly in the subsurface strata.
>
> 3) The proposed phosphine monitoring program is flawed and inadequate because it: a) is premised on an erroneous assumption that phosphine would not be generated in older pond areas or deep within soils ("especially at the furnace building area"); b) would monitor only accumulations of phosphine when it may instead migrate in the soil without accumulating; c) is limited to the surface and shallow subsurface within and around the capped material; d) has no in-depth phosphine monitoring; and e) is premised on a single sampling event in the summer when phosphine generation is lowest without adequate consideration of seasonal fluctuations in phosphine gas generation.

Taking these enumerated comments in turn:

> 1) Page 37 of the Proposed Plan presented the following RAO for phosphine:
>
> "Minimize generation and prevent exposure to phosphine and other gases at levels that represent unacceptable risk to human health or the environment."
>
> This RAO is in the interim ROD Amendment and necessarily includes any migration of phosphine that could cause any harmful exposure. Phosphine generation will be minimized through the installation of ET caps over areas known to contain elemental phosphorus. Since elemental phosphorus reacts with water to form phosphine, the potential for phosphine generation within the soil column is greatly reduced when water infiltration is minimized or eliminated. Although no phosphine has been detected in ambient air in the FMC OU,

institutional controls will limit access to the OU and thus prevent any exposure. A phosphine monitoring program will monitor any changes in phosphine generation or migration. In the event changes occur that pose potential risks from phosphine to human health or the environment, EPA will require additional action as appropriate.

2) At the direction of EPA, FMC conducted an extensive site-wide gas assessment study to characterize the generation of phosphine and other gases within the FMC OU. No assumption was made that phosphine would not be generated in older pond areas or deep within soils. In fact, one of the study areas the assessment focused on was the former furnace building area. The findings of the study are fully documented in the *"Site Wide Gas Assessment Report for the FMC Plant Operable Unit (October 2010)."* Results from the former furnace building area and other areas within the FMC OU that are known to contain elemental phosphorus show that low levels of phosphine and other gases may be generated at these locations and that these gases may be present at low levels within the soil column. However, no phosphine was detected in ambient breathable air within the FMC OU. Phosphine is unstable in the presence of air, and EPA believes that most if not all of the phosphine generated in the FMC OU unsaturated zone soils degrades to phosphate prior to release to ambient air due to the presence of air within the soil column.

Gas samples were collected within areas of the former FMC operations area that have the potential to generate phosphine gas (PH3) due to known P4 contamination. The sampling encompassed both the FMC OU areas and areas where closed RCRA-regulated waste management units that are not part of the FMC OU are located.

These results revealed that although low levels of phosphine gas, and to a lesser extent other gases, are generated in the subsurface as a result of the presence of elemental phosphorus within the FMC OU, levels in soil gas were all below 1 ppm. The permissible exposure limit (PEL) for humans of phosphine is 1 ppm for 15 minutes or 0.3 ppm averaged over eight hours. Of the 420 total recorded soil

gas readings, 37 (only 9%) were non-zero (>0.00 ppm) and individual readings ranged from 0.02 to 0.15 ppm PH_3. No phosphine or other gases were found to be migrating to the ambient breathable air at measureable levels where a complete exposure pathway could occur.

Placing ET caps over the areas of known subsurface elemental phosphorus within the FMC OU, is completely consistent with how EPA has addressed other elemental phosphorus-contaminated sites across the country. Further, engineered containment of wastes is a very common technique employed at many Superfund sites and at solid and hazardous waste landfills throughout the country. When designed, implemented, and monitored properly, containment or closures of this kind are considered protective of human health and the environment without regard to risks posed to underlying soil biota by gases generated from the waste.

The RI did not assess risk to microorganisms in the Former Operations Area. An appropriate RI to characterize any site (EPA's obligation pursuant to Section 300.430(d)), including the baseline risk assessment, does not require a complete analysis of impacts to microorganisms in the soil regardless of whether EPA ultimately decides that these areas require remediation.

3) As stated in the Proposed Plan and IRODA, EPA will require the development of a detailed long-term gas monitoring program for the FMC OU during the Remedial Design phase. EPA expects the tribe to be involved in planning and commenting on the gas monitoring plan and on all other aspects of the Remedial Design.

Based on the foregoing and all of the information in the Administrative Record and Proposed Plan, EPA firmly believes that implementation of the proposed interim remedial action will be protective of human health and the environment.

13.2.7 EPA SHOULD AMEND ITS REMEDIAL ACTION OBJECTIVES TO ADDRESS PHOSPHINE AND INCLUDE PROTECTION OF SUBSURFACE STRATA

EPA Response: EPA believes this concern is adequately addressed in the response to Comment 13.2.1 and RAO 2 presented in the Proposed Plan and contained in the IRODA. This issue is also discussed further as part of the response to Comment 13.2.6.

13.2.8 THE PROPOSED INTERIM SOIL REMEDY DOES NOT MEET THE THRESHOLD CRITERION OF ARAR COMPLIANCE

EPA Response: As stated in the Proposed Plan, CERCLA Section 121(d) mandates that upon completion, a remedial action must at least attain (or waive) all applicable or relevant and appropriate requirements (ARARs) of any Federal environmental laws, or more stringent promulgated State environmental or facility-siting laws. In December 2010, the Shoshone-Bannock Tribes promulgated Soil Cleanup Standards for Contaminated Properties (SCS) as regulations under their Waste Management Act, and on December 3, 2010 sent a letter to EPA requesting that they be designated as ARARs for the FMC OU.

EPA is evaluating the SCS to determine whether these regulations may be ARARs. This evaluation will require careful federal review prior to a decision as to whether all or a part of these unique and potentially precedential SCS are ARARs. The Final Record of Decision (ROD) Amendment will include a remedial action that will fully attain or provide for the formal waiver of all ARARs, or portions thereof, including the SCS to the extent they are determined to be ARARs by EPA at or before the completion of remedial action. Any and all waivers will be pursuant to Section 121(d)(4) of CERCLA. The IRODA, as set forth in the response to Comment 13.2.5, invokes the waiver in Section 121(d)(4)(A) of CERCLA for the interim remedial action. EPA believes this interim action will address immediate human health and environmental risks at the FMC OU and will neither exacerbate conditions at the EMF Site nor interfere with the implementation of any future final remedy.

The Tribes also state that "RCRA Part B standards should be considered as ARARs" for the FMC OU, and appear to state that FMC OU wastes would be covered by a RCRA Part B permit but for "regulatory inefficiencies." EPA assumes the comment refers to the RCRA Part B waste management standards at 40 CFR Part 264. EPA agrees generally that these waste management standards are ARARs to the extent that they are relevant and appropriate, i.e., generally were

meant for circumstances sufficiently similar to those encountered at the FMC OU. However, the following describes why these standards are not ARARs for the FMC OU.

In 1980, when RCRA hazardous waste permitting and associated waste management regulations were promulgated, most elemental phosphorus production and associated waste generation, including storing these wastes in ponds or surface impoundments, was exempted from RCRA permitting and waste management standards by what is commonly referred to as the Bevill Amendment or "Bevill exemption." In 1990, the "Bevill exemption" for wastes from elemental phosphorus production was revised making elemental phosphorus mineral processing subject to RCRA permitting and waste management standards, but not retroactively (just as RCRA management standards were not retroactive to wastes disposed of before 1980). By 1990, the elemental phosphorus containing wastes addressed in the IRODA for the FMC OU had already been disposed of. They would therefore not have been subject to RCRA waste management standards as part of any RCRA permitting. This would certainly be the case for all management standards related to waste storage or disposal siting, including seismic and other location standards, specifically referred to in the comment; and these pre-disposal siting or location standards would similarly be neither relevant nor appropriate to or for previously disposed of wastes.

13.2.9 THE PROPOSED INTERIM SOIL REMEDY DOES NOT MEET THE CERCLA PRIMARY BALANCING CRITERION OF LONG-TERM EFFECTIVENESS AND PERMANENCE

EPA Response: It is important to recognize that the five balancing criteria for CERCLA remedy selection are considered collectively, as a whole or group for the purposes of comparing remedial alternatives that meet both of the threshold criteria: protection of human health and the environment and attainment (or appropriately waiver) of ARARs. The five balancing criteria are long term effectiveness and permanence, reduction of toxicity, mobility and volume through treatment, short term effectiveness or impacts, implementability, and cost.

With proper monitoring and maintenance, containment of contamination provides for long-term effectiveness and permanence. This is particularly true when considering the fact that soil caps are, from an engineering standpoint, relatively easy and cost effective to implement, monitor, and maintain indefinitely. However, EPA readily agrees, as set forth in the Proposed Plan, that capping, particularly as compared to any potential treatment remedy would rate lower or less

effective for the first two of the five balancing criteria outlined above. Conversely however, as emphasized in the Proposed Plan, the selected interim remedy for the FMC OU rates higher or more effective for the other three balancing criteria. Therefore, in EPA's judgment, the Selected Remedy ranks higher overall when the five criteria are considered collectively, as they are designed to be. All of the caps will be constructed of local earthen materials of varying thicknesses using, from an engineering perspective, simple, well proven and established technologies, including effective storm water drainage. Notwithstanding that no significant cap deterioration is expected to occur, long-term operation and maintenance (O&M) will include regular monitoring and repair as necessary to ensure long-term cap integrity. In addition, overall protectiveness will, as mandated by CERCLA, be thoroughly evaluated at least every five years for as long as hazardous substances remain at the FMC OU above levels that allow for unlimited use or unrestricted exposure. If at any time, the implemented remedial action is found to not be protective of human health or the environment, additional actions will be taken. EPA expects the Tribes full involvement in the five-year review process.

The Tribes have previously expressed concern about the fact that the Superfund process generally only projects thirty years into the future, rather than centuries or more. A fundamental reason for this horizon is that technology changes rapidly and cost estimating beyond thirty years introduces significant uncertainties. If an implemented remedy is later found for any reason not to be protective of human health and the environment, and a technological breakthrough allows for one or more safe and practicable alternatives to reinforce the insufficiently protective remedy in place, such potential technology could be fully evaluated during the five-year review process. EPA expects the Tribes to be fully involved in the five-year review process for the FMC OU, which will continue for as long as hazardous substances remain in place above unrestricted use levels.

The Tribes emphasize that phosphorous waste in particular may remain active for thousands of years. They appear to see this as necessarily all but mandating removal with or without treatment as soon as possible. EPA emphasizes in response that in our best professional judgment as long as containment remains protective, safe, reliable, and implementable, the risks over decades to remedial workers and the uncertainty and extraordinary costs associated with any current removal and/or treatment technology, make containment an overall superior choice.

With respect to potential leaching and migration of metals including phosphorus in the soil, containment technology to prevent the further leaching and migration of contaminants in soil and groundwater is a proven technology used on many Superfund sites and at RCRA regulated operating facilities throughout the country. It is also, as noted in response to a portion of Comment 13.2.6, the technology commonly employed at landfills throughout the U.S. and the world.

The FMC OU currently has an extensive infrastructure of groundwater monitoring wells and a groundwater monitoring program. As part of the groundwater Remedial Design for the FMC OU, extraction wells will be installed and the need for additional monitoring wells will be evaluated. In addition, a new groundwater monitoring program will be developed, with input from the Tribes, for the OU. EPA does not believe that reactions in the soil column or in the vicinity of the former furnace building will result in noticeable changes in groundwater. However, should they occur, they would be identified through the groundwater monitoring program. If changes in groundwater quality impact the protectiveness of the remedy or the ability to meet the RAOs, EPA will respond accordingly.

Regarding phosphine specifically, soil gas sampling and flux measurements have shown that the current rate of gas generation within the FMC OU is low and that phosphine is not migrating to the ambient breathable air (see response to Comments 13.2.1 and 13.2.6 for further information). However, EPA agrees with the Tribes that conditions could change over time. Therefore EPA is requiring a robust phosphine and gas monitoring program as part of the interim remedy that will monitor for phosphine and other gases in the soil column and in ambient air. A combination of soil gas, flux measurements, and ambient air samples will be collected on a regular basis. EPA expects the Tribes to review and comment on the details of the monitoring plan and sampling results. Should the sampling results show that gas is generated at a rate or level that poses a threat to human health or the environment, EPA will require additional action, as appropriate.

13.2.10 THE PROPOSED INTERIM SOIL REMEDY DOES NOT MEET THE CERCLA PRIMARY BALANCING CRITERIA OF REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT

EPA Response: As outlined in the response to Comment 13.2.9, the five balancing criteria for CERCLA remedy selection are considered as a whole to differentiate among viable alternatives that meet otherwise disqualifying threshold criteria. EPA readily acknowledges that capping and

institutional controls do not reduce the toxicity, mobility or volume of COCs through treatment because no treatment occurs. Capping is not treatment. However, as also stated in the response to Comment 13.2.9, in evaluating the five balancing criteria collectively in terms of the trade-offs among them, the Selected Remedy in the IRODA is the best choice considering all of the balancing criteria together.

13.2.11 OTHER CONCERNS WITH THE PROPOSED SOIL REMEDY

EPA Response: The first issue raised in the comments under this heading is a request to remove buried rail cars from the FMC OU slag pile as "known and uncontrolled sources of elemental phosphorus." The *SFS Report* documented that there are approximately 30 railcars buried approximately 80 to 100 feet below the surface of the slag pile although their contents are not known. As part of the risk assessment and feasibility study process, EPA reviewed all pertinent information and concluded that the slag pile, and any buried rail cars, could be safely and effectively managed in place by utilizing a soil cap and associated monitoring to detect any future migration of contaminants. EPA is not aware of any unacceptable risks that would be posed by managing these wastes in place as outlined in the Proposed Plan and selected in the IRODA.

The second issue raised under this heading is a Tribal request that EPA conduct a Human Health Risk Assessment using a Tribal risk scenario. As set forth in a December 1, 2008, e-mail from K. Lynch (US EPA Region 10) to K. Wright (SBT), EPA described and requested, but never received information from the Tribes needed to develop a Tribal scenario for a risk assessment. A similar request was made by the Tribes prior to the issuance of the 1998 ROD for the EMF Site. At that time, the Tribes were concerned that EPA had not considered Tribal cultural and other uses of site vegetation. EPA agreed to addend or amend the human health risk assessment as may be necessary if the Tribes would identify specific plants its members used, how frequently, and in what way they consumed or otherwise were exposed to them. EPA did not receive this information and was ultimately told that the Tribes considered this information, which is essential to performing any meaningful assessment of associated risks, necessarily private and in some instances sacred, or both, and that revealing it risked commercialization by non-members among other undesirable consequences. EPA respected this Tribal decision not to reveal this information and was left with no means to evaluate a Tribal risk scenario.

EPA reviewed, provided corrective comments, and subsequently approved the Human Health Risk Assessment that is presented in the *SRI Report* (for the former FMC operations area) and *SRI Addendum Report* (for the Northern Properties, the SUA, and the WUA). The Tribes also reviewed and commented on these documents. EPA believes the comments submitted by the Tribes were adequately addressed, but understands the Tribes disagree with this assessment. EPA believes the Human Health Risk Assessment in the *SRI Report* adequately reflects anticipated land use and thus potential future risks throughout the FMC OU and particularly within the former phosphate production area of the FMC OU. While the selected remedy also includes enforceable land use controls, if land use changed in the future, potential impacts on the protectiveness of the remedy would be evaluated at that time or in a future Five Year Review.

13.3 RESPONSES TO THE DECEMBER 2, 2011 COMMENTS FROM ROGER TURNER, REPRESENTING THE SHOSHONE-BANNOCK TRIBES REGARDING THE FMC OPERABLE UNIT PROPOSED PLAN

13.3.1 General Comments

FMC estimates that there are 5,050 to 16,380 tons of elemental phosphorus in 780,100 cubic yards of contaminated material in place down to 80 feet within the FMC, OU alone. This is a monumental amount of contaminated soils, and Federal RCRA laws should have come into play to control the accumulation of hazardous waste before the long CERCLA process was initiated. Of course FMC knew first-hand of the large degree of their contaminants in these soils and groundwater and should have been working with EPA and the Shoshone-Bannock Tribes at least twenty years ago to begin reducing the on-going releases and cleaning up the RCRA releases. Unfortunately, FMC chose the route of using their attorneys to look for loop-holes to delay the clean-up, hide hazardous waste and cut costs. EPA should take the lack of cooperation into consideration as part of this important plan to clean-up the hazardous waste at this important site, located on the Fort Hall Reservation.

EPA Response: In 1980, when RCRA hazardous waste permitting and associated waste management regulations were promulgated, most elemental phosphorus production and associated waste generation, including storing these wastes in ponds or surface impoundments, was exempted from RCRA permitting and waste management standards by what is commonly referred to as the Bevill Amendment or the "Bevill exemption." By the mid-1980s, with both the FMC and J.R. Simplot Company (Simplot) Pocatello facilities exempt under Bevill from RCRA hazardous waste regulation, EPA initiated the process to add the Eastern Michaud Flats (EMF) Superfund Site (consisting of hazardous substance releases from both facilities) to the CERCLA National Priorities List (NPL). The EMF Site was listed on the NPL on August 30, 1990. At approximately the same time, the "Bevill exemption" for wastes from elemental phosphorus production was revised making elemental phosphorus mineral processing subject to RCRA permitting and waste management standards, but not retroactively (just as RCRA management standards were not retroactive to wastes disposed of before 1980). FMC's elemental phosphorus containing wastes disposed of prior to the revisions to the Bevill Amendment, which were initially addressed in the 1998 ROD for the Site, had already been disposed of and therefore

continued not to be subject to RCRA waste management standards. However, RCRA regulation became applicable to all FMC elemental phosphorus manufacturing wastes generated after the Bevill Amendment revision. The cleanup of the post-Bevill revision RCRA wastes was the subject of a 1999 RCRA Consent Decree. On May 30, 1991, FMC (jointly with Simplot) agreed to perform a Superfund remedial investigation/feasibility study (RI/FS) for the EMF Site under an EPA Consent Order which specifically excluded FMC's RCRA regulated waste units.

13.3.2 Groundwater Comments

We support the plan to implement a long-term groundwater monitoring program and the program to monitor phosphine gas at the site. I support the groundwater treatment section of the FMC-Plan, however I recommend that EPA closely monitor the extraction well design and placement to ensure that the extraction wells collect all contaminated groundwater for treatment. EPA should routinely sample and analyze the groundwater, and surface water, and storm-water collection ponds --independently of FMC or FMC contractors to assure adequate oversight of the monitoring.

EPA Response: The groundwater pump and treat system will be designed to capture all contaminated groundwater exiting the FMC OU thus providing hydraulic containment of contaminated groundwater. Extraction wells will be located in the northeastern corner of the former phosphate production area to capture impacted shallow groundwater before it can migrate down gradient beyond the former phosphate production area boundary. More precise engineering specifications for the system will be developed in the Remedial Design.

EPA agrees with the comment that monitoring must be conducted to ensure the extraction system is performing as it was designed. Detailed long-term groundwater, surface water, and phosphine monitoring plans will be developed during the Remedial Design phase and further refined during and following construction of the groundwater extraction and treatment system. Monitoring of on-site sediment and surface water (from storm-water retention areas) will also be carefully evaluated during the Remedial Design. EPA expects the Tribes to be fully engaged in the Remedial Design and remedy implementation processes, including all of the aspects of the monitoring program(s).

EPA's Superfund remedial program was designed and, particularly since the expiration of its independent tax base, has been funded by Congress with the expectation that willing responsible parties will perform remedial studies and cleanups with EPA oversight pursuant to enforceable court decrees or orders, where EPA determines that such parties can properly perform. The vast preponderance of CERCLA remedial action performed at privately owned Superfund sites have been performed in this manner since Section 122(d) of CERCLA was enacted in its current form in 1986. Assuming FMC agrees to enter into a consent decree substantially conforming to the current United States Model CERCLA RD/RA Consent Decree (last revised in 2011 and available on the EPA web site), FMC would typically perform all sampling and other activities with EPA oversight, just as FMC performed most such tasks during the RI/FS (with Simplot) and the SRI/SFS. Oversight includes, but is not limited to, review and approval of field sampling and data quality assurance plans, observing sample collection, reviewing data reports, and collecting split samples to be analyzed independently. EPA expects the Tribes to actively participate in all Remedial Design and Remedial Action implementation processes and activities, including reviewing and commenting on all draft sampling and other plans or submittals, evaluating data collected, and direct field oversight. As in the past, EPA will continue to ensure the Tribes have funding to continue these oversight activities.

13.3.3 Buried Pipes and Tanks Comments

We support the cleaning of underground reinforced concrete pipes that contain elemental phosphorus and radionuclides to prevent exposure to potential future workers; however, for EPA to be consistent, the railroad tank cars secretly buried under the slag pile should undergo excavation and cleaning of hazardous waste sludges. FMC has been very thorough and predictable in sending any and all scrap metal the short distance to the recycling businesses in Pocatello. If the Tank cars were clean and empty why would FMC bury them rather than sending them to their neighboring recycler? EPA should require a conditional plan, where FMC uncovers at least two tanks, and if they contain sludges that are hazardous waste or other contaminant of concern, then all the tanks should be extracted from the slag pile for treatment and clean-up.

The claim, that there is not enough hydraulic head to allow tank car contamination to reach the ground- or surface-water is not a valid one, in that storm events may cause a surge of aqueous

movement through the slag pile. Also, for all we know, the tanks may have enough water in them to contribute to a surge of contaminated groundwater once erosion causes them to breach. Finally, there may be unknown aqueous contaminants in these tanks, completely distinct from simple P4 sludge, such as organic solvents, that have greater tendency to move through the aquifer or vadose zone. In summary, EPA doesn't know the contents of these tanks, since they were buried secretly and consequently should require these tanks to be excavated, removed and contaminants treated and disposed of.

EPA Response: EPA agrees that the contents, if any, of the buried railcars are unknown. However, EPA also believes that it is highly likely and should be assumed that the railcars contain one or more types of waste generated at or by the facility. The selected remedy for the slag pile and railcar area is consistent with all known facility waste types and is expected to be fully protective of human health and the environment. It similarly cannot be known if the railcars were filled with water or nitrogen, along with elemental phosphorus-containing wastes, prior to burial. The presence of water with such wastes would increase the likelihood that phosphoric acid would be formed, resulting in an increased rate of internal corrosion. If some or all buried railcars have deteriorated through corrosion, any attempt at removing them would likely result in exposure of elemental phosphorus sludge to air and an elemental phosphorus fire, which is a risk posed whenever dry elemental phosphorus is exposed to oxygen, as in ambient air.

Currently, groundwater monitoring data down gradient from the suspected location of the railcars indicates that no potentially harmful railcar contents are in contact with groundwater. Down gradient groundwater monitoring data will continue to be used to determine if such contents are leaking or begin to leak, and are contaminating groundwater. Should monitoring data indicate the presence of any threat to human health or the environment, additional actions will be evaluated at that time.

13.3.4 New Utility Lines and Extraction Wells Comments

The following comment arises from the following excerpt of the list of remedial actions, Page 10:

" Implementation of 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."

The above remedial action infers that FMC may need to excavate soil in order to install extraction wells and utility lines. The Air Quality Department fully supports the need for extraction wells. However, any excavation that would occur where there is elemental phosphorus should be prohibited, until the soils are treated. To do otherwise may cause hazardous air releases and risk the health of workers. What utility lines are needed to be buried? All utility lines should be above ground, or at least be buried only within the cap depth, and even in that case, have aboveground markers placed to avoid inadvertent damage to them. Once the clean-up is complete, these utility lines should be removed by FMC.

EPA Response: The existing RCRA pond caps will be integrated with the development of new CERCLA-required caps, access roads, groundwater extraction system, and utility lines. The engineering details related to this integration will be developed during Remedial Design. Upon completion of the construction of the interim remedial action, management and maintenance requirements and procedures for as long as the caps are in place will be documented in an EPA-approved Operation Management and Monitoring Plan (OMMP). The OMMP will describe how any future excavation activities, including any possible work related to buried utilities, would be conducted to ensure to protection of workers.

If, during the installation of groundwater monitoring or extraction wells, or any utility lines or any other activity, elemental phosphorus is encountered at levels that present risks to human health or the environment, such wastes would be managed and disposed of as RCRA investigation derived wastes. Further, EPA will require submittal of a Health and Safety Plan for all activities that will describe all required personal air monitoring during excavation work and associated actions to prevent unacceptable exposures to workers, and a Fugitive Dust Mitigation Plan which will require, among other things, perimeter air monitoring to protect nearby residents and others in the vicinity of the FMC OU. EPA does not have the authority to require FMC to remove utility lines after a remedial action has been implemented since the purpose of the CERCLA remedy is to protect human health and the environment by preventing contaminants of concern from entering pathways which could reach receptors. In most cases, utility lines do not

pose a threat to human health and the environment. EPA expects the Tribes to review and comment on documents generated as part of the Remedial Design phase and the Operations Management and Monitoring Plan.

13.3.5 Treatment of Elemental Phosphorus in the Soils

The treatment technology assessment undertaken several years ago, which has led EPA to preliminarily select a cap over the contaminated soils is not up-to date with the current technologies. The INL site approximately 60 miles north of the EMF site, routinely excavates contaminated soils with the workers safely protected in covered equipment. An inert gas blanket could be used, along with heavy equipment that protects workers from igniting phosphorus compounds in the soil and transferring the soils to the treatment system.

With reduced manpower at EPA due to budget cuts, EPA will be less and less able to oversee this clean-up plan and that is why a treatment option of the phosphorus waste is advisable. One of the problems is of enforceability, for example, is the Soil/Fill management plan proposed by EPA that prohibits any future excavation over most of FMC, including a prohibition of digging for placement of utilities, and is unenforceable and destined to fail. With phosphorus wastes remaining ignitable or reactive for hundreds of years, and FMC actively marketing the property, there is a strong likelihood of future worker exposures to the toxic contaminants lying just under the surface of this facility. That is why the more protective and enduring treatment alternative is preferred. EPA should approve the treatment of the Phosphate-contaminated waste now, under controlled conditions, rather than to allow future workers and the public to be exposed under uncontrolled conditions in the years, decades, or centuries ahead, with a cap alternative.

The reactivity and ignitability characteristics of P4-contaminated soils continues for decades, and as time goes on it is inevitable that excavation into the soils will occur, to risk workers and adversely impact with the environment. While it is most beneficial to human health and environment for FMC to extract and treat the phosphorus-contaminated soils, the alternative of soil stabilization was also not adequately considered. EPA should look at the alternative to use soil stabilization, perhaps in combination with an ET cap, as a way to reduce ignitability and reactivity. Stabilization converts hazardous elements into less soluble, mobile or toxic forms. Mixing the right combination of binding reagents into the P4-contaminated soils may allow them to be either excavated and disposed of in a landfill or used in another area of the FMC site as

fill. The solidification treatment has the further benefit of improving the structural properties of the site as well.

The EPA should review in more detail the possibility of oxidation treatment of the phosphate soils. Because of its outstanding oxidizing power and low cost, sodium hypochlorite can be considered one of the best candidates for the treatment of phossy water. Kinetics studies of Phosphorus with sodium hypochlorite performed by Lai (1979) show that the oxidation of phosphorus is extremely rapid. It is believed that a dose of a few milligrams of hypochlorite per liter should be adequate for the complete oxidation of phosphorus.

EPA Response: The contamination at Idaho National Laboratory is very different in nature than the elemental phosphorus-contaminated soils at FMC. Wastes at INL are heavily contaminated with radionuclides, primarily cesium-137, cobalt-60, tritium, strontium-90, iodine-129, and technetium-99. The pyrophoric elemental phosphorus-contaminated wastes at FMC would require entirely different kinds of excavation techniques and personal protective measures than those used at INL because the hazards posed to workers by direct radiation exposure are not analogous to the hazards posed to workers by elemental phosphorus releases including fires and explosions.

An inert gas blanket covering portions of elemental phosphorus-contaminated soils within an enclosed area is not an implausible idea, though it is very difficult to work in over extended periods of time (decades in this case), and creates dangers of its own for remediation workers. Most significantly however, it does not begin to address the problems associated with how the extraordinary volume of ignitable elemental phosphorus-contaminated material at the FMC OU would be sorted, delivered, handled, managed and processed within a treatment plant.

With respect to any prospective EPA "manpower" or budget cuts, installation of ET caps containing the elemental phosphorus wastes at the FMC OU would occur in a fraction of the time (and cost) of any treatment regime, danger and practicability issues aside. During this shorter installation period, FMC can be expected to pay for both the installation and EPA and Tribal oversight costs pursuant to a judicial Consent Decree (or Unilateral Order if a Consent Decree cannot be negotiated and entered). Further, any Consent Decree or Unilateral Order implementing the IRODA would also require FMC to provide financial assurance (such as a

performance bond, letter of credit, trust account, etc.) to ensure the obligations outlined in the CD or UAO are fulfilled. Conversely, the implementation of a significantly more complicated, time consuming, and costly treatment regime, danger and practicability issues aside, requiring substantially more oversight, would be more likely to be affected by prospective fiscal uncertainties, at both FMC and EPA.

Land-use restrictions, in the form of enforceable environmental easements or covenants will be placed on all capped areas (areas known to contain metals and elemental phosphorus-contaminated wastes and soils) to prohibit any excavation or other penetration that may cause exposure. All caps, and particularly ET caps, will be rigorously maintained with EPA oversight, or by EPA itself if necessary, as explained above, and any capping that may be disturbed by utility operations will be restored. Caps will be regularly monitored and repaired as necessary.

Easements, environmental or otherwise, are fully enforceable property rights with any violator fully liable for any violation. Such easements are recorded in the chain of title of any subject property and run with the land in perpetuity in Idaho, thereby binding all future owners. They are typically enforced by the United States through the Consent Decree that requires them, or by the Grantor of the easement (who is a Settling Defendant to a Consent Decree or a Respondent to an EPA Unilateral Administrative Order). Violators of an easement related to a CERCLA matter also become responsible parties under Section 107(a) of CERCLA if their violation generates any CERCLA response costs. The wording of these easements is typically dictated by a Consent Decree. Easements also provide notice to prospective purchasers of their limitations. For as long as any hazardous substances remains in place above levels protective of unrestricted use, at a minimum EPA will perform reviews every five years to determine if conditions at the FMC OU are protective of human health and the environment, as mandated by CERCLA. Environmental covenants operate very similarly though there are some legalistic procedural differences.

The residual long-term risks of capping the elemental phosphorus-contaminated soils at the FMC OU were weighed against the short-term risks of excavating these soils and found comparatively minor. EPA determined the risks posed to remediation workers excavating and treating these soils, using currently available technologies, far outweigh the risks of capping, and provides a comparable level of protection with proper maintenance and the mandated five year review

process. The statement in this comments that "there is a strong likelihood of future worker exposures to the toxic contaminants lying just under the surface," is not scientifically supported. Subsurface elemental phosphorus does not pose a risk to human health or the environment if left undisturbed, although it is anticipated to remain reactive into the foreseeable future.

Soil stabilization was considered as a possible remedial technology in the *Treatment Technologies for Historical Ponds Containing Elemental Phosphorus – Summary and Evaluation, EPA 2003*. This report found that no data was available (as of 2003) on the effectiveness of soil stabilization treatment. In 1998, EPA selected *in situ* soil stabilization as a remedy for elemental phosphorus-contaminated materials at a Stauffer Management Company site in Tarpon Springs, Florida. However, at the time of the report, no *in situ* stabilization pilot studies had been performed at the Tarpon Springs facility.

A pilot test for *in situ* solidification/stabilization was conducted at this Stauffer facility during late January to mid February 2006. On February 15, a fire occurred in the test area from a reaction between the subsurface elemental phosphorus and the cement mixture used as an oxidative reagent for solidification. This reaction contributed to the formation of phosphine gas which bubbled through the cement slurry. Agitation of the mixture exposed elemental phosphorus to the air that resulted in ignition of the elemental phosphorus. Onsite workers used water, sand, and a carbon/sand mixture to try to control the fire. Ultimately, the Tarpon Springs Fire Department responded to the incident. Site workers continued to control flare ups on the test cell that evening and continued monitoring for several days. As a result of the pilot scale study, EPA concluded that the *in situ* solidification remedy at Tarpon Springs could not be implemented. In June 2007, EPA issued an Explanation of Significant Differences (ESD) to modify the on-site solidification component of the remedy. No solidification will be performed at this site; instead a ground water cut-off wall was designed to surround much of the waste in ponds on the southern parcel and reduce the movement of ground water contamination. Other components of the remedy, including capping and restrictions regarding future on-site ground water use and land use, remain unchanged.

The FMC OU has significantly higher concentrations of subsurface elemental phosphorus over a significantly larger area than the Stauffer Tarpon Springs facility. Based on the experience at that facility and other available technical information, including the scope and degree of FMC

OU contamination, EPA determined that *in situ* stabilization of FMC OU elemental phosphorus-contaminated soils was not a viable option. EPA therefore selected an interim remedy that includes groundwater extraction, capping, and institutional controls that are consistent with the Tarpon Springs remedy.

EPA has also committed to working with the Tribes to commission another independent review of potential soil excavation and/or treatment technologies (in-situ or ex-situ) to ensure no promising technology for treating elemental phosphorus was missed during the Supplemental Feasibility Study process. The details of this review are currently under discussion between EPA and the Tribes. However, it is critical to implement the interim remedy as quickly as possible to stop the migration of contaminated groundwater from the FMC OU onto the Simplot OU, potentially impacting that remedy, and the Portneuf River, while the possibility of treatment of buried elemental phosphorus-contaminated soils continues to be researched.

13.3.6 RCRA Violations with the Discarding of Waste Below and Near the Furnace Building

EPA should take into account the long history of EPA violations by FMC at this site, along with their lack of cooperation in disclosing, early on, the great quantities of hazardous waste they were releasing to the soils. Clearly, FMC was subject to RCRA laws in their discarding and disposal of the solid and ignitable waste below their furnace building and surrounds.

EPA Response: EPA recognizes and shares many of the Tribes' frustrations with environmental conditions at the EMF Site and the FMC OU in particular, and with many past actions of FMC and Simplot at the Site. However, EPA believes it is critical to move forward with the interim remedy outlined in the Interim ROD Amendment to address the legacy of contamination in the FMC OU. Further, EPA believes, based on the Administrative Record for the FMC OU, a remedy requiring the capping of contaminated soils and waste on site and collection and treatment contaminated groundwater is the best way to protect human health and the environment. Soil treatment technologies for elemental phosphorus will be further evaluated by the independent review EPA has committed to undertaking. For the history of RCRA hazardous waste regulation and the Bevill Amendment, see also the response to the first comment of Section 13.3.

13.3.7 ET Cap Details Are Too Vague

The FMC-OU-Plan is too vague in the details of the ET cap construction to allow adequate review. The question of how the cap depth will be monitored and maintained is not answered. We have concern that between the time of soil application and seed growth of the vegetative cover, there may be enough soil and wind erosion to expose parts of the contaminated soil and slag pile or reduce the soil cover to depths that are not protective. What is the plan to prevent this?

We recommend at least two feet of soil depth on the slag pile and the placement of an array of depth indicator stakes or rods that would better enable inspections of the cap depth and integrity to ensure that the one-foot depth is a "long-lasting minimum depth" not just a "start-up depth". In order to determine if the caps are effective EPA should require an array of boreholes with water detection equipment such as pisometers to determine if water is making its way below the caps and reacting with, or mobilizing the contaminants.

EPA Response: Evapotranspiration and gamma caps will be designed to meet specific engineering and performance specifications developed for optimal location-specific performance in prevailing conditions, specifically including potential soil and/or wind erosion. They will be monitored and maintained to ensure proper soil depth and vegetation cover. Precise engineering details in monitoring and maintenance planning documents will be developed during the Remedial Design, and will be enforced as necessary after remedy implementation. EPA expects the Tribes to review and comment on all design and implementation submittals, including all long-term monitoring plans.

The quality and projected durability of the proposed caps is expected to be very high and the residual risk levels after capping are very low. All the proposed caps will be constructed of local earthen materials of specific thicknesses determined during Remedial Design on location-specific bases for optimal performance. They will all be engineered for durability and performance as well as effective storm water drainage.

13.3.8 Tribal Air Quality Rules as Applicable or Relevant and Appropriate Regulations (ARARs) Under CERCLA Actions

The Tribal Air Quality Department is very concerned about the fugitive dust and other releases from the FMC site during and after the clean-up. The EPA should work closely to ensure that Tribal Air Regulations are enforced. The Air Quality Department sent a request to Region 10

EPA Linda Meyer to consider them as ARARS. These regulations were reviewed and approved as part of the "Treatment-As-State" application to EPA for these air quality regulations that adopt many of the Clean Air Act requirements. Although Linda Meyer acknowledged that she received it, as did Kira Lynch, we did not receive a response to our request and believe that EPA may not have reviewed it. EPA may have delayed the decision to review the ARAR status, because in the original ROD they did not think Superfund was taking actions that would result in air releases, however, now that hundreds of acres are proposed for capping by heavy equipment, the potential to emit air emissions is significant. Please review the request for ARAR status (attached) and revise ARAR status of the Tribal Air Quality Rules.

EPA Response: EPA has considerable experience in overseeing the placement of caps and soil covers like those selected for the FMC OU and a Fugitive Dust Mitigation Plan that will outline specific requirements as well as Best Management Practices (BMPs) will be developed, approved, and followed. This Plan will include effective monitoring and actions to minimize fugitive dust and other potential releases during capping and/or any other aspect of remedy implementation. EPA expects the Tribes to review all remedial design and remedial action implementation documents, as well as all monitoring data, and provide comment and input in the development of effective BMPs.

EPA provided an e-mail response to Roger Turner dated March 14, 2008, from a (now former) EPA Region 10 attorney who specialized in tribal matters, Rich McAllister, regarding the Tribal Air Quality regulations referred to in this comment as part of the Tribes' Clean Air Act (CAA) Treatment As State (TAS) application to EPA. This McAllister e-mail was a reiteration of the same substantive EPA response in a letter dated November 1, 2007, from EPA Region 10 attorney, Julie Vergeront, specializing in CAA matters generally, to Roger Turner. As the McAllister e-mail states, the Tribes' TAS application, dated October 20, 1999, sought, and EPA approved, TAS status only for the limited purposes of Sections 105, 106, 107(c)-(e), and 505(a)(2) of the CAA. The Tribes did *not* seek and EPA did *not* approve TAS for the purposes of Section 110 of the CAA *or of the Tribal Air Quality regulations* as represented in this comment. Such air quality regulations would be approved under a Section 110 Tribal Implementation Plan (TIP) or CAA permitting program, neither of which the Tribes have sought approval for. Although these tribal standards were submitted to EPA as Attachment 7 of the

Tribes' TAS application, for the reasons clearly outlined in the McAllister e-mail, they were neither reviewed nor approved by EPA.

In any case, to be ARARs, duly promulgated state (or tribal) standards, as set forth in Section 121(d)(2)(A)(ii) of CERCLA must be more stringent than federal standards. The comment states only that these tribal regulations "adopt many Clean Air Act requirements." Similarly, in the McAllister e-mail, Roger Turner is quoted to say only that they "incorporate many Clean Air Act standards." The comment above does not state, nor is EPA aware of any claim by the Tribes, that any of its specific standards or requirements are more stringent than federal standards. Therefore, also for this reason, these tribal standards are not ARARs for this remedial action.

13.4 EPA RESPONSE TO THE DECEMBER 2, 2011 COMMENTS FROM THE FMC CORPORATION REGARDING THE FMC OPERABLE UNIT PROPOSED PLAN

FMC General Comment 1: *FMC supports and is prepared to timely implement Soil Alternative 3 as presented in the Proposed Plan*

FMC supports EPA's proposed Soil remedial Alternative 3, and in particular EPA's incorporation of redevelopment into remediation of areas at the site. EPA's proposed containment (capping) remedy for the FMC Plant OU has been the remedy selected and implemented for other similar sites, including other former elemental phosphorus production facilities such as the Stauffer Tarpon Springs, Florida Superfund Site. Soil Alternative 3 meets the threshold criterion of overall protection of human health and can be implemented within 2 to 3 years following entry of the Remedial Design and Remedial Action Consent Decree. Constructing Evapotranspirative (ET) caps at the identified Remediation Areas (RAs) within that time frame will accomplish the most significant environmental benefit by eliminating or minimizing future source loads to groundwater. Further delay in implementing these source control actions will result in additional migration of specific Constituents of Concern (COCs) to groundwater as detailed in the Groundwater Current Conditions Report for the FMC Plant OU. The combination of ET caps, soil caps, and institutional controls will prevent potential future exposure to soil containing COCs at levels that present a risk to human health and the environment.

The Administrative Record for the FMC Plant OU contains significant and detailed evaluations of potential technologies and alternatives for excavation and treatment of soil containing elemental phosphorus. Experts from EPA and the U.S. Army Corps of Engineers performed multiple independent evaluations, and FMC and its consultants and contractors, who have extensive experience working at the FMC plant site and other elemental phosphorus production and handling facilities, have considered all current and potential excavation and treatment technologies for elemental phosphorus in soil. Those evaluations all found that there is no treatment technology that has been operated at a full scale that would be capable of safely and reliably treating elemental phosphorus-containing soils at the FMC Plant OU. More importantly, and as detailed in the SFS Report, any modified method to excavate elemental

phosphorus contaminated soil would be very difficult to implement, has never been implemented on any scale similar to the FMC OU, and represents a significant risk to remediation workers and the public.

During the EPA public meetings regarding the Proposed Plan, several people provided comments suggesting "modified" excavation methods that they believed would be effective and implementable. None of those suggestions are materially different than the modified excavation and treatment technologies evaluated in the SFS and rejected due to the high risk to workers and the public, difficulties to implement, and the grossly excessive cost for those alternatives that included excavation and treatment of elemental phosphorus-contaminated soil when compared to containment technologies that are proven, effective, and demonstrated to be protective of human health and the environment both during the implementation phase and in the long term.

EPA Response to General Comment 1: This comment does not require any change in the IRODA from the Preferred Alternative in the Proposed Plan.

FMC General Comment 2: *FMC supports and is prepared to timely implement Groundwater Alternative 2 as presented in the Proposed Plan*

FMC is prepared to implement EPA's proposed Groundwater remedial Alternative 2. However, as FMC has pointed out repeatedly, implementing the remaining source control actions at the FMC OU (e.g., ET caps) will accomplish the most significant environmental benefit by eliminating or minimizing future source loads to groundwater. Groundwater Alternative 2 is predicted to achieve a small increment of arsenic and total phosphorus mass reduction compared to Groundwater Alternative 1 by augmenting source control actions with groundwater extraction and treatment. The estimated cost to implement Groundwater Alternative 2 is disproportionate to the predicted benefit to groundwater and surface water.

In 2010, EPA issued an Interim Record of Decision Amendment (IRODA) for the Simplot OU at the EMF Site to address discharges of phosphorus to groundwater, similar to an April 2008 voluntary agreement that Simplot had entered into with the Idaho Department of Environmental Quality (IDEQ). Simplot is currently extracting contaminated groundwater at rates such that the IDEQ 2013 "intermediate" goals for phosphate reductions in the river were achieved in early 2011. Although not approved by EPA, Simplot's mass-loading studies indicate that FMC's

groundwater contributes less than 1% of the phosphate/total phosphorus loading and less than 5% of the arsenic loading to the Portneuf River from the EMF site.

The IRODA for the Simplot Plant Operable Unit does not provide separate cost estimates for the Simplot source control actions, such as installation of a synthetic liner on the receiving surface of the gypsum stack to reduce groundwater impacts and development and implementation of a source control plan, nor a cost estimate for the Simplot groundwater extraction system. However, of the estimated net present value (NPV) cost of $50.6M for Simplot to implement their IRODA, FMC believes most of that cost is related to the source control actions. The estimated total NPV cost just for FMC OU Groundwater Alternative 2 is $9.6 to $11.2M. The estimated cost for FMC's groundwater extraction system under Alternative 2 is likely more than the cost for Simplot's groundwater extraction system, but can address only the groundwater contaminant loading to the Portneuf River that is carried from the FMC OU – which Simplot's study has shown represents less than 5% of the EMF total. The substantial cost of groundwater extraction at the FMC OU is disproportionate to this marginal benefit.

EPA Response to General Comment 2: This comment does not require any change in the IRODA from the Preferred Alternative in the Proposed Plan.

There are no provisions under CERCLA requiring matching or comparing capital and operating costs for adjacent facilities instituting remedial actions for similar contaminants of concern (COCs), nor would such provisions be sensible. The fact that the Simplot groundwater remediation may achieve a substantially greater economy of scale, due significantly to its initially substantially greater COC contribution to groundwater and ultimately surface water (or for any other reasons), is no basis on which to gauge or measure the benefit of the selected FMC OU groundwater remediation, or remedial alternatives for any other facility with dissimilar facts or circumstances.

CERCLA remedies are selected to address specific risks identified for sites and costs are based on engineering estimates for implementation of those selected remedies. FMC's argument wholly inappropriately suggests a cost-benefit ratio for the Simplot groundwater remedy as a yardstick by which the FMC OU groundwater remedy, or any other remedy, should be measured. Further, EPA does not believe that the projected benefit from the selected groundwater interim

remedial action for the FMC OU will be "marginal," or disproportionate to its cost, in any respect.

FMC General Comment 3: *The EPA Proposed Plan incorrectly states that Tribal Soil Cleanup Standards may be Applicable or Relevant and Appropriate Requirements (ARARs).*

The Shoshone-Bannock Tribes (the Tribes) take the position that they promulgated Soil Cleanup Standards (SCS) in December 2010. The SCS reference soil contaminants that are present at the FMC OU. At pages 27 and 51-52 of the Proposed Plan, EPA states that the SCS might constitute Applicable or Relevant and Appropriate Requirements (ARARs) that the FMC OU final remedial action could be required to meet. FMC disagrees.

First, it is unnecessary for the Proposed Plan to make or predict any determination regarding the standards that might constitute ARARs with respect to the FMC OU, whether the standards in question are Federal, State or Tribal. The Proposed Plan is for an interim and not final remedial action. CERCLA Section 121(d)(4)(A) provides that interim remedial actions are not required to meet ARARs. The Proposed Plan recognizes this, but nevertheless makes the unneeded and somewhat gratuitous observation that EPA might classify the Tribal SCS as an ARAR at later point. This speculation has no bearing on the remedial action outlined in the Proposed Plan and should be withdrawn.

Second, even if the Proposed Plan was for a final and not an interim remedial action, EPA would have no legal basis for classifying the Tribal SCS or other Tribal standards as an ARAR. CERCLA categorically excludes Tribal laws and regulations from designation as ARARs. The CERCLA section that authorizes EPA to designate ARARs is Section 121(d)(2)(A). That Section provides that "Federal" and "State" laws and regulations can be designated as ARARs. It does not refer to "Tribal" standards. Further, the Tribal "treatment as States" provision at CERCLA Section 126 very specifically lists the CERCLA provisions for which Tribes are regarded as States, and that list notably does not extend that to Tribal authority to designate ARARs. This lack of CERCLA statutory basis overrides any EPA regulations or policies to the contrary and prohibits EPA from classifying Tribal standards as ARARs.

Further, even if the CERCLA statute allowed Tribal standards to be ARARs, the Tribal SCS would not meet ARARs criteria. As an initial matter, they have not met the requirement of being a promulgated standard with respect to Tribal non-members such as FMC. The Tribal

Constitution requires U.S. Department of the Interior review before Tribal ordinances can be applied to Tribal non-members. The SCS constitutes an ordinance under Tribal law. Because the Tribes have not submitted the SCS for review by Interior, the SCS cannot be applied to FMC or other non-members. In addition, because the Tribes lack jurisdiction over fee property owners such as FMC, the SCS are not "applicable." Nor can they be considered "relevant and appropriate," for reasons including the fact that they do not set defined cleanup standards but rely on standardless and unpredictable site-specific determinations. More fundamentally, by categorically prohibiting all wastes the SCS classify as "ignitable or reactive" regardless of their concentration or any risk they might pose, the SCS cannot be viewed as an environmental or health standard eligible for ARAR designation. Instead, as the SCS itself states, its purpose is to return all land within the Reservation to its condition before contact with Western civilizations. That may be a Tribal societal goal but it is not a health or environmental standard that can be enforced as an ARAR under the CERCLA statute. These and other factors demonstrate that neither the Tribal SCS nor other Tribal standards can be designated as CERCLA ARARs.

EPA Response to General Comment 3: EPA maintains that the Shoshone-Bannock Tribes promulgated Soil Cleanup Standards (SCS) may be identified as ARARs for the final remedial action at the FMC OU. The selected interim remedy invokes the waiver for meeting ARARs in Section 121(d)(4)(A) of CERCLA for interim remedial action. It requires EPA to find that "the remedial action selected is only part of a total remedial action that will attain" ARARs. In order to make this finding, EPA believes it has to first identify the universe of potential ARARs - which includes the SCS. EPA has determined this interim action will address immediate human health and environmental risks at the FMC OU and will neither exacerbate conditions at the EMF Site nor interfere with the implementation of any future final remedy. The Final ROD Amendment will include remedial action(s) that will fully attain or provide for the formal waiver of all ARARs, or portions thereof, including the SCS to the extent they may be determined to be ARARs by EPA in consultation with U.S. Department of Justice (DOJ), at or before the completion of all remedial actions. Any and all waivers will be pursuant to Section 121(d)(4) of CERCLA.

While some of the issues in this comment are still being evaluated, others may be addressed as follows. EPA does not believe CERCLA textually forecloses Tribal standards as ARARs, given EPA's broad authority in Section 105 of CERCLA to revise the National Contingency Plan (NCP), and the reference in Section 126(a) to Section 105, among other bases. EPA last revised the NCP in March 1990. EPA also believes the SCS are duly promulgated regulations under a duly promulgated ordinance (Tribal Waste Management Act). EPA has taken no position to date with respect to tribal jurisdiction based on criteria in *U.S. v. Montana* and later cases, nor does EPA believe it would be required to in order to find that the SCS contain relevant and appropriate requirements (which EPA currently believes would be substantively the same as if these SCS requirements were applicable).

FMC General Comment 4: *The CERCLA RI/FS process with respect to the FMC OU that has led to EPA issuance of the Proposed Plan has fully met federal trust responsibility requirements to Indian tribes*

Federal agencies owe a fiduciary responsibility, known as the trust responsibility, to Indian tribes. Morongo Band of Mission Indians v. F.A.A., 161 F.3d 569, 574 (9th Cir. 1998). While the U. S. government has a trust responsibility to Indian tribes, those responsibilities depend upon the existence of underlying substantive law to create an enforceable right. Shoshone-Bannock Tribes v. Reno, 56 F.3d 1476 (D.C. Cir. 1995). An Indian tribe cannot force the Federal government to take a specific action unless a specific treaty, statute, or regulation imposes that duty. Id. EPA fulfills its trust responsibility by applying its environmental expertise consistent with the relevant statute and regulations not specifically aimed at protecting Indian tribes. Morongo Band of Mission Indians, 161 F.3d at 574. EPA is not required to do whatever a tribe asks or demands.

We have been down the very same road before. When EPA entered into the 1999 RCRA Consent Decree with FMC, the Tribes objected to capping elemental phosphorus and called instead for its removal and treatment. The Tribes argued that EPA's trust responsibility required the Agency to implement the Tribes' preferred action. The Ninth Circuit expressly rejected the Tribes' claim that EPA had failed to fulfill its trust responsibility, holding that EPA had discharged its responsibility because the record disclosed "a diligent assertion of RCRA claims by the government, a fair and extensive consultation with the Tribes, and a reasonable settlement

reached at arm's length between the government and FMC." United States v. Shoshone-Bannock Tribes, 229 F.3d 1161 (9th Cir. 2000).

The extensive consultations between EPA and the Tribes and the clear application of EPA's environmental expertise, consistent with CERCLA procedures and requirements, demonstrate that EPA has fully discharged its trust responsibilities. The Tribes have again made clear throughout the process that they did not agree with a containment remedy for the site. EPA thoroughly considered those concerns before concluding, based on CERCLA criteria and our scientific expertise that implementing the Tribes' preferred remedy would pose undue risks to human health and the environment and would not be necessary to achieve CERCLA protectiveness requirements. The trust responsibility does not require that

EPA agrees with the Tribes' request – rather it requires that EPA apply its environmental expertise consistent with the relevant statute and regulations, and ensure that Tribal interests are considered. The record amply shows that EPA has done this.

EPA Response to General Comment 4: This comment does not require any change in the IRODA from the Preferred Alternative in the Proposed Plan. EPA agrees that it has fully met its tribal trust responsibilities.

FMC Specific Comment 1: *Section 1.3, bullets 1 and 2, page 9: The areas for ET caps and 12 inch topsoil cover ("gamma caps") should list the RAs identified for those caps. The generalized description of the areas for these caps is incorrect. For example, the RAs for ET caps do not contain a significant volume of baghouse dusts, and the ET cap designated for RA-E includes a significant area of the calciner pond solids stockpile.*

EPA Response to Specific Comment 1: The IRODA contains the following language:

- "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 in Figure 1 and described in Table 1

- Place approximately 12 inches of soil cover over areas containing slag fill, ore stockpiles, and the former Bannock Paving areas to prevent the exposure to gamma radiation and fugitive dust of potential future workers. Gamma radiation-protective soil covers will be placed over RA-A, RA-A1, RA-F, and RA-G as shown in Figure 1 and Table 1

FMC Specific Comment 2: *Section 1.3, bullet 3, page 9 incorrectly states: "Excavation and onsite consolidation of Parcel 3 of FMC's Northern Properties to prevent exposure to residents and future potential workers…" There are no current residents on Parcel 3. Further, FMC has already recorded a covenant prohibiting residential use of Parcel 3 so there also is no potential for "future" residents. Delete "residents" from this bullet. In addition, Parcel 3 should be referenced as RA-J for a clearer connection to the SFS Report.*

EPA Response to Specific Comment 2: Parcel 3 is referred as RA-J in the IRODA. The reference to residents was not intended to mean residents within RA-J, but for a potential residential scenario, as evaluated in the *Supplemental Human Health Risk Assessment (HHRA)Addendum*, and for residents immediately north of the parcel, and therefore "residents" is used in the IRODA.

FMC Specific Comment 3: *Section 1.3, bullet 8, 2nd sentence, page 10: "In addition, engineering controls or barriers such as fencing will be installed to limit site access." The site already is entirely surrounded by fencing that limits access to the site. Revise to read "In addition, engineering controls or barriers such as additional fencing may be installed to further limit site access."*

EPA Response to Specific Comment 3: The IRODA adopted this recommended change.

FMC Specific Comment 4: *Section 1.3, paragraph following bullet list, 2nd sentence, page 10: "The proposed alternative addresses…and phosphine gas associated with the FMC OU…" Because the Proposed Plan does not address phosphine at the RCRA ponds and as correctly stated in Section 3.2, 3rd paragraph, page 22 "Phosphine gas has not been detected in ambient air at levels that would present a risk to human health in the FMC OU," this sentence should be*

revised to read "The proposed alternative addresses…and potential phosphine gas associated with the CERCLA RAs with subsurface elemental phosphorus at the FMC OU…"

EPA Response to Specific Comment 4: Proposed Plans and decision documents have different purposes. Consistent with CERCLA and EPA policy, the FMC OU IRODA does not use every Proposed Plan sentence, or necessarily the Proposed Plan's sequencing of all information. EPA believes the Proposed Plan and IRODA are clearly never referring to "the RCRA ponds" when the term "FMC OU" is used, contrary to what the comment could be read to have suggested. Further, EPA does not see the proposed alternative sentence to be meaningfully different than the sentence in the Proposed Plan.

FMC Specific Comment 5: *Section 2.1.4, last sentence of paragraph, page 14: The reference to the Fort Hall Bottoms as a "particular" area used by migratory birds is incorrect in that the nearby American Falls Reservoir provides far more extensive migratory bird habitat that is used by many thousands of birds annually. The sentence also incorrectly states that there are "thousands of migratory bird species." It should have stated instead that there are thousands of (individual) birds from numerous migratory species.*

EPA Response to Specific Comment 5: This comment does not require any change in the IRODA from the Preferred Alternative in the Proposed Plan. The IRODA does not use this sentence. EPA believes the IRODA is accurate.

FMC Specific Comment 6: *Section 2.2, 3rd sentence of paragraph, page 14: "In the risk assessment and FS, adjacent FMC and Simplot-owned properties, some of which were acquired during the RI, were considered part of the 'Plants' and were not evaluated for current or future residential use." This statement is incorrect in two respects. First, for the purpose of the 1995 draft and 1996 final RI Report and Baseline Human Health Risk Assessment, the FMC properties north of Highway 30 (i.e., the FMC OU Northern Properties) were considered off-site. Despite the lack of any residences at that time (or now for that matter), EPA and its contractor Ecology & Environment included the FMC properties north of Highway 30 as off-site and performed a hypothetical future residential risk assessment for those properties. Second, FMC acquired only one (not some) property during the RI, the Batiste Springs parcel, which became part of the FMC Subarea, now referred to as the FMC Plant OU. Further, EPA required*

that the risk assessment conducted as part of the SRI Addendum include residential receptors for FMC's northern properties, disregarding the current zoning and deed restrictions that are in place.

EPA Response to Specific Comment 6: This comment does not require any change in the IRODA from the Preferred Alternative in the Proposed Plan. The IRODA does not use this sentence. EPA believes the IRODA is accurate.

FMC Specific Comment 7: *Section 2.2.1, Summary of Former Operations, 1st paragraph, sentence 9, page 15: Calciner solids (waste) is incorrectly listed as yielded from "the furnace reaction" and should be deleted from this list. If EPA believes this is an important "waste," it should be correctly described as a waste from the calcining process summarized in sentence 5 of this paragraph.*

EPA Response to Specific Comment 7: The IRODA contains the following language:

"The calcining process involved heating the ore briquettes to a sintering temperature of approximately 1,200°F – 2,000°F to form nodules. Carbon monoxide (CO), a by-product of the phosphorus furnace reaction, was used as fuel to fire the calciners. The nodules were blended with coke and quartzite (known as *silica*) to make the phosphorus furnace feed. This mix of nodules, coke, and silica was fed into four electric arc furnaces. The furnace reaction primarily yielded gaseous elemental phosphorus (product), CO gas (used as an energy source for the process), slag (by-product/waste), ferrophos (by-product), precipitator dust (waste), calciner solids (waste), and phossy solids (waste)."

FMC Specific Comment 8: *Section 2.2.1, Summary of Former Operations, 3rd paragraph, sentence 5, page 16: The statement regarding the closure of the RCRA Ponds should be corrected to "…have already been closed and capped by FMC with EPA oversight pursuant to the applicable RCRA regulations and the 1999 RCRA Consent Decree." In addition, the correct reference is Pond 17 (there is no Pond 17S).*

EPA Response to Specific Comment 8: The IRODA is consistent with this comment with respect to RCRA ponds generally, and the typo "S" does not appear in the IRODA.

FMC Specific Comment 9: *Section 2.2.1, Summary of Former Operations, 4th paragraph, section 1, page 16: The statement "Air deposition from plant emissions resulted in contaminants being dispersed throughout the region" is an overstatement. Sampling outside the company-owned properties has shown very limited impact beyond the property boundaries.*

EPA Response to Specific Comment 9: No conceptual change was made in the IRODA. However, alternative wording to "throughout the region" was used. The substantive point is that data collected in the Off-Plant OU during the Remedial Investigation indicates there have been aerial depositions of contaminants from FMC and Simplot that extend beyond the facilities.

FMC Specific Comment 10: *Section 2.2.1, Summary of Former Operations, 4th paragraph, sentence 2, page 16: The statement "Air deposition from FMC plant operations has been confirmed within the FMC OU-1, the Simplot OU-2, and the Off-Plant OU" is incomplete because it does not reference other EMF Site emissions. As stated on page 17, surface soils (are) impacted by deposition from former and ongoing EMF facility air emissions at FMC's Northern Properties/SUA/WUA. The sentence on page 16 should be corrected to replace "FMC plant operations" with "former and ongoing EMF facility emissions."*

EPA Response to Specific Comment 10: The IRODA contains the following language:

"Air deposition from FMC Plant emissions, including fugitive dust, has dispersed contaminants to surface soil adjacent to the Former Operations Area, north of the historic ore stockpile. Air deposition from former and ongoing EMF Plant (Simplot and FMC Plant operations) emissions has been confirmed within the FMC OU, the Simplot OU, and the Off-Plant OU. Risks posed by air deposition within the FMC OU will be addressed by this interim remedial action.

FMC Specific Comment 11: *Section 3.3.1, 2nd paragraph, first sentence, page 24: The statement "Over the ten years of routine monitoring, elemental phosphorus has been sporadically detected in both upgradient and downgradient wells at Pond 8S, as well as in rinseate blanks associated with the elemental phosphorus sampling and analysis events." Although this text was taken directly from the Groundwater Current Conditions Report (GWCCR), without the full text from Section 5.1.1 of that Report the statement is misleading and out of context. The complete text should be inserted as follows:*

Elemental phosphorus has not been detected in wells 112, 113, 120, 128, 131, 134, 135, 140, 141, 151, 159, 165, and 168 in the western pond area. Over the ten years of routine monitoring for elemental phosphorus at pond 8S, there have been sporadically reported detects at the upgradient and downgradient pond 8S wells as well as in rinseate blanks associated with the elemental phosphorus sampling and analysis events. A summary of the reported detected elemental phosphorus results for the pond 8S well and rinseate blanks is provided below:

Well / Sample	*Total Number of Primary Results*	*Number of Reported Detects*	*Maximum Reported Detected Result (ug/L)*	*Maximum Reported Result Sample Date*
155	*22*	*5*	*0.17*	*5/03/2007*
156	*20*	*6*	*0.55*	*11/09/2005*
157	*20*	*7*	*0.15*	*11/12/2001*
158	*20*	*8*	*0.35*	*5/22/2003*
183	*19*	*11*	*0.32*	*5/21/2003*
Rinseate Blank	*21*	*9*	*0.19*	*11/09/2005*

Note: Sample results are fore the period January 1998 through May 2008.

In addition to the relatively low frequency of detections, there is no discernible temporal pattern to the reported detections for the pond 8S wells, except that the rinseate blanks associated with the November 2005 and May 2007 sampling events were reported as having detected elemental phosphorus. There were no rinseate blanks associated with the May 2003 event.

The elemental phosphorus analytical method (EPA method 7580) has an extremely low detection limit and FMC's current laboratory typically achieves a detection limit of 0.05 ug/l. The higher frequency of reported detections for the rinseate blank samples compared to the downgradient pond 8S wells 155, 156 and 157 and upgradient well 158 suggests that the reported results for the pond 8S wells may be laboratory artifacts. In any event, none of the reported results for the pond 8S wells has exceeded the comparative value of 0.73 ug/l for elemental phosphorus.

EPA Response to Specific Comment 11: The exact sentence referred to in the comment was not used in the IRODA. EPA believes the IRODA is accurate on this substantive point.

FMC Specific Comment 12: *Section 3.3.2, 4th paragraph, sentence 5 and 6, page 24: The 5th sentence should be revised as follows to identify the primary suspected source of P4 beneath the furnace building as documented in the SFS Report: "Releases of liquid elemental phosphorus*

occurred primarily from the furnace building elemental phosphorus sumps and resulted …" Also, the 6th sentence should be revised as follows to specify the source of the "significant heat generated" to eliminate the current ambiguity in that sentence regarding the heat source: "Due to the significant heat generated and imparted to the soil column in the vicinity of the furnace building from 50 years of tapping molten slag into the slag pit immediately south of the furnace building, the …."

EPA Response to Specific Comment 12: EPA agrees with the factual clarifications in the comment and the IRODA contains the following language:

"Releases of liquid elemental phosphorus from the furnace building elemental phosphorus sumps, the phosphorus loading dock and condensers led to elemental phosphorus migrating beneath the furnace building approximately 85 feet to groundwater. Significant heat required to mobilize elemental phosphorus in a mobile, molten state was transferred to the soil column in the vicinity of the furnace building and the slag pit during continuous operation of the furnaces."

FMC Specific Comment 13: *Section 3.3.2, 4th paragraph, last sentence, page 25: As detailed in the GWCCR, elemental phosphorus has been consistently detected only in monitoring wells 108 and 122. Delete the reference to wells 121 and 123.*

EPA Response to Specific Comment 13: Wells 121 and 123 have historic detections of elemental phosphorus in groundwater. EPA believes the IRODA is accurate on this substantive point.

FMC Specific Comment 14: *Section 3.3.2, 5th paragraph, sentence 1, page 25: As detailed in the GWCCR, elemental phosphorus has been consistently detected only in monitoring wells 108 and 122. Delete the references to wells 121 and 123.*

EPA Response to Specific Comment 14: Wells 121 and 123 have historic detections of elemental phosphorus in groundwater. EPA believes the IRODA is accurate on this substantive point.

FMC Specific Comment 15: *Section 3.4, last sentence, page 26, the sentence "The only EMF Site COC greater than an MCL in groundwater discharging to the Portneuf River is arsenic,"*

should be expanded to note that arsenic concentrations are only marginally above the MCL at the point of discharge and meet applicable surface water standards in the river.

EPA Response to Specific Comment 15: The IRODA contains the following language reflecting this comment:

"Arsenic in ground and surface water poses a potential threat to people who may drink the water. The concentration of arsenic in groundwater in the FMC OU was as high as 2,660 µg/L (well 150) in 1992. After dilution and attenuation in groundwater, arsenic levels in water discharging near the Portneuf River have recently been as high as 37µg/L (reported in 2007) measured at Batiste Springs. The current MCL for arsenic is 10 µg/L."

FMC Specific Comment 16: *Section 4.2, 1st paragraph, sentence 2, page 27: "Those units (hazardous waste management units that are regulated under RCRA) are not part of the FMC OU, or subject to this proposed CERCLA remedial action." This statement is overbroad. As the Proposed Plan acknowledges at Section 7.1 under Item 4 Cap Integration, Monitoring and Maintenance, last sentence, page 40, "each of the alternatives would require construction of one or more caps that may intersect with one or more RCRA or calciner pond caps." The CERCLA remedial action cap designs will need to incorporate provisions for continued access to monitoring wells, pond leachate collection systems, and other monitoring and/or maintenance systems. The IRODA should acknowledge this need for cap integration and coordination.*

EPA Response to Specific Comment 16: The IRODA contains the following language reflecting this comment:

> "A number of these surface impoundments are RCRA-regulated units (Ponds 8S, 11S, 12S, 13S, 14S, 15S, 16S, 17, 18A, 8E, and 9E, see Figure 1 and Figure 5) and are not subject to action under this IRODA beyond the RCRA/CERCLA cap integration activities in the selected interim amended remedy. These RCRA-regulated units have already been closed and capped by FMC with EPA oversight pursuant to the applicable RCRA regulations and the 1999 RCRA Consent Decree.

FMC Specific Comment 17: *Section 4.2, 2nd paragraph, sentence 1, page 28: The statement regarding the closure of the RCRA ponds and other units should be corrected to "…that were*

closed under the pursuant to the applicable RCRA regulations and the 1999 RCRA Consent Decree."

EPA Response to Specific Comment 17: The IRODA contains the following language reflecting this comment:

> "These RCRA-regulated units have already been closed and capped by FMC with EPA oversight pursuant to the applicable RCRA regulations and the 1999 RCRA Consent Decree."

FMC Specific Comment 18: *Section 4.2, 3rd paragraph, sentence 3, page 28: The sentence should acknowledge "The carbon treatment technology for safely removing and treating phosphine gas" was specified in the RCRA pond Closure Plans and that technology was installed and operated at some of the RCRA ponds.*

EPA Response to Specific Comment 18: This comment does not require any change in the IRODA from the Preferred Alternative in the Proposed Plan. EPA believes the IRODA is accurate.

FMC Specific Comment 19: *Section 4.2, 3rd paragraph, sentence 4, page 28: This sentence is ambiguous and should be clarified to state "…does not anticipate phosphine gas production in these areas (i.e., is not anticipated to be a potential risk…)"*

EPA Response to Specific Comment 19: The IRODA contains language reflecting this comment.

FMC Specific Comment 20: *Section 4.3, 5th paragraph, sentence 5, page 30: The statement that "the SRI defined the limits of the lateral and vertical extent of elemental phosphorus contamination based on modeling, assumptions, and extrapolation of historic operations data" is both incomplete and inaccurate. As detailed in the SRI Report, the extent of the RUs with known or suspected P4 was primarily defined with direct evidence and investigation. The following describes these empirical determinations:*

- *The location and number of railcars buried under the east slag pile are based on 1) a historic aerial photograph showing the location of the railcars and 2) an internal*

memorandum describing the number and status of the railcars that became buried under the east slag pile.

- *The location and footprint of the old phossy ponds are based on 1) aerial photographs, 2) plant drawings, 3) RI borings to groundwater through the footprint of certain old ponds, 4) SRI "cap delineation" borings to 2 feet below the native soil interface around the perimeter of the old phossy ponds (as a group), and 5) volume estimates based on plant operating records and fill volume calculations conducted during the SFS that compared pre-FMC plant topography to current topography.*
- *The extent of P4 in the subsurface at the furnace building, slag pit, secondary condenser and phosphorus dock was bounded with the SRI "cap delineation" borings to groundwater that surrounded Remediation Units (RUs) 1 and 2 and the step-outs that defined the extent of P4 in the vadose zone extending to the northeast from those RUs.*
- *The extent of P4 in the subsurface at the railroad swale was defined by borings performed during the RI and laterally bounded by trenching performed during the SRI.*
- *The locations of the underground process piping were compiled from an extensive review of plant drawings.*

EPA Response to Specific Comment 20: This comment does not require any change in the IRODA from the Preferred Alternative in the Proposed Plan. The IRODA substantively covers these points. RODs are typically substantially longer with significantly greater detail than Proposed Plans which are designed to provide sufficient notice and description of the selected remedial action without reiterating the voluminous supporting documentation in the RI/FS and rest of the Administrative Record, which are consistently referred to as necessary or appropriate.

FMC Specific Comment 21: *Section 5.1.1, 5th (last) paragraph, sentences 2 and 3, page 34: The highest incremental cancer risk to future workers from groundwater ingestion is cited as 5 x 10-3 and the highest non-cancer HQ is cited as 37. However, these risk estimates, reported in the Baseline Human Health Risk Assessment (HHRA) (E&E, 1996), were revised using more recent analytical data in the Groundwater Current Conditions Report (GWCCR) for the FMC Plant Operable Unit. As reported in Tables 7-9 through 7-13 of the GWCCR, the highest worker incremental cancer risk estimate is 1.76 x 10-3 (Well 136), due to assumed arsenic exposure. The*

highest non-cancer HQ estimate is 61.3 (Well 108), primarily due to assumed exposure to elemental phosphorus.

EPA Response to Specific Comment 21: As reported in Tables 7-9 through 7-13 of the GWCCR, the highest worker incremental cancer risk estimate is 5×10^{-3} primarily due to arsenic from Well 150 from the Baseline Human Health Risk Assessment. Well 150 was not analyzed for COCs for the GWCCR and therefore 5×10^{-3} is the highest reported incremental cancer risk for the ingestion of groundwater to date. EPA acknowledges the highest non-cancer HQ estimate is 61 for Well 108 as reported in the GWCCR. The IRODA contains the following pertinent language:

"Groundwater contamination exceeded MCLs, or RBCs (for COCs for which there are no MCLs). Incremental risks to future workers who ingest groundwater from the FMC OU were estimated to be as high as 5×10^{-3}, primarily due to arsenic. An HI of 61 was primarily attributable to elemental phosphorus. Arsenic, elemental phosphorus, fluoride, manganese, nitrate, selenium, vanadium, and uranium were evaluated as part of the *GWCCR* to determine incremental risk for future workers who ingest groundwater. Table 6 shows the summary of groundwater risk associated with the FMC OU.

FMC Specific Comment 22: *Section 5.1.1, 5th (last) paragraph, sentence 4, page 34: The list of parameters that "exceed groundwater MCLs" is not accurate and is inconsistent with the table of "FMC OU Groundwater COCs" presented on page 26 of the Proposed Plan. As presented on that Table, arsenic, fluoride, nitrate and selenium exceed MCLs. As detailed in the Groundwater Current Conditions Report for the FMC Plant OU, radium-226 (and radium-228) do not exceed the MCL in FMC groundwater based on recent analytical results; gross alpha was only detected above the MCL in three wells (515, 161 and 164) but is not related to FMC sources of impacts to groundwater. Elevated gross beta correlates to elevated potassium concentrations, but because the gross beta MCL is a dose-based standard and there is no exposure (consumption) of shallow groundwater with elevated potassium / gross beta, there can be no exceedance of the gross beta MCL.*

EPA Response to Specific Comment 22: Arsenic, fluoride, nitrate, radium-226, selenium, thallium, gross alpha, and gross beta were COCs evaluated in the risk assessment to determine

incremental risk to future workers who ingest groundwater. However, the majority of the risk is due to arsenic or elemental phosphorus. The IRODA contains the following table which clearly indicates the COCs for this IRODA and the COCs used to determine groundwater risk for future workers due to ingestion.

TABLE 8: CONTAMINANTS OF CONCERN IN GROUNDWATER AND CLEANUP LEVELS FOR THE FMC OU

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]		1,355 pCi/l	-	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.

FMC Specific Comment 23: *Section 5.1.2, 1st paragraph, last bullet item, page 34, "Residents – including children and adults" should be removed. Residential use of any FMC-owned property is inconsistent with current zoning and the FMC deed restrictions that are in place. Further discussion in this section regarding residential exposures should similarly be deleted.*

EPA Response to Specific Comment 23: The IRODA covers this point while also making clear that institutional controls likely in the form of environmental easements will be required, even though in some instances, in some areas where controls may be required, EPA agrees that FMC already has similar controls in place.

FMC Specific Comment 24: *Section 5.1.2, 2nd paragraph, bullet 5, page 34: This bullet states that "Inhalation of Volatiles" was an exposure pathway evaluated in the SRI Addendum HHRA for the FMC-Owned Northern Properties, SUA and WUA. However, as shown in Table 2-1 of the HHRA (Appendix D) to the SRI Addendum, this pathway was not evaluated for any of the receptors of concern. The SRI Addendum HHRA did not consider this pathway because volatile chemical contamination is not present on the FMC-Owned Northern Properties, the Southern Undeveloped Area (SUA) or the Western Undeveloped Area (WUA) at the FMC Plant OU.*

EPA Response to Specific Comment 24: The IRODA makes this substantive point more clearly. As stated in the *Supplemental HHRA Addendum*, under current EPA guidance, "inhalation of volatiles" was an exposure pathways identified as potentially being relevant to outdoor commercial/industrial workers and construction workers; however it was not considered a relevant exposure pathway because volatile contaminants are not a concern in the SUA, WUA, or Northern Properties.

FMC Specific Comment 25: *Section 5.1.2, Summary of Human Health Risks at the FMC-Owned Northern Properties, the Southern Undeveloped Area and the Western Undeveloped Area, final bullet item, page 34, "Ingestion of homegrown fruits and vegetables (residents only)" should be removed. Residential use of any FMC-owned property is inconsistent with current zoning and the FMC deed restrictions that are in place. Further discussion in this section regarding consumption of home grown fruits and vegetables also should be deleted.*

EPA Response to Specific Comment 25: Ingestion of homegrown fruits and vegetables for a residential scenario were evaluated as an exposure pathway in the *SRI Addendum* HHRA. The IRODA did not use the language noted in this comment.

FMC Specific Comment 26: *Section 6.1, Updated RAOs enumerated as 1 through 7, page 37: Other than RAO 2 in this list, the RAOs are not identical to the RAOs presented in the EPA-approved SFS Report. EPA's changes to RAOs 1, 3, 4 and 5 are basically "wordsmithing" and are consistent with these RAOs as stated in the SFS Report. However, Proposed Plan RAOs 6 and 7 have been revised in a manner that materially disrupts the intended objective and must be revised so that they align with the SFS Report RAOs:*

- *RAO 6 ("groundwater restoration RAO") presented in the Proposed Plan is an abbreviated version compared to the groundwater restoration RAO presented in the SFS Report. The SFS Report groundwater restoration RAO was carefully crafted to incorporate text directly from the NCP as follows (text directly from 40 CFR § 300.4 (a)(ii)(F) is underlined for emphasis):*
  "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."

- *RAO 7 ("surface water RAO") in the Proposed Plan incorrectly states:*
  "Reduce the release and migration of COCs to surface water from facility sources at concentrations exceeding RBCs or ARARs including water quality criteria pursuant to Sections 303 and 304 of the Clean Water Act."

  The corresponding RAO from the SFS Report states:

  "Reduce the release and migration of COCs to surface water from facility sources 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."

  The SFS Report RAOs for groundwater and surface water set forth above were taken directly from the Simplot Interim ROD Amendment and should also be applied to the

FMC Plant OU, consistent with EPA's statement in the Proposed Plan that "The proposed alternative is consistent with remedial actions selected for the Simplot OU of the Superfund Site."

EPA Response to Specific Comment 26: The IRODA contains the following surface water RAO:

> "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."

FMC Specific Comment 27: *Section 6.2, 1st paragraph, sentence 3, page 38: "The Uranium Mill Tailing Radiation Control Act (UMTRCA) standard for radon flux is also an ARAR." Although UMTRCA is identified in the SFS Report as potentially relevant and appropriate, the SRI data do not support identifying UMTRCA as an ARAR for radon. As stated in the SFS Report:*

"Radon emanation from feedstocks, byproducts, or waste materials containing radium-226 was measured in the ore stockpile area (RU 7), slag and bull rock piles (RU 19), and in the former waste pond areas (RU 22b). While some radon emanation rates were measured to be slightly higher than background, the emanation rates were significantly lower than the UMTRCA guideline of 20 μR/hr. Radon emanation does not constitute an exposure pathway of concern for future workers."

The cited sentence from the Proposed Plan should not be carried forward into the IRODA.

EPA Specific Comment 27: Whether an ARAR is exceeded is not a standard or criterion for the selection of ARARs.

FMC Specific Comment 28: *Section 6.2, 2nd paragraph, sentence 2, page 38: "The presence of radium-226 could pose a risk to air quality by emitting radon, alpha, beta, and gamma radiation." This statement requires revision. Radium-226 in feedstocks, byproducts, or waste materials at the site presents a risk to potential future workers (receptors) at the site, not to air quality. Further, as stated in comment 26 above, radon emanation does not constitute an exposure pathway of concern for future workers at the site.*

EPA Response to Specific Comment 28: The IRODA refers to the risk to workers rather than air quality.

FMC Specific Comment 29: *Section 6.2, last paragraph: This paragraph states that the proposed site-specific cleanup level for radium-226, which corresponds to a 2 x 10-4 cancer risk under the residential scenario, is within the acceptable EPA excess cancer risk range. However, the acceptable excess cancer risk range is defined earlier in the document as 1 x 10-4 to 1 x 10-6 (Section 5.1.1, last paragraph on page 33). FMC recommends that EPA incorporate the following footnote into this paragraph of the Section 6.2 text:*

"EPA's acceptable risk range is generally defined as 1 x 10-4 to 1 x 10-6 but also includes an upperbound of 3 x 10-4 as essentially equivalent to 1 x 10-4 (see EPA's Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination, OSWER No. 9200.4-18, 1997)."

EPA Response to Specific Comment 29: The IRODA makes this substantive point.

FMC Specific Comment 30: *Section 6.3, Table – "Soil Cleanup Levels for Workers and Residents within the Former Operations Area and Northern Properties," page 39: A worker cleanup level of 39 mg/kg is provided for cadmium. This cleanup level is driven by assumed sub-chronic exposure of construction workers to fugitive dust generated by heavy construction zone traffic, with no control measures. As documented in the SRI Addendum HHRA (Section 6.2.3 of Appendix D), this risk scenario is highly conservative for technical reasons (e.g., a chronic inhalation toxicity factor, which overstates risk, is used in the absence of a sub-chronic toxicity factor for cadmium). However, despite the inherent conservatism of this exposure scenario, requiring implementation of a dust suppression program during any future redevelopment project would effectively mitigate potential risks to construction workers. With such a requirement incorporated into the Interim Amended ROD, a cadmium concentration protective of future commercial/industrial workers (830 mg/kg) would constitute the most appropriate cleanup level.*

EPA Response to Specific Comment 30: The IRODA reflects this comment.

FMC Specific Comment 31: *Section 6.3, Table – "Soil Cleanup Levels for Workers and Residents within the Former Operations Area and Northern Properties," page 39: While not*

documented, it appears that EPA developed the proposed residential soil cleanup level for cadmium (3.1 mg/kg) by performing a simple linear extrapolation of the worst-case non-cancer HQ estimated in the SRI Addendum HHRA (i.e., for FMC Northern Property Parcel 3 a cadmium HQ of 46.4 was predicted for an exposure point concentration of 142 mg/kg, from which a cadmium concentration of 3.1 mg/kg can be equated to a HQ of 1 by linear extrapolation). However, over 95% of this projected cadmium residential risk is associated with the homegrown produce ingestion pathway. As documented in numerous exchanges between

FMC and EPA during the course of the SRI/SFS, plant uptake of cadmium is nonlinear and, as such, so are risks. To minimize uncertainties in the HHRA, EPA agreed that cadmium risks via the homegrown produce ingestion pathway should be evaluated using uptake factors derived from empirical co-located plant and soil data collected during the RI (see Attachment G to the SRI Addendum HHRA). EPA stipulated that this approach be used for all areas with soil concentrations within the range detected during the RI plant uptake study (i.e., up to a cadmium soil concentration of 30.09 mg/kg). Using the EPA-approved empirical plant uptake factors, a soil concentration of 30.09 mg/kg equates to a worst-case cadmium non-cancer HQ of 0.88. Therefore, the residential soil cleanup level for cadmium should be no lower than 30 mg/kg. In addition, inclusion of residential clean up levels is not appropriate given the current zoning and deed restrictions, as well as future institutional controls to be developed.

EPA Response to Specific Comment 31: The IRODA reflects this comment.

FMC Specific Comment 32: *Section 7.1, Item 4 Cap Integration, Monitoring and Maintenance, last sentence, page 40. That sentence is incomplete and should read "The cap designs will incorporate provisions for continued access to monitoring wells, pond leachate collection systems, and other monitoring and/or maintenance systems."*

EPA Response to Specific Comment 32: EPA agrees with the factual clarifications in the comment. The IRODA contains language reflecting this comment.

FMC Specific Comment 33: *Section 7.2.1, sentence 4, page 42: "If a redevelopment option is identified during remedial design that would provide equally protective shielding…" As stated in FMC's General Comment 1, FMC supports EPA's incorporation of redevelopment into remediation of areas of the site. However, the inclusion of redevelopment under Section 7.2.1*

Topsoil Cover while not also acknowledging potential future redevelopment under Section 7.2.2 Evapotranspiration (ET) Cap is not fully consistent with Section 9.0. The first bullet under Section 9.0, Proposed Alternative, does not limit redevelopment to any specific "cap type" but, consistent with EPA guidance, allows "integration of a reuse / redevelopment option if development plans are timely identified during the remedial design…" The discussion of redevelopment in Section 7.2.1 should be deleted to eliminate the perception of inconsistency with the overall goal of promoting maximum reuse / redevelopment of the site consistent with the remedial action.

EPA Response to Specific Comment 33: The IRODA does not preclude potential redevelopment in any area of the FMC OU, though it does make clear that redevelopment options or future uses are more limited in ET capped areas.

FMC Specific Comment 34: *Section 7.5.3, Item 2, last sentence, page 48: Groundwater Alternative 2, disposal option 2 ("2B" in the SFS) does not include a "third option" consisting of "the treated water would be transferred to the Pocatello POTW." This sentence should be deleted.*

EPA Response to Specific Comment 34: This option is clearly stated in the IRODA.

FMC Specific Comment 35: *Section 7.5.4, Items 1 and 2, page 49: Groundwater Alternative 3, disposal option 1 ("3A" in the SFS) should state "By a wastewater treatment facility built onsite, then transferred to the Pocatello POTW and then discharged to the Portneuf River." Groundwater Alternative 3, disposal option 2 ("3B" in the SFS) should specify that the treated water would be discharged to "an infiltration basin from which it would either percolate down to groundwater or evaporate into the atmosphere" and should delete the ambiguous reference to Alternative 2.*

EPA Response to Specific Comment 35: EPA agrees with the factual clarifications in the comment. These options are clearly stated in the IRODA.

FMC Specific Comment 36: *Section 8.1.7, Table – "Key features, Capital Costs, and Costs of Operation and Maintenance of Soil Alternatives," page 55: The table is incomplete and misrepresents the cost estimate in the SFS Report for Soil Alternative 6. The SFS Report presented the implementation time and capital, O&M and NPV cost estimate for Soil Alternative*

2 as 1-2 years, $28,400,000, $513,000 and $32,700,000 respectively. The SFS Report presented an implementation time of 30-40 years and an NPV cost estimate of >$450,000,000. The SFS did not present capital or O&M cost estimates for Soil Alternative 6. At a minimum, the table should include the implementation time and cost estimate for Soil 2 and a footnote citing a reference for the cost estimates for Soil 6, 7, and 8.

EPA Response to Specific Comment 36: The table comparing soil alternative cost estimates is included in the IRODA. The IRODA contains the following language regarding Soil Alternative 3 costs:

"Costs for the selected interim amended soil remedy are estimated at $47 million for design, construction, and 30 years of operations costs with a future interest rate of 7 percent. The costs for the treatment alternatives evaluated in the SFS and independently by EPA during the development of the Proposed Plan were on the order of 10 to 100 times more expensive than the selected interim amended soil remedy because they would require the design, construction, and operation of a treatment plant and would require an estimated 20 to 44 years to complete. In addition, because treatment of this type of waste has never before been attempted on a scale of this magnitude, there are significant uncertainties associated with the total estimated cost (i.e., treatment efficacy and means for addressing significant health and safety issues). These are order-of-magnitude engineering cost estimates that are expected to be within +50 to -30 percent of the actual project cost."

FMC Specific Comment 37: *Section 9.0, bullet 2, page 62: The bullet states "Consolidation of contaminated soil and minimization of the extent of the covers and caps (i.e., to make cover/cap footprint as small as practicable)." This bullet is vague and potentially could be interpreted to require "consolidation" far beyond Soil Alternative 3 as defined and evaluated in the SFS. While FMC agrees that there will be opportunities to optimize the configuration of the capped areas during the Remedial Design and that optimization would likely include minimizing the cap footprint, the overall site grading and drainage plan, cap grade (crown and slopes) and integration with existing capped areas will be far more important design criteria and could be in direct conflict with minimizing the extent of the covers and capped areas even if "practicable." This "implementation refinement" should not be carried forward into the IRODA.*

EPA Response to Specific Comment 37: The specifics of the cap design will be evaluated during the Remedial Design phase. Minimizing the extent of covers and caps while integrating overall site grading and drainage plans, cap crown and slopes, and integration with existing capped areas will be considered during the Remedial Design. In any case, the IRODA does not use the specific language noted in this comment, and is accurate.

FMC Specific Comment 38: *Section 9.0, 2nd paragraph, sentence 3, beginning on page 62: "Groundwater Alternative 3, or perhaps some groundwater alternative that was not evaluated in the SFS and this Proposed Plan, could be selected and implemented in the future should its implementation prove necessary." A full array of potentially effective groundwater remediation technologies was identified and screened in the SFS. The groundwater alternatives were then assembled and subjected to detailed and comparative analysis in the SFS process, including the development of the groundwater flow and transport model to simulate the performance of the groundwater alternatives. Excluding the no action alternative, all three groundwater alternatives meet the RAOs for protection of human health and the environment by (1) preventing the ingestion of contaminated groundwater through institutional control, and (2) reducing/ eliminating the release of COCs from identified sources by source controls implemented under the soil remediation program. However, the groundwater modeling predicts that none of the alternatives will achieve the RAO for groundwater restoration beneath the FMC Plant Site in a reasonable time frame (within 100 years).*

Similarly, Groundwater Alternatives 1, 2 and 3 would comply with the Safe Drinking Water Act ARAR by preventing, through institutional controls, use (receptor contact) of contaminated groundwater above MCLs. The source controls under Groundwater Alternatives 1, 2 and 3 support meeting groundwater quality ARARs by reducing or eliminating future release of site COCs to groundwater. However, the groundwater model predicts that none of the alternatives will fully comply with the groundwater quality ARARs beneath the FMC Plant Site within a reasonable timeframe.

Based on the substantial and deliberative process of development and evaluation of the groundwater remedial alternatives and EPA's approval of the SFS Report, there is no foundation for a hypothetical future condition under which some groundwater alternative that was not evaluated in the SFS would "prove necessary."

EPA Response to Specific Comment 38: The comment correctly states that groundwater modeling predicts that none of the alternatives will achieve the RAO for groundwater restoration beneath the FMC Plant Site in a reasonable time frame (within 100 years). For that reason, the selected groundwater remedy is an interim action that EPA expects may require additional action such as optimization of the initial extraction system design, an ARAR waiver ,or other actions. Depending on the action taken, a ROD Amendment may be required.. The selected groundwater remedial action is clearly described in the IRODA.

FMC Specific Comment 39: *Table 2, "Summary of Waste Fill by Remediation Area." This table appears to be a modified combination of SFS Tables 2-1 and 5-1b. The average fill depth column is not traceable to a value published in the SFS. The column should be replaced with the RU-specific average depth presented in SFS Table 2-1. In addition, the average fill depth for RA-H is clearly a typographical error. The secondary fill type column also misrepresents the source SFS Table 2-1 by including materials that were identified as "Incidental to Fill" (i.e., in very small volumes but assumed to be present) as "secondary fill types" that were in a separate column on SFS Table 2-1 and were identified as secondary but identified fill materials in the RUs. As an alternative to revising this table, replace the table with the original source SFS tables.*

EPA Response to Specific Comment 39: Table 2 is a modified combination of SFS Tables 2-1 and 5-1b. The average fill depth was calculated by converting the area and volume of each remediation area to square feet and cubic feet respectively and then dividing the volume by the area. The average fill depth for RA-H was calculated using the same method as the other average fill depths. The actual fill depth of RA-H was not reported in any investigation documents provided to EPA.

FMC Specific Comment 40: *Table 3, "Typical levels and Concentrations of Contaminants of Concern Present in Source Materials." The data sources for the values presented in this table should be identified as a footnote to the table. The 95th UCL Background Concentrations column appears to be based on the SRI Addendum Table 3-1 Composite 0-2" 95UCL values, with the exception of polonium-210 and potassium-40 that were not included on the SRI Table 3-1. The source of these values should be provided. As an alternative to revising this table, replace the table with the original source tables. In addition, phosphine is a gas and should be quantified not as "mg/kg" but as "ppmV." Further, the "reported" upper phosphine "range" of 1.0*

"mg/kg" is not supported by the findings of the Site-Wide Gas Assessment Report for the FMC Plant OU. The Table should be revised as follows to be consistent with the findings described in Summary of Results for the CERCLA Remedial Areas in the Site-Wide Gas Assessment Report for the FMC Plant OU:

- *All of the 107 results from the surface scans at RA-D, underground piping at RA-C, the traverse along the slag pile at RA-F1, and the bottom of the slag pit at RA-B were 0.00 ppm PH3.*
- *The majority of the soil gas sampling results, 383 of 420 total recorded readings (over 90%), were 0.00 ppm PH3 and none of the readings were above the OSHA 8-hour TWA PEL of 0.30 ppm PH3. Non-zero (>0.00 ppm) readings were only recorded on all five (5) sampling days at the soil gas probe at RA-C Pond 10S #3, low level PH3 readings (below 0.05 ppm PH3) were not reproduced on all five days at all of the others soil gas probes.*

EPA Response to Specific Comment 40: The 95 UCL background concentrations for polonium-210 and potassium-40 were collected from Table 1 of *Field Modification #14 – Revision 2, SRI Work Plan Addendum D, FMC Plant OU, October 22, 2008*. Polonium-210 and potassium-40 were not analyzed as part of the *SRI Addendum* background study. Therefore the 95 UCL background values for polonium-210 and potassium-40 were obtained from data collected during the RI.

FMC Specific Comment 41: *Table 4, "Soil Alternatives Summary of Comparative Rankings." Because this table was not taken directly from SFS Report Table 8-1, the table should be footnoted to specify the source of the information. A column for Soil Alternative 2 is completely missing, and only Soil Alternatives 1 through 4 were retained for comparative analysis in the SFS. The cost estimates for Soil Alternatives 6, 7 and 8 should be footnoted to indicate that these costs were developed by EPA and were not presented in the SFS Report. As an alternative to revising this table, replace the table with the original source SFS table.*

EPA Response to Specific Comment 41: The IRODA will appropriately reference all information required for the comparative analysis of alternatives.

FMC Specific Comment 42: *Table 5, "Groundwater Alternatives Summary of Comparative Rankings." Because this table was not taken directly from SFS Report Table 8-2, the table*

should be footnoted to specify the source of the information. Also, because Groundwater Alternative 3 was not retained for comparative analysis in the SFS process, the source of information for this alternative appears to be SFS Section 7.6 Screening of the Assembled Groundwater Alternatives. As an alternative to revising this table, replace the table with the original source SFS table.

EPA Response to Specific Comment 42: The IRODA will appropriately reference all information required for the comparative analysis of alternatives.

FMC Specific Comment 43: *Figure 7, "Zoning in the Vicinity of the EMF Facilities." This figure appears to be taken from the 1996 RI Report and, as such, is out of date. The FMC Plant OU is located within Power County, and Power County's current zoning should be shown. SRI Appendix A, Plate 1 "POWER COUNTY ZONING MAP HEAVY INDUSTRIAL ZONE AROUND FMC" presents the current Power County zoning, including the fact that the FMC Northern Properties are zoned "Heavy Industrial" along with the FMC former operating areas.*

EPA Response to Specific Comment 43: The referenced figure is not in the IRODA.

13.5 RESPONSES TO THE DECEMBER 2, 2011 COMMENTS FROM J.R. SIMPLOT COMPANY REGARDING THE FMC OPERABLE UNIT PROPOSED PLAN

Comment 1: *Simplot supports EPA's prompt action to finalize the remedy selection with issuance of an amended Record of Decision in early 2012. This site was first listed on the National Priorities List in 1990 and has been subjected to intense study for over 20 years under EPA direction. No further study should be required at this point.*

EPA Response to Comment 1: This comment does not require any change in the IRODA from the Preferred Alternative in the Proposed Plan.

Comment 2: *Although the plan states "The proposed alternative is consistent with remedial actions selected for the Simplot OU of the Superfund Site", there is a difference in the stated goals.*

One of the Remedial Action Objectives (RAOs) identified for the FMC OU is:

> *"Reduce the release and migration of COCs to surface water from facility sources at concentrations exceeding RBCs or ARARs including water quality criteria pursuant to Sections 303 and 304 of the Clean Water Act"*

The corresponding RAO from the Simplot Interim ROD Amendment is:

> *"Reduce the release and migration of COCs to surface water from facility sources that result in concentrations exceeding risk-based concentrations (RBCs) or Applicable or Relevant and Appropriate Requirements (ARARs), including ambient water quality criteria (AWQC) pursuant to the Clean Water Act."*

The FMC RAO was initially proposed by EPA for Simplot, but it was open to an interpretation that was not appropriate at the site (that surface water standards could be applied to groundwater aquifers). The FMC RAO must be modified to be consistent with the objective already established for the Simplot OU.

EPA Response to Comment 2: The RAO for COCs in surface water in the FMC OU IRODA will track the language cited in the comment from the Simplot OU IRODA. There are minor

editorial changes in the RAOs which address site-specific differences between the FMC and Simplot OUs. They will therefore be completely consistent as follows:

"Reduce the release and migration of COCs to surface water from FMC OU sources at concentrations exceeding RBCs or ARARs, including water quality criteria (WQC) pursuant to Section 303 and 304 of the Clean Water Act."

Comment 3: *As briefly mentioned in the FMC Proposed Plan, Simplot has been implementing a groundwater remedy at the Site since 2002. A groundwater extraction and reuse system is fully operational and is pumping approximately 1,000 gallons per minute. A liner system is being installed on the gypsum stack; the main Simplot source of contaminants of concern (COCs) to groundwater. This project began in 2009 and is scheduled to be completed in 2014 or 2015. The remedy is predicted to result in an overall reduction in phosphorus in the Portneuf River of 94%. It will essentially control the gypsum stack as a source of COCs to groundwater. Amongst other things this will have a significant effect on groundwater quality and flow directions in the Joint Fenceline/Calciner area. The hydrogeology in this area has been assessed in detail through the Simplot design process. The assessment included installation of wells by Simplot on the FMC OU, a detailed model of geologic and hydrogeologic conditions along the entire Joint Fenceline/Calciner Pond area and assessment of groundwater chemistry data, including isotopic data generated independently by the State of Idaho. The findings of this assessment are briefly summarized in the attachment. In summary, the following are key findings:*

a) *Groundwater affected by the Simplot gypsum stack does cross the fenceline onto the FMC OU.*

b) *The westerly extent of the groundwater flow is limited by a bedrock channel that underlies the canyon feature just north of the gypsum stack and extends northward into the subsurface. Groundwater from the Simplot gypsum stack does not flow as far west as shown on Figure 4 of the Proposed Plan. It does not flow onto the Reservation and is not present at well 110.*

c) *Other non-Simplot groundwater sources are present in the area that contribute COCs to groundwater.*

d) *Once the western cell of the gypsum stack is lined, seepage from the stack will be essentially eliminated and groundwater flows in the Fenceline/Calciner Pond area will be reduced. This will further limit the extent of the stack influence on FMC groundwater immediately adjacent to the fenceline.*

Based on this, if EPA selects groundwater extraction for the FMC OU, the general locations of the wells shown on Figure 21 of the Proposed Plan are in an area that is appropriate for capturing groundwater affected by FMC sources with no influence of groundwater affected by Simplot sources.

EPA Response to Comment 3: This comment does not require any change in the IRODA from the Preferred Alternative in the Proposed Plan. EPA agrees that the well placement in Figure 21 of the FMC OU Proposed Plan is appropriate based on known and modeled hydraulic information.

Comment 4: *Page 9 contains the following statement: "Excavation and onsite consolidation of Parcel 3 of FMC's Northern Properties to prevent exposure to residents and future workers to elevated levels of radionuclides due to windblown dust from FMC and Simplot ore handling processes". The comprehensive air emission inventory, ambient air sampling program and dispersion modeling completed as part of the 1996 RI clearly show that Simplot operations were not emitting significant levels of radionuclides to the air. There is no evidence that emissions from Simplot operations that occurred in the 1980s and before have contributed to radionuclide levels in FMC soils that require remediation.*

EPA Response to Comment 4: EPA generally concurs that most of the windblown dusts that contribute to risk in Parcel 3 are probably attributable to FMC operations. However: 1) EPA is not aware of any studies that have definitely shown that these radionuclides are not, at least in part, attributable to Simplot operations; 2) even the 1990s-era data cited in Simplot's comment states only that Simplot was not emitting *significant* levels of radionuclides to the air in that timeframe; and most significantly 3) both FMC and Simplot were processing radionuclide-containing ore and generating radionuclide-containing wastes for decades in the pre-environmental regulatory era (pre-1970s), which Simplot clearly seems to acknowledge in the next comment below. The FMC OU IRODA states, that most of the windblown dusts that contribute to risk in Parcel 3 are probably attributable to FMC operations.

Comment 5: *Page 17 contains the statement that secondary sources of contamination to the FMC OU are "Surface soils impacted by deposition from former and ongoing EMF facility air emissions ... " On-going EMF emissions (i.e., from the Don Plant) do not measurably contribute to levels of contaminants in soils that are affecting remediation decisions at the FMC OU. Extensive source characterization, air monitoring and dispersion monitoring was performed during the 1996 RI. The Don Plant process is not significantly different from the mid-1990s and those evaluations are valid for current and on-going evaluations. In the RI modeling report, the total emissions of radium-226 from the Don Plant was estimated at 7.07E-8 Cilday; less than 3% of the total EMF emissions at that time (including FMC, Simplot and BAPCO). Considering that emissions from the EMF facilities since their operations began in the 1940s have resulted in radionuclide levels in surface soils in Parcel 3 that EPA proposed for removal due to marginal potential future risks, it is clear that on-going emissions from Simplot (just 3% of the mid- 1990s total values) will not have any measurable effect of radium levels in soils. Indeed, as noted above, recent sampling showed that contaminants of potential concern (COPC) concentrations in Offplant OU soils have decreased since the mid-1990s.*

EPA Response to Comment 5: The text in the IRODA reflects this comment**.**

Comment 6: *The Proposed Plan appropriately documents the significant potential risks associated with excavation of materials containing elemental phosphorus. It is common experience that excavation during Superfund remediation activities in former industrial processing areas encounters unexpected conditions that cannot be reasonably identified by pre-*

remediation sampling. This would be the case at FMC where elemental phosphorus is predominantly in the subsurface from leaks, which by their nature are uncontrolled. Indeed the Proposed Plan states the extent of elemental phosphorus in the subsurface is poorly understood, due to the hazards associated with collecting soil samples. As noted, phosphine gas can be generated by disturbing fill material that contains elemental phosphorus due to the reaction of elemental phosphorus with moisture that may be present in the fill. The Proposed Plan describes the potential for risks to remediation workers and residents; however, it should also discuss the potential for significant risks to workers at the Don Plant, which operates 24-hours a day, year round. Approximately 370 workers are employed at the Don plant which is in close proximity to the FMC OU and is often downwind of the areas where excavation of elemental phosphorus-containing fill would occur. Further it would not be possible to quickly evacuate the Don Plant in the event of a phosphine gas release from remedial actions at FMC, because the safe shut down of facility operations requires several hours to complete. Based on the potentially significant risk to its workers, Simplot supports the proposed approach to cover areas with elemental phosphorus, rather than attempting to excavate and treat.

EPA Response to Comment 6: Text is included in the IRODA covering this important consideration, including the lengthy safe shut down time for the facility.

Comment 7: *The interpreted groundwater flow potential map annotated with groundwater flow directions shown in Figure 4 of the Proposed Plan implies that groundwater flows in a northwesterly direction onto FMC property from Simplot property near the location of well 164 then follows a curving flow path through the locations of wells 130, 145 and to 110 in the northeastern portion of the FMC facility area near Highway 30. The arsenic concentration map shown in Figure 10 also provides the appearance that the elevated concentrations of arsenic in the shallow groundwater in northeastern portion of the FMC facility area are emanating from the Simplot site. More detailed analysis of the groundwater flow path in this area shows that groundwater from the Simplot OU does not flow as far north on the FMC property as shown in Figure 4 and that elevated concentrations of arsenic and sulfate shown in this area results from FMC sources.*

Simplot's design analysis included interpretation of stable isotope concentration data from groundwater samples collected by IDEQ in November 2004. Stable isotopes of hydrogen and

oxygen can be fractionated if subjected to evaporation producing relatively higher concentrations of the heavier isotopes 2H and 180 in the remaining water. The decant water on Simplot's gypsum stack is subjected to this process before the water seeps into the ground making the resulting seepage traceable as it migrates downgradient. Analyses of stable isotope concentrations are typically reported as a change (delta) from a standard in units of per mil (tenths of a percent). When the change in 2H and 180 are plotted against one another, naturally occurring samples derived from precipitation plot along a straight line known as the Global Meteoric Water Line (GMWL). At the EMF Site, the line is shifted downward due to local meteoric fractionation, the shifted line is called the Local Meteoric Water Line (LMWL). Results of the 2H and 180 analytical results from the 2004 sampling event are shown in Figure 1. Departure from the slope of the LMWL represent samples that have been subjected to evaporation and, as shown in Figure 1 the departure occurs where the 0018 is about -16 per mil. When the 0018 results are plotted spatially, the limit of migration of groundwater that has been subjected to evaporation can be mapped. As shown in Figure 2, blue symbols represent water that has been subjected to evaporation, such as the sample from the Decant Pond, and red symbols represent water that has not been subjected to evaporation. The flow path of groundwater affected by the gypsum stack seepage turns eastward in the vicinity of well 145 and does not reach well 110. This flow pattern can be explained by examining the local hydrogeology. Groundwater flow just west of Simplot's gypsum stack is directed northward in the alluvial deposits that fill the north-south trending canyon in the Bannock Range located at the boundary of the Simplot and FMC OUs. This canyon continues as a bedrock feature in the subsurface, limiting westward migration of groundwater from the gypsum stack and directing seepage northward. An abrupt change in flow direction to the east near well 145 results as groundwater flowing from the Bannock Range through generally less permeable strata meets groundwater flowing in an easterly direction in the Michaud Flats in more permeable strata.

The distribution of selenium, chloride, and nitrate in groundwater support the interpretation of the stable isotope data. The source of selenium in groundwater (Figure 15 in the Proposed Plan) is entirely within the FMC facility area and elevated concentrations extend through the location of well 110 indicating that groundwater at the location of well 110 is migrating from the FMC facility area and not from the Simplot OU. Concentrations of chloride and nitrate are elevated in

groundwater samples from well 143 downgradient of FMC's former Calciner Ponds, but not in groundwater samples from wells within the groundwater flow path from Simplot's gypsum stack.

EPA Response to Comment 7: This comment does not require any change in the IRODA from the Preferred Alternative in the Proposed Plan. The purpose of the FMC Proposed Plan and the IRODA is to address releases and threats of releases of hazardous substances from the FMC OU, not describe the complicated groundwater flow regime throughout the site.

14. REFERENCES

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(MWH, 2009b). Montgomery Watson Harza. 2009. Groundwater Current Conditions Report for the FMC Plant Operable Unit—June 2009 (*GWCCR*).

(MWH, 2009c). Montgomery Watson Harza. 2009. Identification and Evaluation of P4 Treatment Technologies – January 2009. Located in Appendix A of the *SFS Report* (MWH, 2010b).

(MWH, 2010a). Montgomery Watson Harza. 2010. Supplemental Remedial Investigation Addendum Report for the FMC Plant Operable Unit—January 2010 (*SRI Addendum Report*).

(MWH, 2010b). Montgomery Watson Harza. 2010. Supplemental Feasibility Study Report for the FMC OU—March 2010 (*SFS Report*).

(MWH, 2011). Montgomery Watson Harza. 2011. Site Wide Gas Assessment Report for the FMC Plant OU With January 14, 2011 Replacement Pages—January 2011 (*Gas Assessment Report*).

(SBT, 2010). Letter sent from Shoshone-Bannock Tribes to EPA requesting that the Tribes promulgated Soil Cleanup Standards for Contaminated Properties be included as ARARs for the remedy decision, December 3, 2010.

(Simplot, 2010). Groundwater Extraction and Monitoring System Remedial Design Report, 2010.

LIST OF ACRONYMS USED IN THE IRODA

AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirements
AWQC	Ambient Water Quality Criteria
bgs	below ground surface
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CO	Carbon Monoxide
COC	Contaminant of Concern
CSM	Conceptual Site Model
DO	Dissolved Oxygen
DOJ	Department of Justice
EMAP	Environmental Monitoring and Assessment Program
EMF	Eastern Michaud Flats (Superfund Site)
EPA	Environmental Protection Agency
ERA	Ecological Risk Assessment
ET	Evapotranspiration
FS	Feasibility Study
gpm	gallons per minute
GWCCR	Groundwater Current Conditions Report
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
IDEQ	Idaho Department of Environmental Quality
IRODA	Interim Record of Decision Amendment
LOAEL	Lowest Observed Adverse Effect Level
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MTR	Minimum Technological Requirements
NCP	National Contingency Plan
NOAEL	No Observed Adverse Effect Level
NPDES	National Pollutant Discharge Elimination System
NPV	Net Present Value
OU	Operable Unit
O&M	Operations and Maintenance
P_4	Elemental Phosphorus
POTW	Publically Owned Treatment Work
ppm	parts per million
PTW	Principal Threat Waste
RA	Remediation Area
RAO	Remedial Action Objective
RBC	Risk Based Concentration
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI	Remedial Investigation
RME	Reasonable Maximum Exposure

ROD	Record of Decision
RU	Remediation Unit
SCS	Soil Cleanup Standards
SEP	Supplemental Environmental Projects
SFS	Supplemental Feasibility Study
SRI	Supplemental Remedial Investigation
SUA	Southern Undeveloped Area
SWMU	Solid Waste Management Unit
TBC	To Be Considered
TMDL	Total Maximum Daily Load
Tribes	Shoshone-Bannock Tribes
WQC	Water Quality Criteria
WUA	Western Undeveloped Area

FIGURES

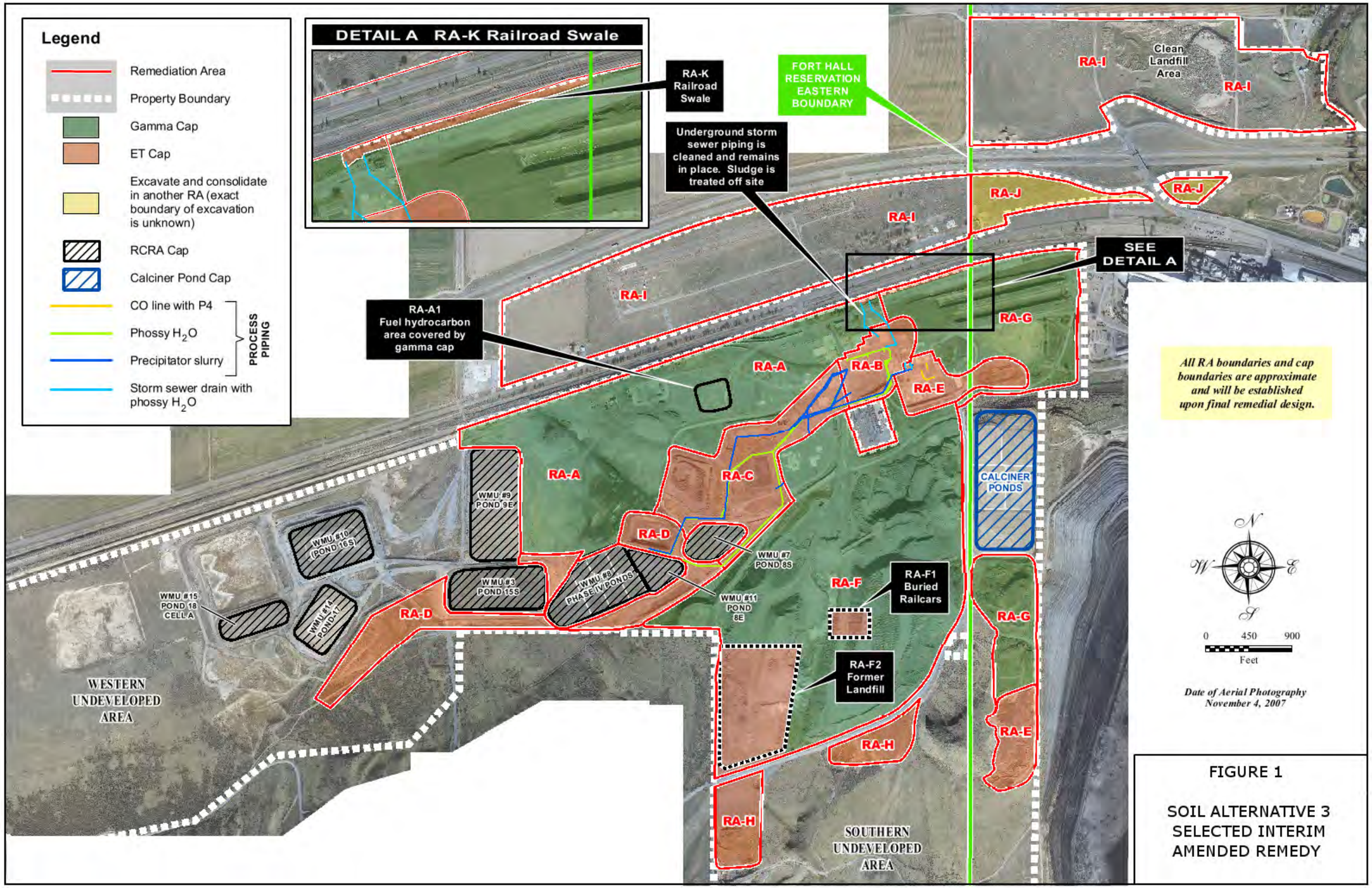


FIGURE 1

SOIL ALTERNATIVE 3
SELECTED INTERIM
AMENDED REMEDY

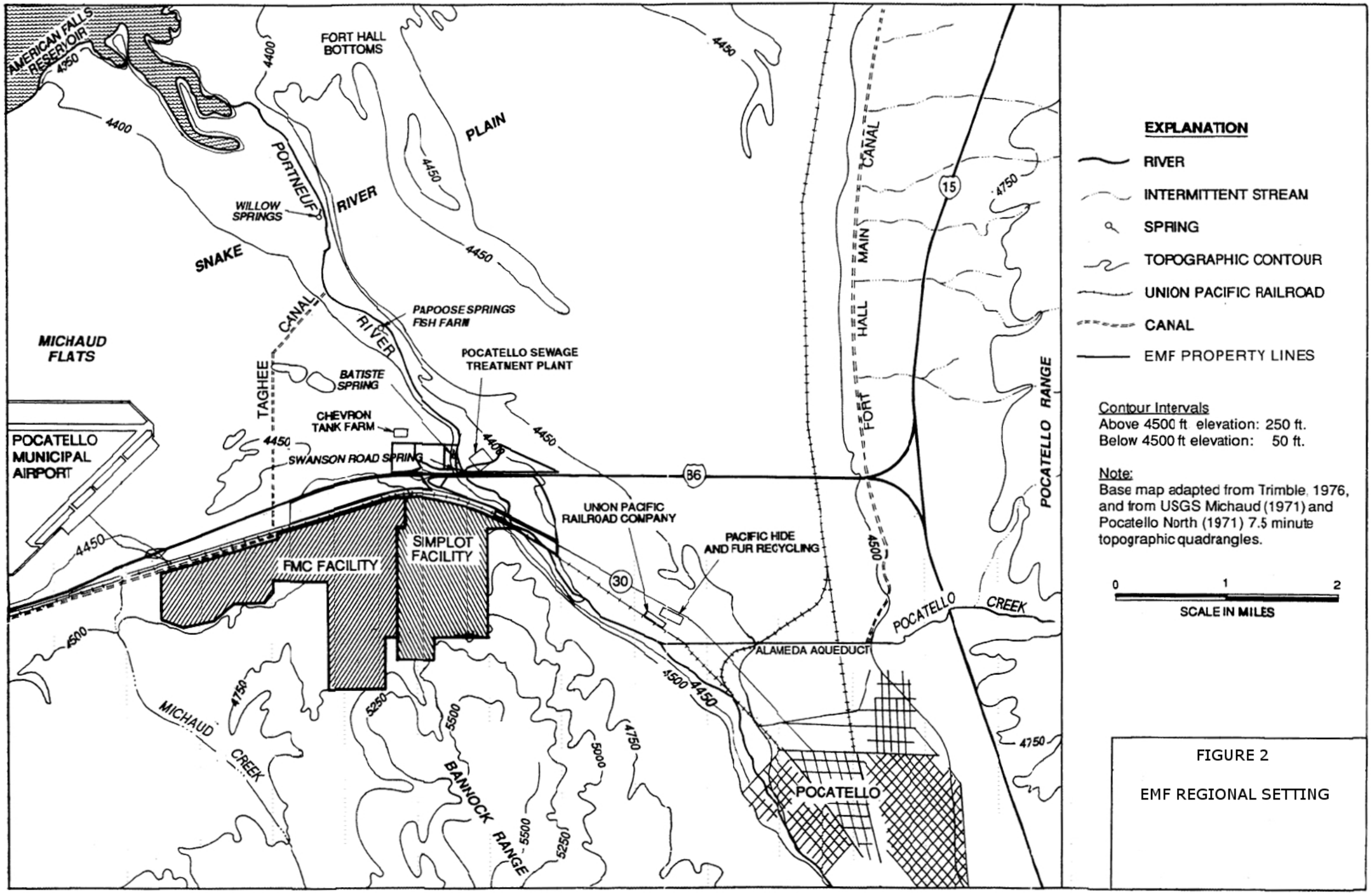


FIGURE 2

EMF REGIONAL SETTING

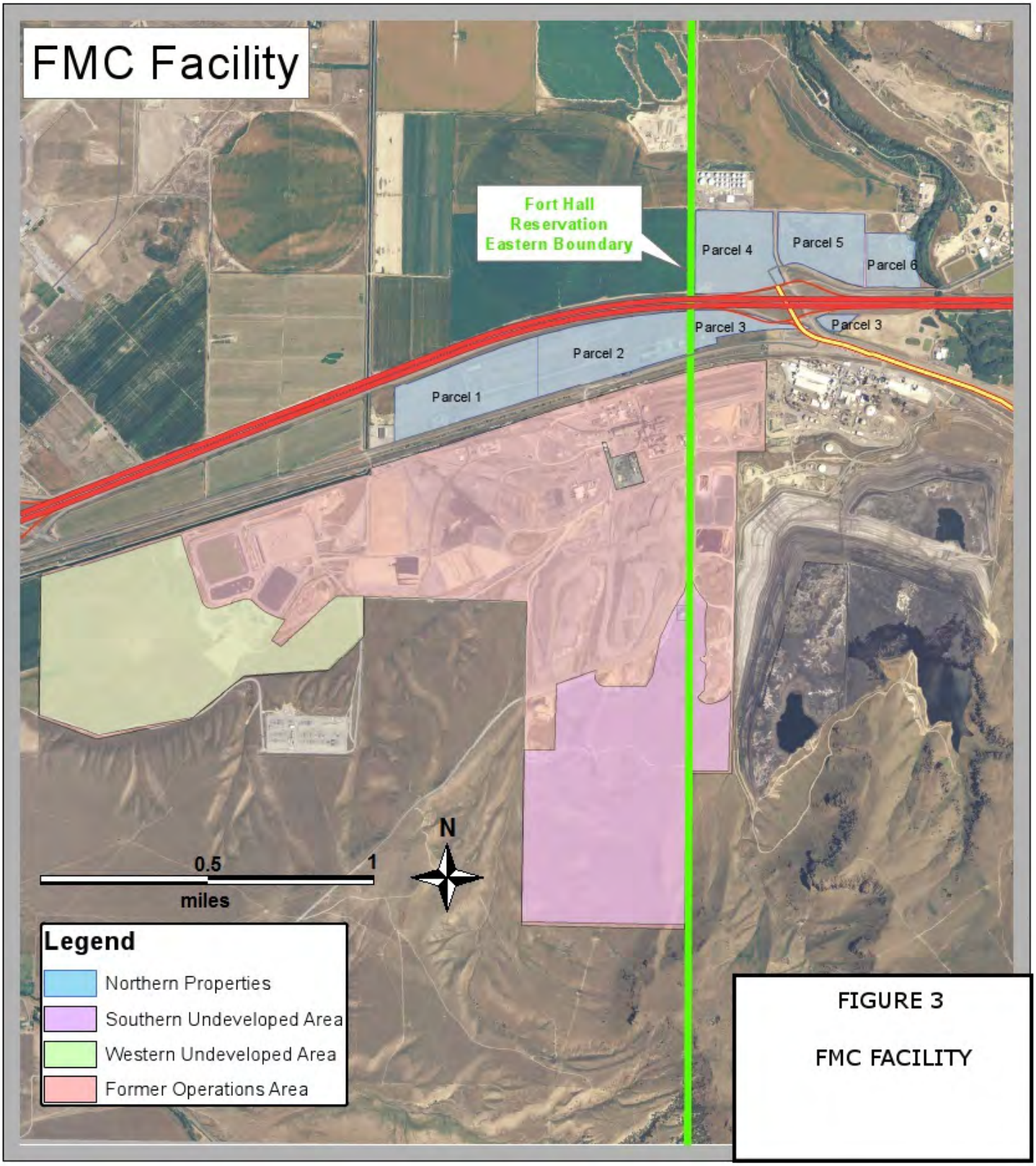
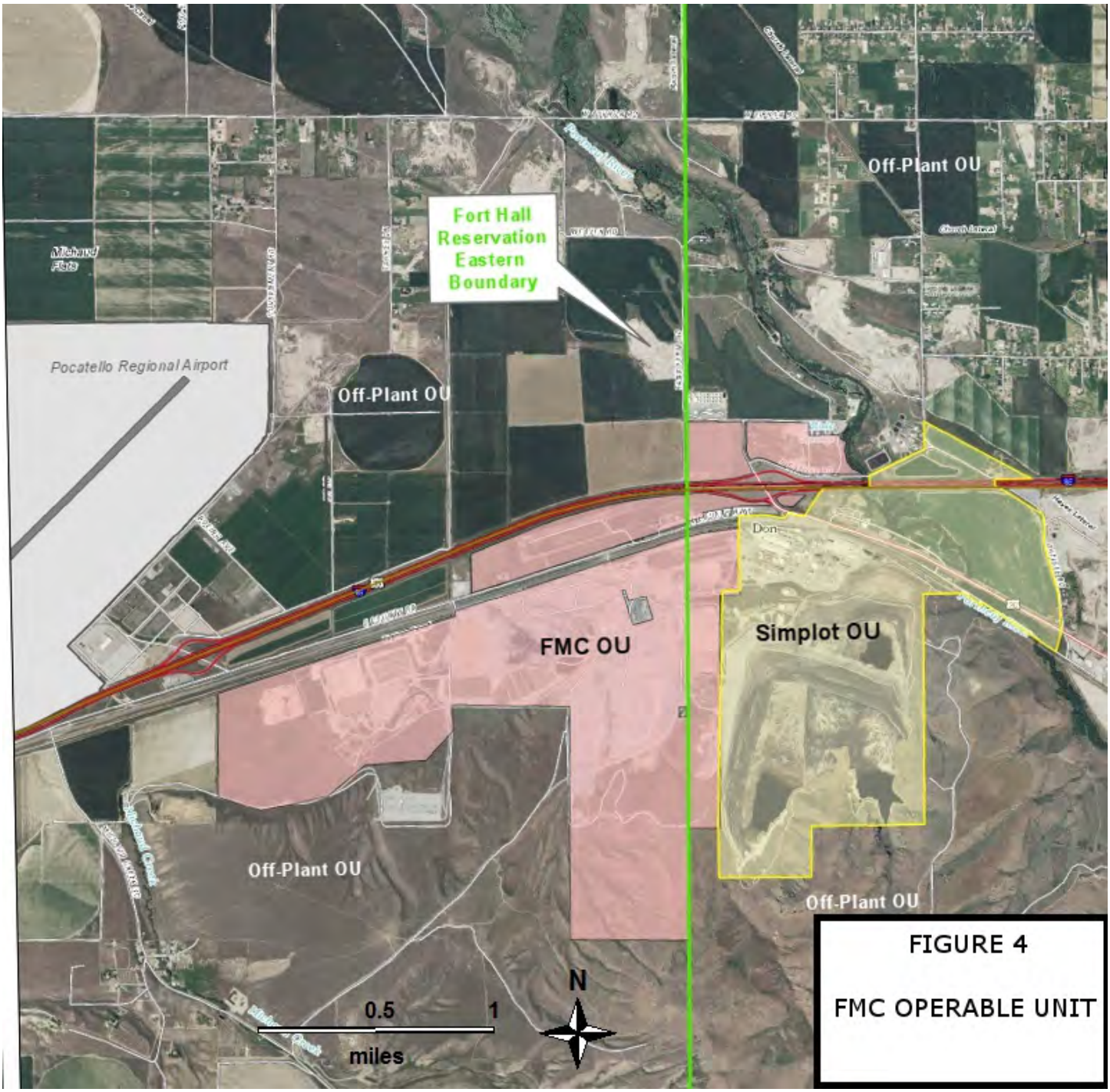


FIGURE 3

FMC FACILITY


Fort Hall Reservation Eastern Boundary
Off-Plant OU
Pocatello Regional Airport
Off-Plant OU
FMC OU
Simplot OU
Off-Plant OU
Off-Plant OU
0.5
1
miles
N
FIGURE 4
FMC OPERABLE UNIT

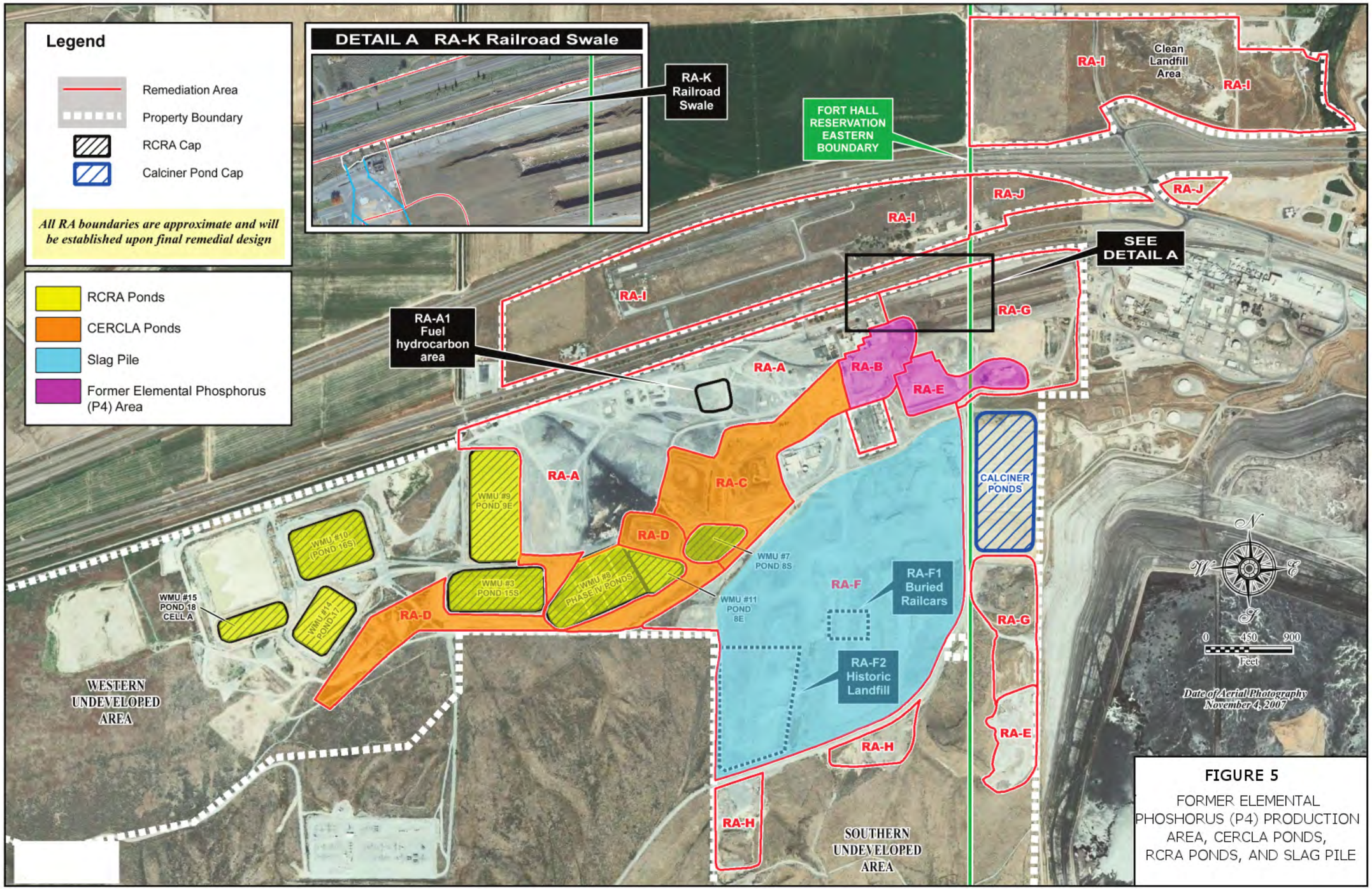


FIGURE 5

FORMER ELEMENTAL PHOSHORUS (P4) PRODUCTION AREA, CERCLA PONDS, RCRA PONDS, AND SLAG PILE

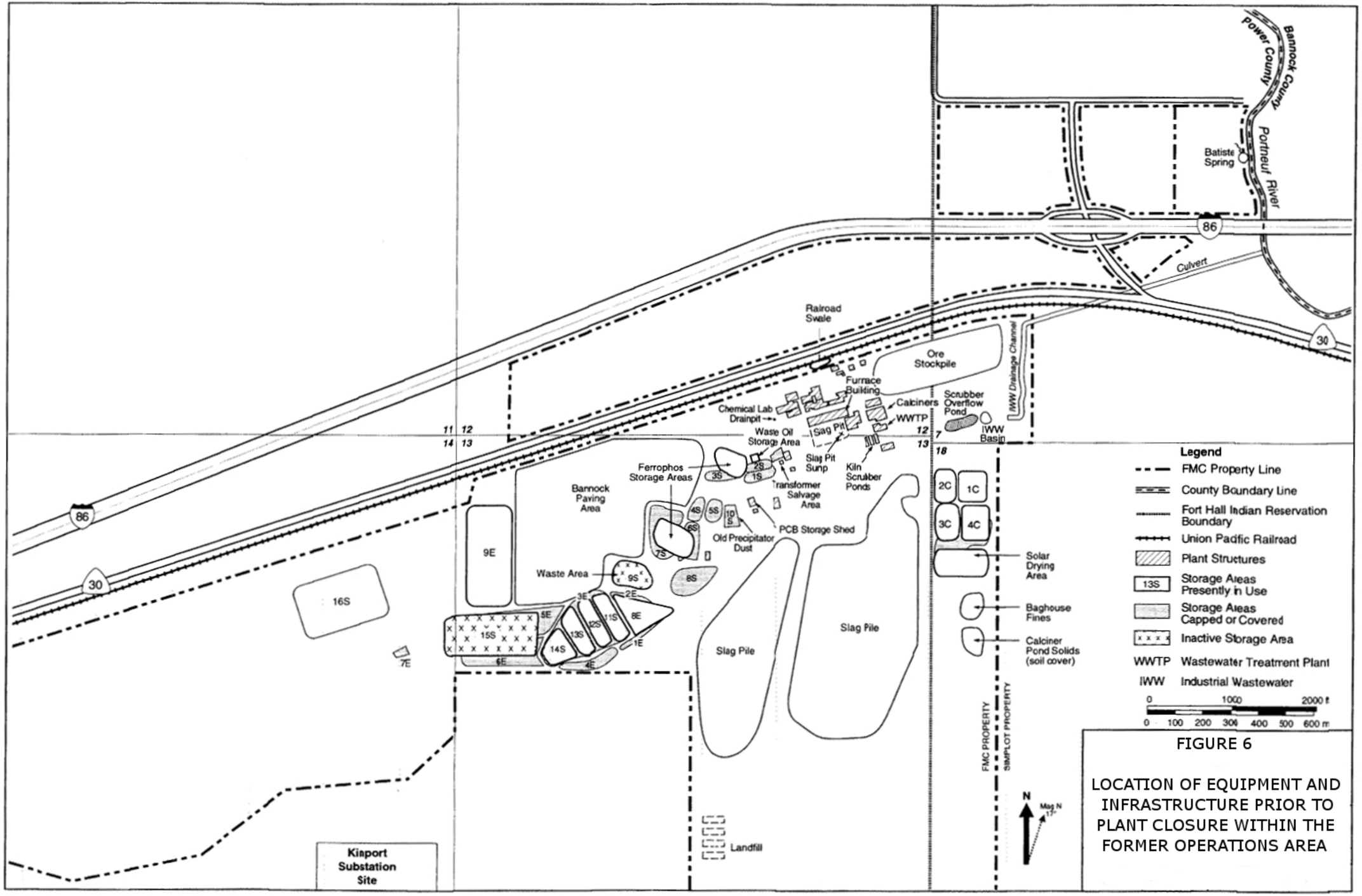


FIGURE 6

LOCATION OF EQUIPMENT AND INFRASTRUCTURE PRIOR TO PLANT CLOSURE WITHIN THE FORMER OPERATIONS AREA

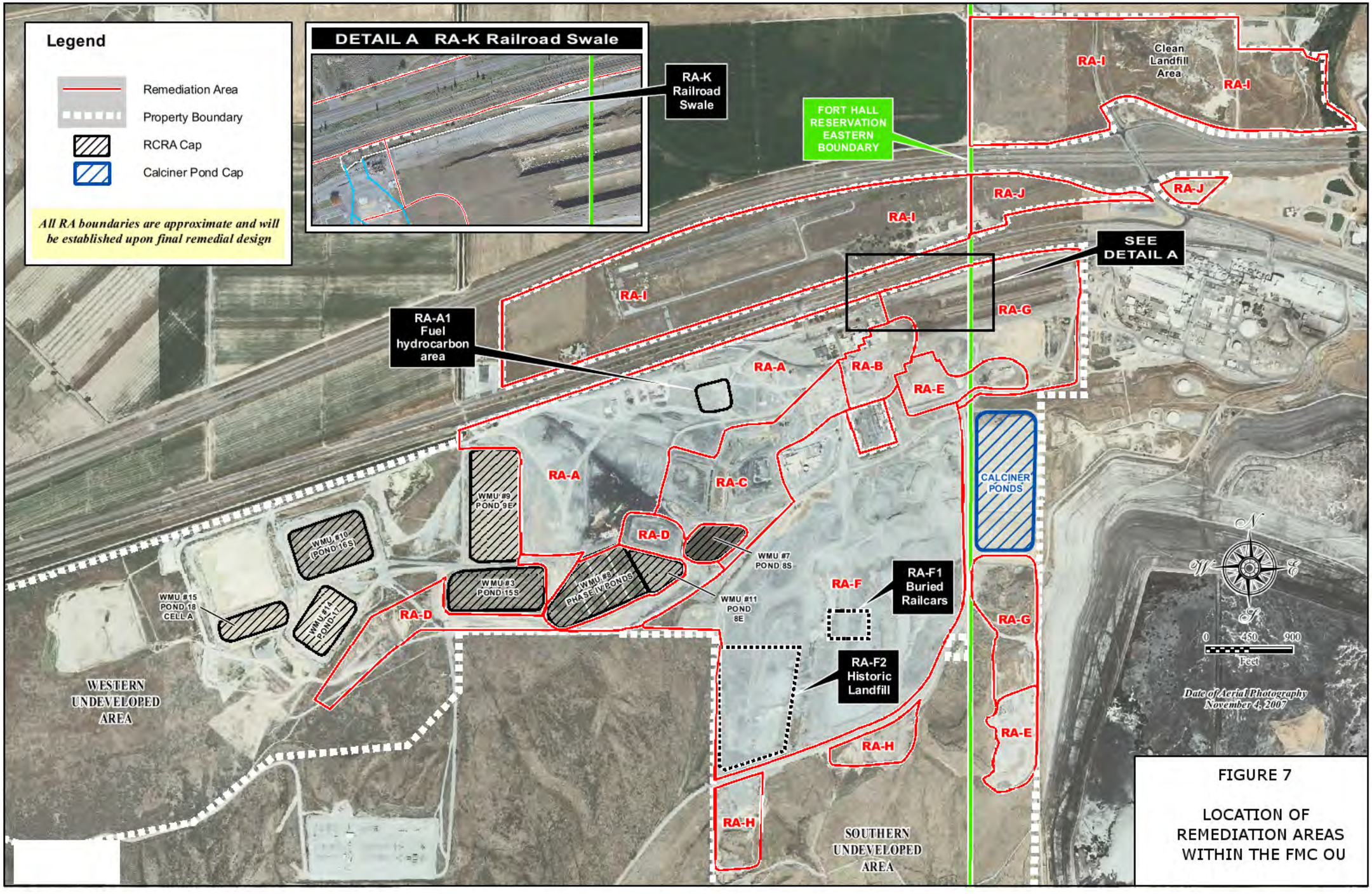


FIGURE 7

LOCATION OF REMEDIATION AREAS WITHIN THE FMC OU

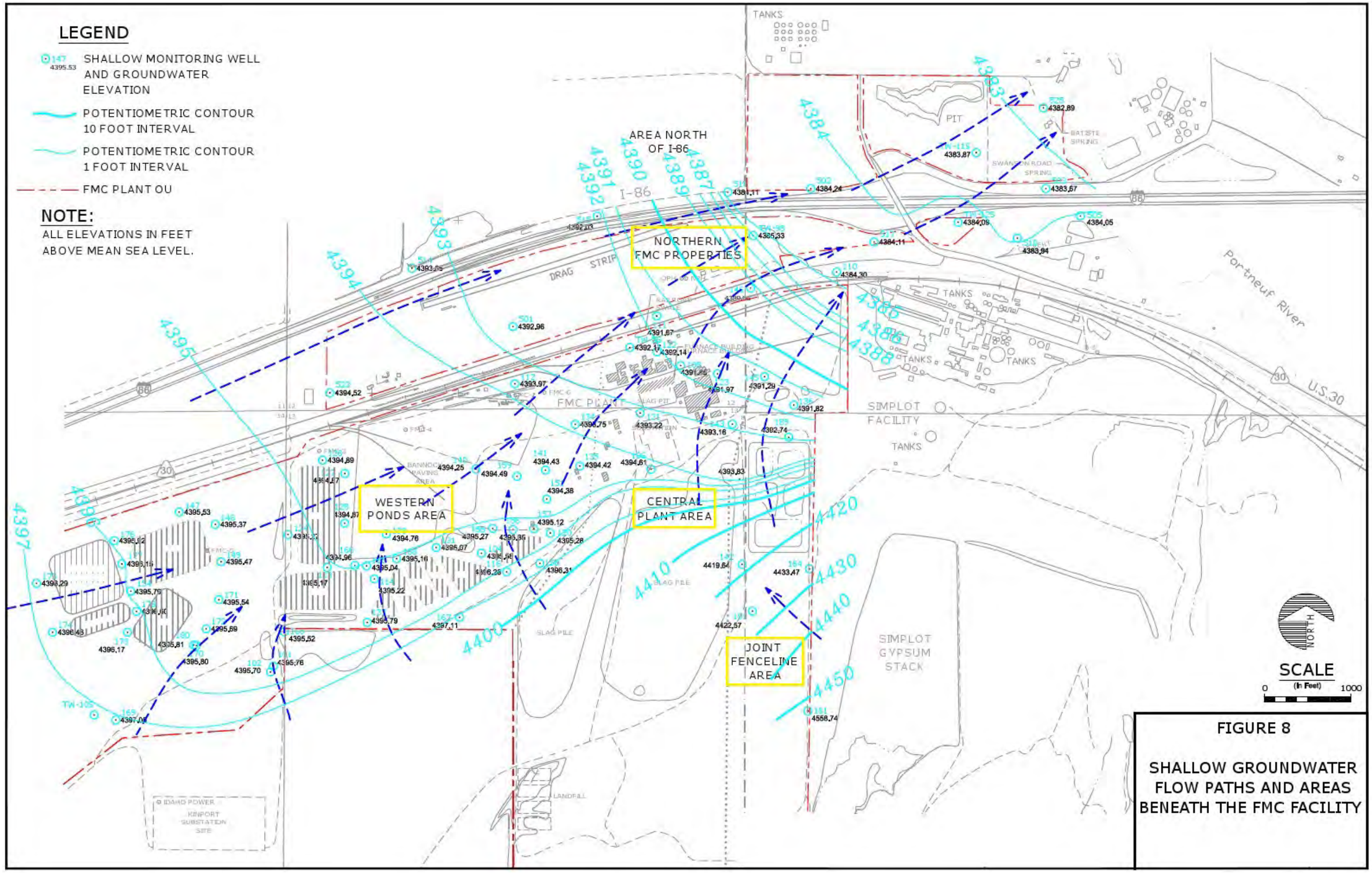
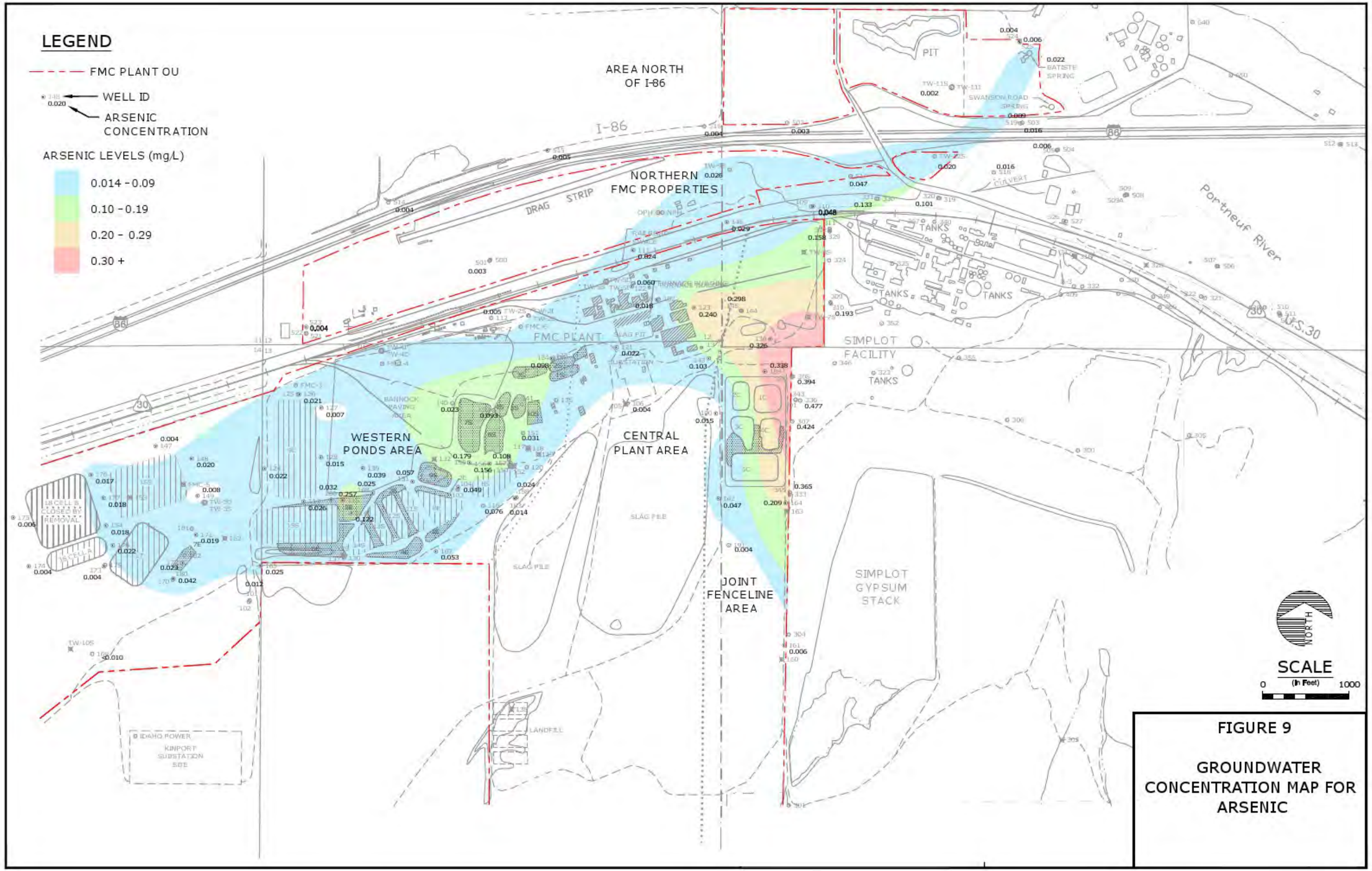


FIGURE 8

SHALLOW GROUNDWATER FLOW PATHS AND AREAS BENEATH THE FMC FACILITY


LEGEND
FMC PLANT OU
WELL ID
ARSENIC CONCENTRATION
ARSENIC LEVELS (mg/L)
0.014 - 0.09
0.10 - 0.19
0.20 - 0.29
0.30 +
AREA NORTH OF I-86
NORTHERN FMC PROPERTIES
WESTERN PONDS AREA
CENTRAL PLANT AREA
JOINT FENCELINE AREA
FMC PLANT
SIMPLOT FACILITY
SIMPLOT GYPSUM STACK
SLAG PILE
LANDFILL
PIT
BATISTE SPRING
SWANSON ROAD SPRING
DRAG STRIP
TANKS
Portneuf River
U.S.30
I-86
18 CELL B CLOSED BY REMOVAL
IDAHO POWER KINPORT SUBSTATION SITE
NORTH
SCALE
0
(In Feet)
1000
FIGURE 9
GROUNDWATER CONCENTRATION MAP FOR ARSENIC

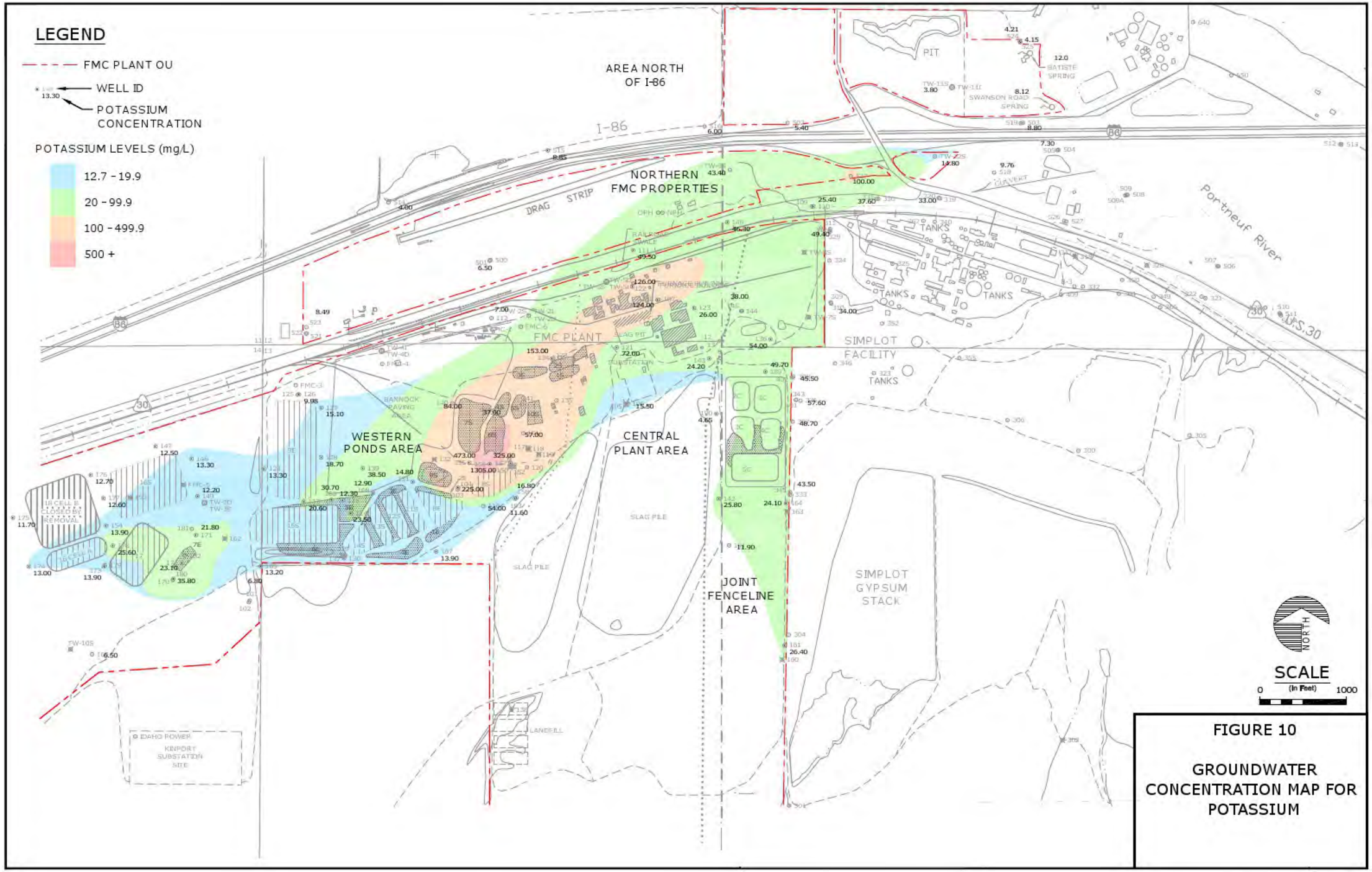


FIGURE 10

GROUNDWATER CONCENTRATION MAP FOR POTASSIUM

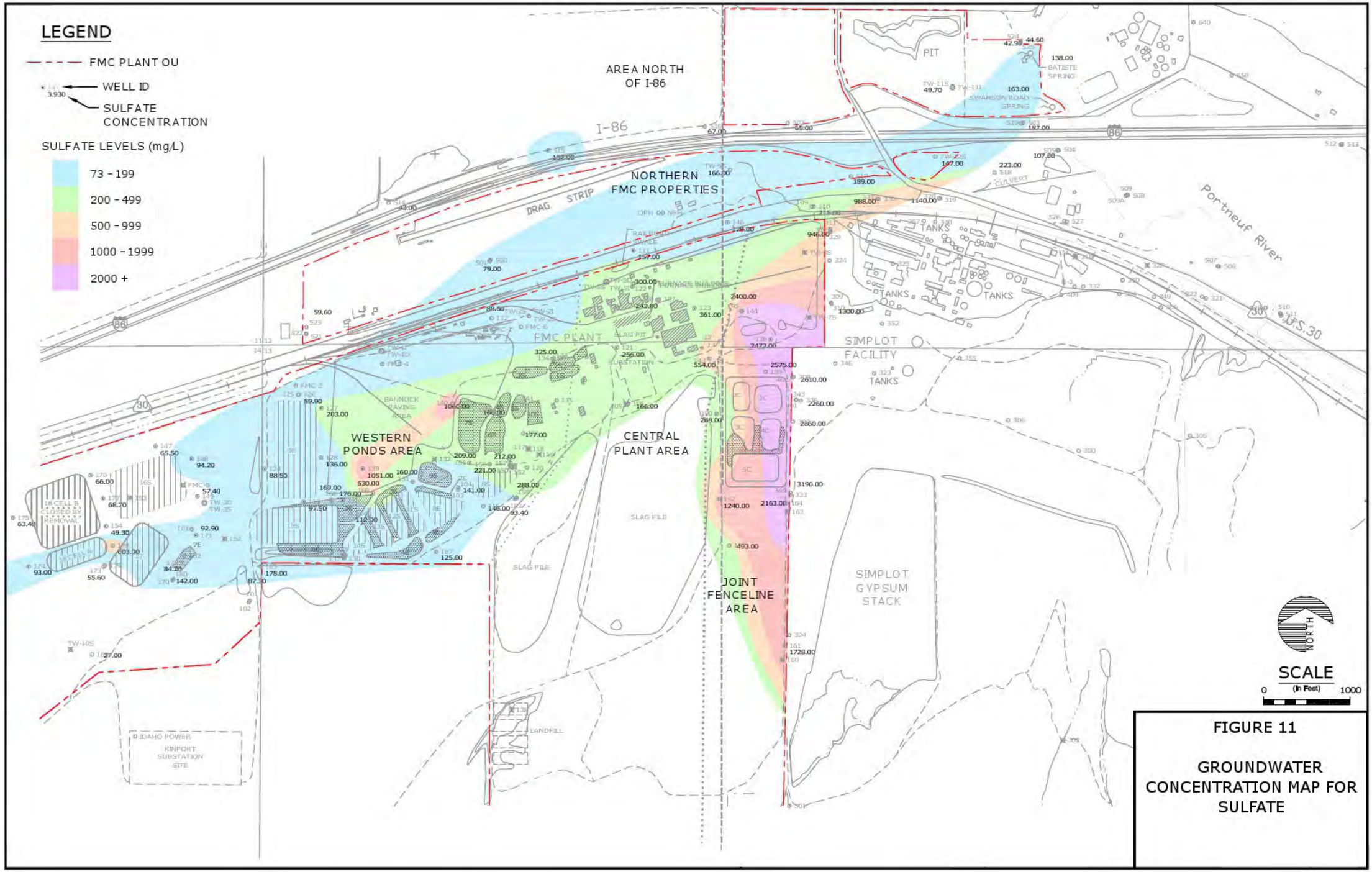


FIGURE 11

GROUNDWATER CONCENTRATION MAP FOR SULFATE

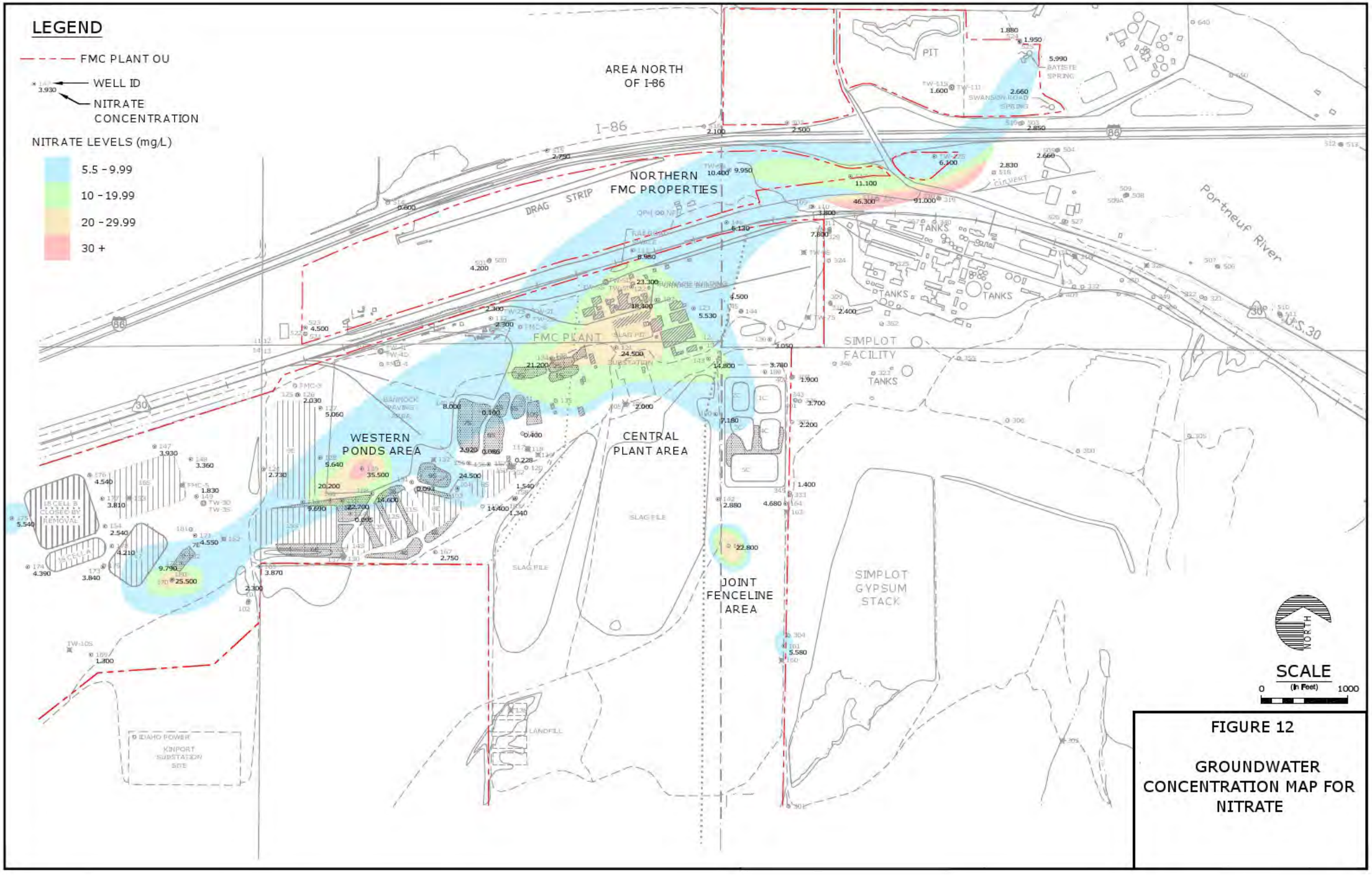


FIGURE 12

GROUNDWATER CONCENTRATION MAP FOR NITRATE

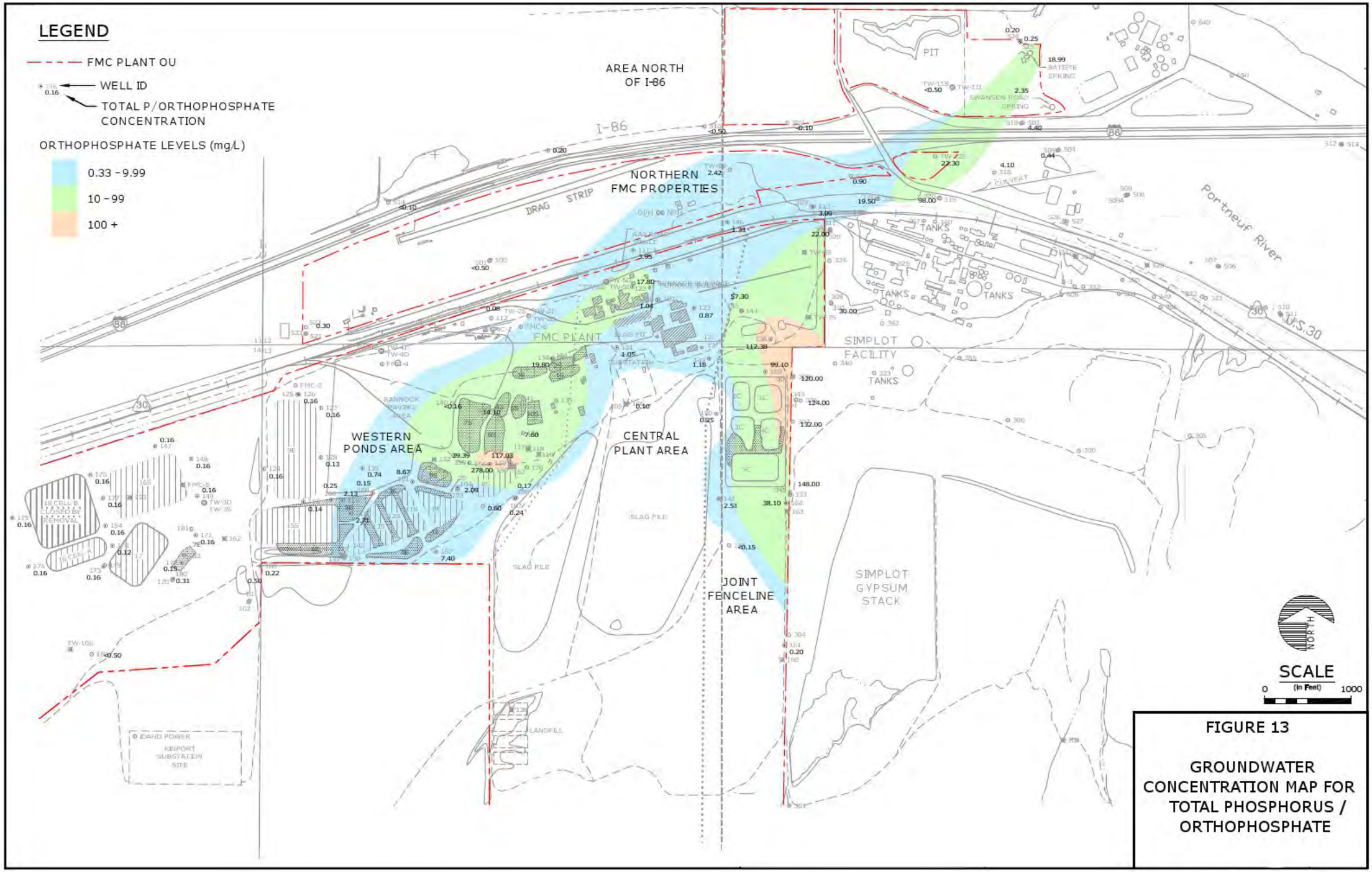


FIGURE 13

GROUNDWATER CONCENTRATION MAP FOR TOTAL PHOSPHORUS / ORTHOPHOSPHATE

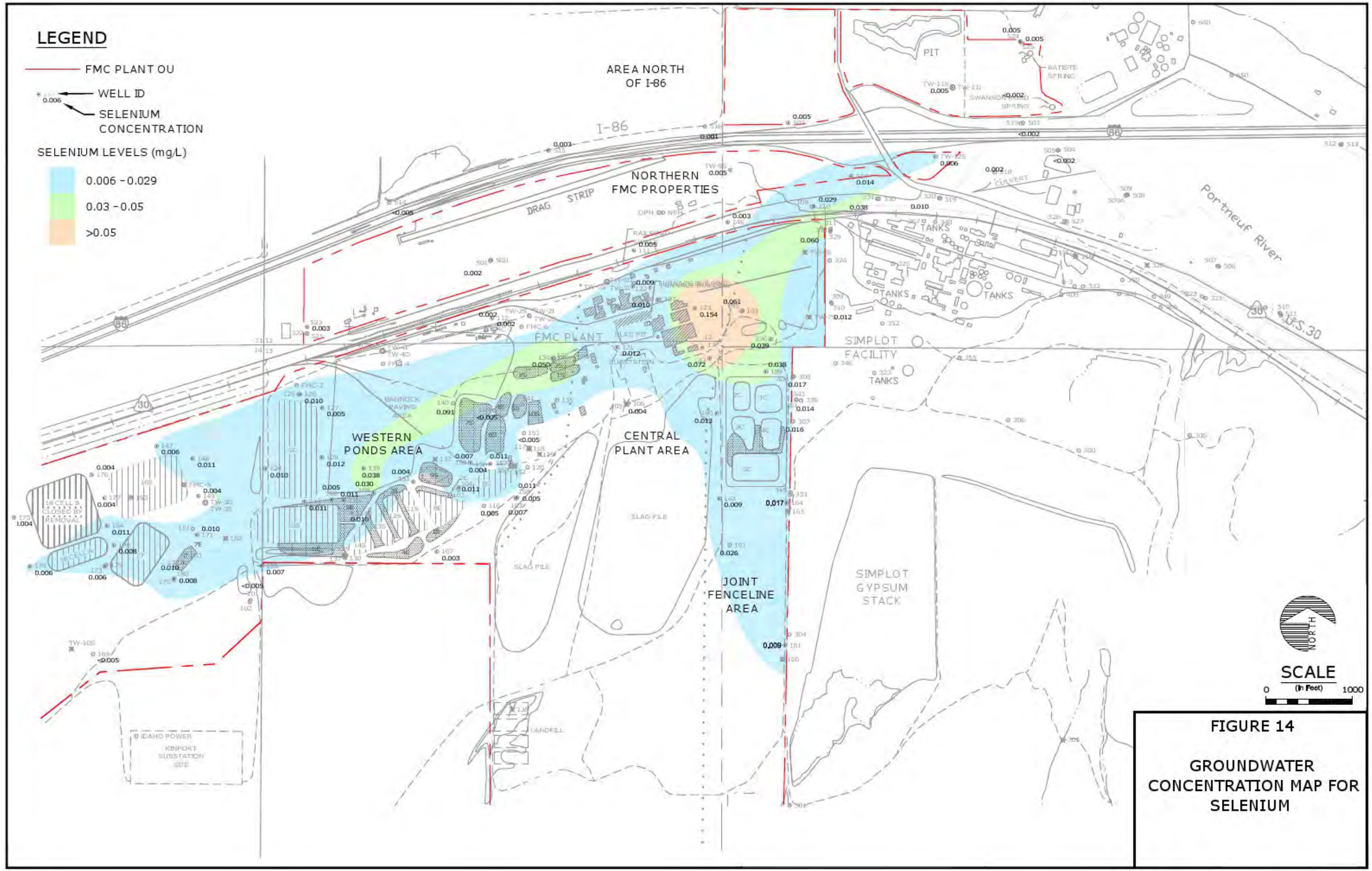


FIGURE 14

GROUNDWATER CONCENTRATION MAP FOR SELENIUM

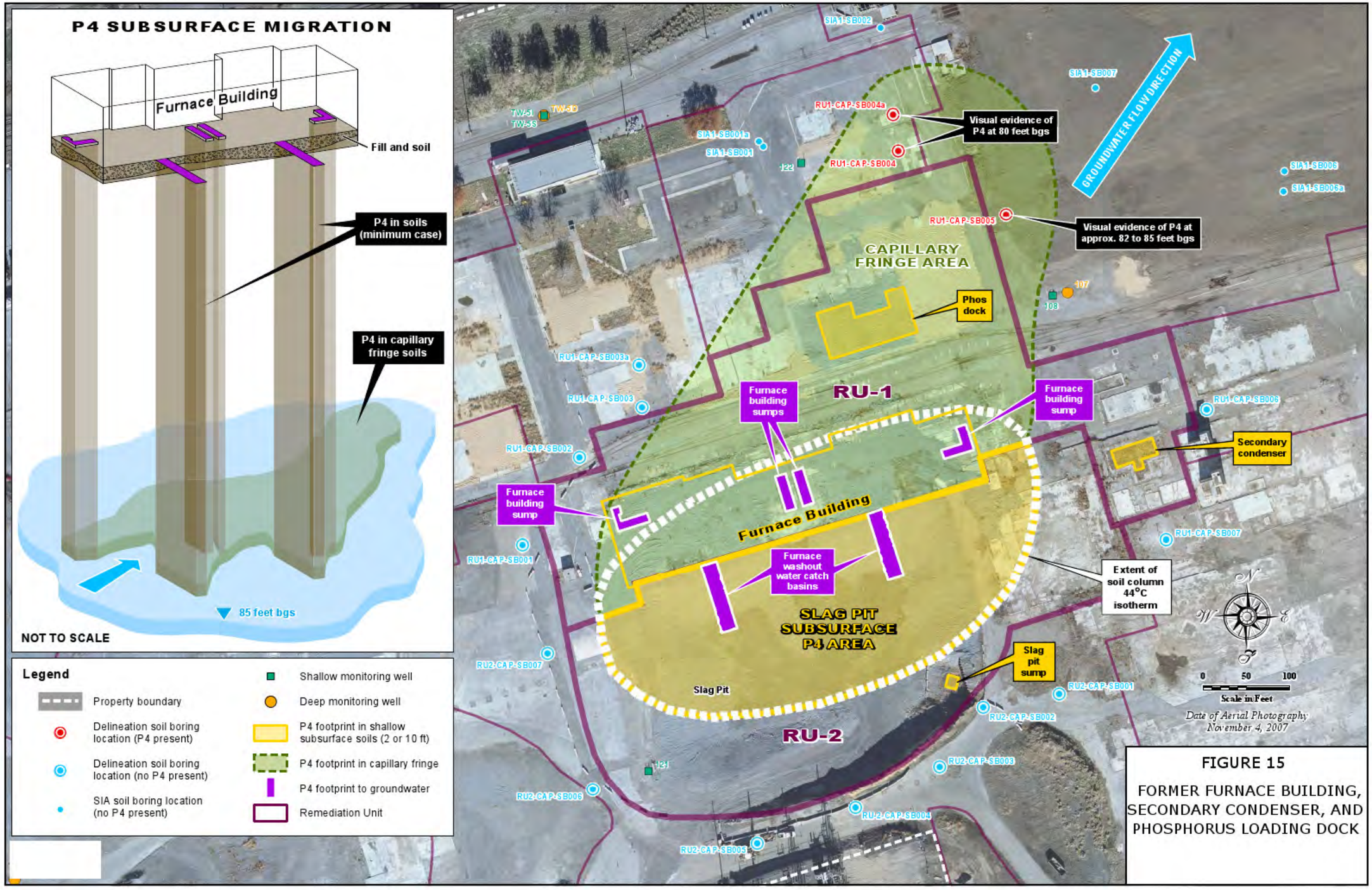


FIGURE 15

FORMER FURNACE BUILDING, SECONDARY CONDENSER, AND PHOSPHORUS LOADING DOCK

FIGURE 16

GROUNDWATER ALTERNATIVE 2
SELECTED INTERIM AMENDED REMEDY
APPROXIMATE LOCATIONS OF
PROPOSED EXTRACTIONS WELLS AND
PIPING / POTW OPTION

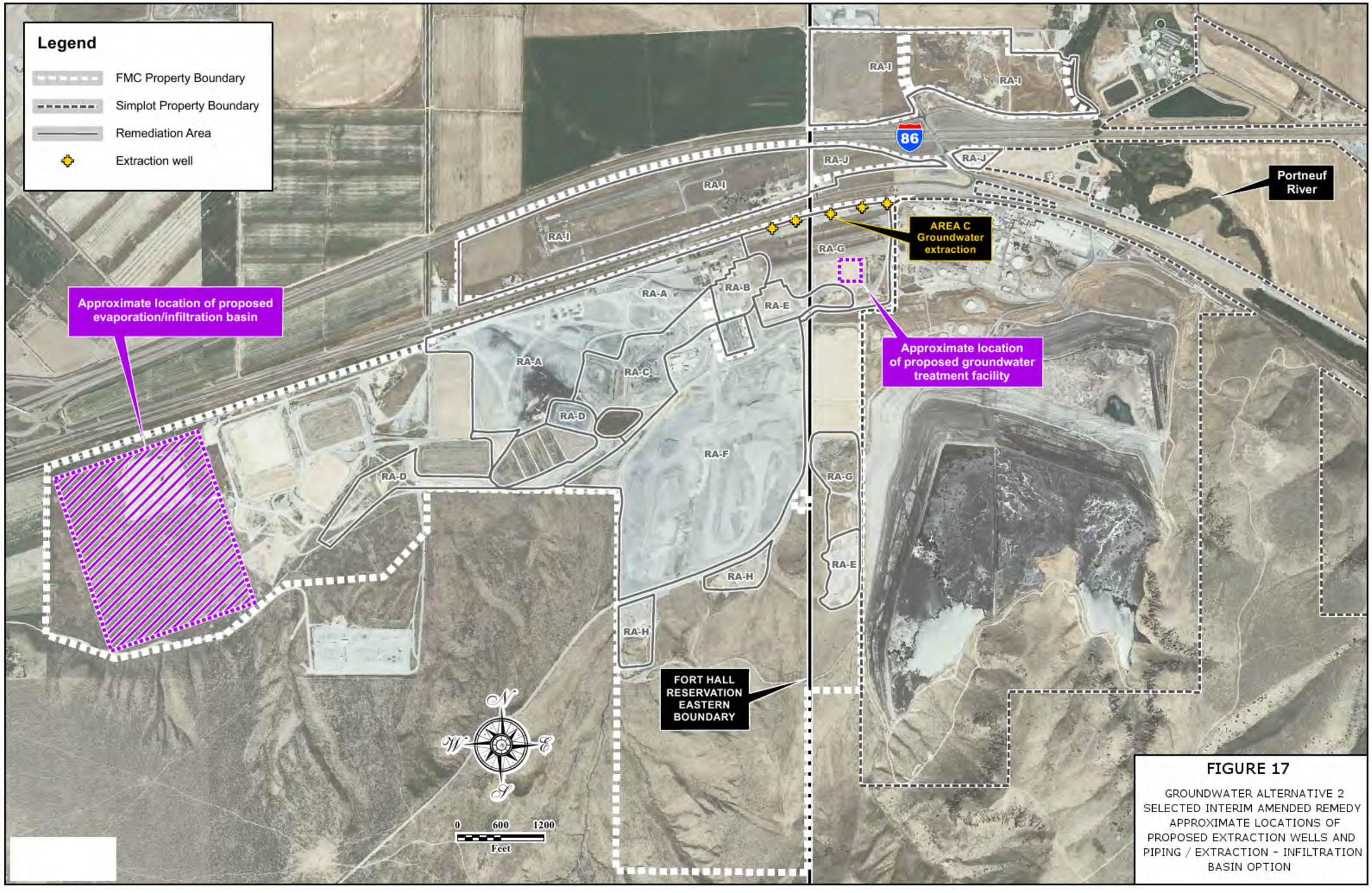


FIGURE 17

GROUNDWATER ALTERNATIVE 2
SELECTED INTERIM AMENDED REMEDY
APPROXIMATE LOCATIONS OF
PROPOSED EXTRACTION WELLS AND
PIPING / EXTRACTION - INFILTRATION
BASIN OPTION

TABLES

TABLE 1
SUMMARY OF RAs, RUs, DESCRIPTION OF FILL,
AND ASSOCIATED RCRA SWMUs

RAs Area	RUs	Description and Fill/Source Materials	Associated RCRA SWMUs [1]
RA-A 103 acres	3, 4, 5, 6, 20, and portions of 24	This area contains former office areas, parking areas, railroad siding, laydown areas, and Bannock Paving area. Most of the remedial area is covered with non-leachable fill including primarily slag, coke, silica, concrete, asphalt, and native soil. Underground piping (storm sewers) containing COCs (including P4) exists in RU 3 as listed separately below. RA-A does not encompass any identified or potential sources of COC releases to groundwater. **Fill/Source Materials Considered for HHRA Exposure Scenarios[2]:** Slag Coke Ferrophos PCDT water residue	SWMU# 1 Drum Storage Unit SWMU# 38 Road Segments SWMU# 39 Chemical Lab Drain Pit SWMU# 46 Railcar Loading and Unloading Area-BPC SWMU# 47 Bannock Paving Areas SWMU# 47 Coke Settling Pond (former BAPCO Unit) SWMU# 48 Surface roads Bannock Paving Company SWMU # 61 Laboratory Chemical Disposal Area SWMU# 63 Long-Term Phosphorus Storage Tanks SWMU# 66 Boiler Fuel Tank and Pipeline Area SWMU# 68 Railroad Spurs SWMU# 70 Satellite Storage Area for Spent Laboratory Solvents SWMU# 72 Former Satellite Storage Area for Waste Paint Solvents SWMU# 92 P4 Maintenance Cleaning Facility (Decon Building) SWMU# 99 Drum Storage Area at Training Center SWMU# 101 Railcar Loading Overflow Tank
RA-A1 < 1 acre	Portion of RU 20	This area is located at the former Bannock Paving area and included above ground fuel storage tanks and vehicle fueling area. This area was investigated during the SRI in 2007 and found to contain fuel PAHs above the soil SSLs. RA-A1 does not encompass any identified or potential sources of COC releases to groundwater. **Fill/Source Materials Considered for HHRA Exposure Scenarios[2]:** Slag PCDT water residue Fuel spill residue	SWMU# 47 Bannock Paving Areas SWMU# 48 Surface roads Bannock Paving Company
RA-B 10.8 acres	1, 2, and down gradient to include P4-impacted capillary fringe.	This area contains former the furnace building, phos dock, secondary condenser, and slag pit and extends to the east to capture the capillary fringe soils contaminated with P4. 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 (including P4) exists in RA-B. RA-B encompasses identified and potential sources of COC releases to groundwater. **Fill/Source Materials Considered for HHRA Exposure Scenarios[2]:** Slag P4 Precipitator solids Phossy solids Underground Piping Containing P4	SWMU# 5 Slag Pit Wastewater Collection Sump SWMU# 13 Andersen Filter Media (AFM) Washing Unit SWMU# 36 & 55 Rail Car Loading/Unloading, and Phos Dock SWMU# 38 Road segments SWMU# 41 (partial) Stacks and Vents SWMU# 54 Phos Dock Area SWMU# 60 Secondary Condenser/Former Fluid Bed Dryer Area SWMU# 68 Railroad Spurs SWMU# 73 Satellite Areas for Spent Anderson Filter Media SMWU# 74 East AFM Bin Area SMWU# 75 Precipitator Dust Slurry Pots SWMU# 76 Medusa Scrubber Blowdown Collection Tank SWMU# 77 P4 Load Dock, Scrub. Blowdown Sump, and NS Tank SWMU# 78 Washdown Collection Sumps--Furnace Building Area

[1] RCRA SWMUs do not necessarily contribute to the Remediation Area (RA) risk, but are identified here to integrate RCRA corrective action into the SFS under the "one clean-up" initiative.
[2] Risks associated with exposure to the contents of underground piping runs are evaluated separately from risks associated with exposure to other surface and subsurface fill/source materials identified in an RU.
[3] These RAs / subareas have not been identified as sources that have discernibly impacted groundwater (GWCCR, June 2009); however, based on historical knowledge and/or the SRI results, the SFS will consider these RAs / subareas as potential sources of COC releases to groundwater.

TABLE 1
SUMMARY OF RAs, RUs, DESCRIPTION OF FILL,
AND ASSOCIATED RCRA SWMUs

RAs Area	RUs	Description and Fill/Source Materials	Associated RCRA SWMUs [1]
			SWMU# 79 Northeast Collection Sump - Furnace Building Area SWMU# 80 Southeast Collection Sump - Furnace Building Area SWMU# 81 Furnace Washdown Collection Tank (V-3600) SWMU# 82 Facility-Wide Wastewater Piping System SWMU# 86 V-3700 Tank and Associated Piping SWMU# 90 V-3800 Tank and Associated Piping SWMU# 91 NOSAP Intercept Tank (Tank T-8010) SWMU#102 Former Slag Pit (prior to slag handling) SWMU# 104 #3 P4 Sump
RA-C 34.6 acres	RUs 13, northern portion of 12, eastern portion of 22b, and a small portion of RU 24 between RUs 1 & 2 and RU 22b.	This area contains former phossy/precipitator slurry ponds, the piping corridor between RUs 1 and 2 and 22b (small portions of RUs 12 and 24), 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 (including P4) exists in RUs 13, 22b and 24. RA-C encompasses identified and potential sources of COC releases to groundwater. **Fill/Source Materials Considered for HHRA Exposure Scenarios[2]:** Slag Precipitator solids Phossy solids P4 Ferrophos PCDT water residue Underground Piping Containing P4	SWMU# 4 Former 8S Recovery Process SWMU# 25 Pond 0S SWMU# 26 Pond 00S SWMU# 27 Pond 1S SWMU# 28 Pond 2S SWMU# 29 Pond 3S SWMU# 30 Pond 4S SWMU# 31 Pond 5S SWMU# 32 Pond 6S SWMU# 33 Pond 7S SWMU# 34 Pond 10S (Including Precipitator Dust Pile atop pond 10S) SWMU# 38 Road Segments SWMU# 43 Ferrophos Storage Areas SWMU# 53 Old Pond 7S Tree-Line Area SWMU# 56 Drum Storage Area for other Nonhazardous Wastes SWMU# 57 Transformer Salvage Area SWMU# 58 PCB Storage Shed (removed 2000) SWMU# 59 Waste Oil Storage Area SWMU# 62 Area West of Mobile Shop SWMU# 64 (partial) Phossy Waste Pipeline Cleanout Areas SWMU# 65 (partial) Precipitator Slurry Pipeline Cleanout Areas SWMU# 71 Satellite Storage Areas for Waste Degreasing Solvents SWMU# 82 (partial) Facility-wide Wastewater Piping System SWMU# 83 High-pressure steam cleaning Station SWMU# 84 Used Oil Collection Tank SWMU# 107 Portable Storage Tanker for Dielectric Fluid

[1] RCRA SWMUs do not necessarily contribute to the Remediation Area (RA) risk, but are identified here to integrate RCRA corrective action into the SFS under the "one clean-up" initiative.
[2] Risks associated with exposure to the contents of underground piping runs are evaluated separately from risks associated with exposure to other surface and subsurface fill/source materials identified in an RU.
[3] These RAs / subareas have not been identified as sources that have discernibly impacted groundwater (GWCCR, June 2009); however, based on historical knowledge and/or the SRI results, the SFS will consider these RAs / subareas as potential sources of COC releases to groundwater.

TABLE 1
SUMMARY OF RAs, RUs, DESCRIPTION OF FILL,
AND ASSOCIATED RCRA SWMUs

RAs Area	RUs	Description and Fill/Source Materials	Associated RCRA SWMUs [1]
RA-D 33.6 acres	Western portion of RU 22b including former Pond 9S	This area contains former clarified phossy water/precipitator slurry overflow ponds and precipitator slurry ponds. No P4 is present but surface/subsurface fill contains phossy solids, precipitator solids, slag, and ore. RA-D encompasses identified and potential sources of COC releases to groundwater. **Fill/Source Materials Considered for HHRA Exposure Scenarios[2]:** Slag Precipitator solids Phossy solids PCDT water residue Underground Piping Containing P4	SWMU# 6 Area 9S SWMU# 19 Pond 1E SWMU# 20 Pond 2E SWMU# 21 Pond 3E SWMU# 22 Pond 4E SWMU# 23 Pond 5E SWMU# 24 Pond 6E SWMU# 52 Pond 7E
RA-E 21.2 acres	RU 8, southern portion of RU 9, and southern portion of RU 16.	This area contains former ore kilns, kiln scrubber ponds, calciners, calciner pond solids stockpile, silica stockpiles, and calcined ore stockpiles. No P4 is present but surface/subsurface fill contains slag, ore, silica, kiln pond solids (subsurface). Underground piping containing COCs (including P4) exists in RU 8 and is listed separately below. RA-E encompasses identified and potential sources of COC releases to groundwater. **Fill/Source Materials Considered for HHRA Exposure Scenarios[2]:** Slag Ore Calciner pond solids Calcined ore Coke Underground Piping Containing P4	SWMU# 12 Wastewater Treatment Unit SWMU# 17 Calciner Pond Sediment Stockpile SWMU# 35 Three kiln Scrubber Ponds SWMU# 38 Road Segments SWMU# 41 Stacks and Vents (i.e., calciner system) SWMU# 51 Kiln (scrubber) Overflow Pond SWMU# 67 Former Flare Pit for Carbon Monoxide SWMU# 103 New Horizontal Flare Pit
RA-F 171 acres including RA-F1 and RA-F2	RUs 19, 11, and southern portion of 12	This area contains the slag pile and bullrock pile (RU 19) and former equipment maintenance/laydown areas (RUs 11 and 12). Surface and subsurface fill within this area consists predominantly of slag and bull rock. Southwestern corner of slag pile was location of the former plant landfill (RU 19b) and is listed separately below. Railcars containing P4 and phossy solids (RU 19c) are listed separately below. RA-F does not encompass any identified or potential sources of COC releases to groundwater. **Fill/Source Materials Considered for HHRA Exposure Scenarios:** Slag Precipitator solids Phossy solids Ferrophos PCDT water residue	SWMU# 38 FMC surface road segments SWMU# 42 Slag Pile

[1] RCRA SWMUs do not necessarily contribute to the Remediation Area (RA) risk, but are identified here to integrate RCRA corrective action into the SFS under the "one clean-up" initiative.
[2] Risks associated with exposure to the contents of underground piping runs are evaluated separately from risks associated with exposure to other surface and subsurface fill/source materials identified in an RU.
[3] These RAs / subareas have not been identified as sources that have discernibly impacted groundwater (GWCCR, June 2009); however, based on historical knowledge and/or the SRI results, the SFS will consider these RAs / subareas as potential sources of COC releases to groundwater.

TABLE 1
SUMMARY OF RAs, RUs, DESCRIPTION OF FILL,
AND ASSOCIATED RCRA SWMUs

(Page 4 of 6)

RAs Area	RUs	Description and Fill/Source Materials	Associated RCRA SWMUs [1]
RA-F1 (Buried Railcars) 2.7 acres		In 1964, 21 railcars containing an estimated 10 to 25% P4 sludge were placed at the southern edge of the slag pile and covered with native soil. The railcars were then covered with 80 to 120 feet of slag as the slag pile progressed to the south. RU 19c is a potential source of COC releases to groundwater [3]. **Fill/Source Materials Considered for HHRA Exposure Scenarios:** Slag Phossy solids P4	None
RA-F2 (Former Landfill) 20.3 acres		This sub-area is located within the southwestern corner of the slag pile (RU 19). Landfill operations within this sub-area (RU 19b) began at the inception of plant operations in 1949 and ceased in 1980. Wastes placed in RU 19b included slag, office wastes (consisting of office and lunchroom solid wastes), industrial wastes (consisting of asbestos, spent solvents, oily residues, transformer oil, kiln scrubber solids, phosphorus-bearing wastes, fluid-bed dryer wastes, and AFM) furnace rebuild/digout wastes (consisting of furnace feed materials, carbon materials, concrete, rocks, and debris), IWW sediments, and baghouse dust. These wastes are covered by 50 - >100 ft of slag. RU 19b is a potential source of COC releases to groundwater [3]. **Fill/Source Materials Considered for HHRA Exposure Scenarios:** Slag Office wastes Industrial wastes – asbestos wastes, spent solvents, and oily residues, transformer oil, kiln scrubber solids, phosphorus-bearing wastes, fluid-bed dryer wastes AFM Furnace digout/rebuild wastes	SWMU# 44 Landfill (old)

[1] RCRA SWMUs do not necessarily contribute to the Remediation Area (RA) risk, but are identified here to integrate RCRA corrective action into the SFS under the "one clean-up" initiative.
[2] Risks associated with exposure to the contents of underground piping runs are evaluated separately from risks associated with exposure to other surface and subsurface fill/source materials identified in an RU.
[3] These RAs / subareas have not been identified as sources that have discernibly impacted groundwater (GWCCR, June 2009); however, based on historical knowledge and/or the SRI results, the SFS will consider these RAs / subareas as potential sources of COC releases to groundwater.

TABLE 1
SUMMARY OF RAs, RUs, DESCRIPTION OF FILL,
AND ASSOCIATED RCRA SWMUs

RAs Area	RUs	Description and Fill/Source Materials	Associated RCRA SWMUs [1]
RA-G 65.9 acres	RUs 7, northern portion of 9, 10, 15, northern portion of 16, and portions of 24.	This area contains the ore stockpiles, silica stockpile, IWW pond and ditch, dry process waste pile (RU 15) and the northern portion of RU 16. Surface and subsurface fill within this area include various plant solid materials including ore, baghouse dust, coke, carbon, calciner solids, and slag. RA-G does not encompass any identified or potential sources of COC releases to groundwater. The northeastern portion of RA-G (on State land) includes areas within the PCDA Development Agreement. **Fill/Source Materials Considered for HHRA Exposure Scenarios:** Slag Ore Coke Calcined ore Calciner pond solids Precipitator solids	SWMU# 16 Calciner Solids Pile SWMU# 37 Shale Ore Handling Areas SWMU# 38 Road segments SWMU# 49 Industrial Wastewater Basin SWMU# 50 Industrial Wastewater Ditch SWMU# 69 Oversize Ore, Broken and Used Electrode, Baghouse Dust Storage and Recycling, and Used Conveyor Belt Area SWMU# 105 Coke Unloading Building SWMU# 106 Nodule Pile
RA-H 17 acres	RUs 17 and 18	This area contains the active plant landfill (RU 18) and the construction/demolition debris landfill (RU 17). 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-H is a potential source of COC releases to groundwater [3]. **Fill/Source Materials Considered for HHRA Exposure Scenarios:** Slag Furnace feed materials (ore, silica, coke) Office wastes Packaging materials AFM Asbestos containing materials Carbon	SWMU# 38 Road segments SWMU# 45 Landfill (also referred to as Solid Waste Landfill) SWMU# 89 Roadway Landfill
RA-I 191 acres	Northern Properties (Parcels 1, 2, 4, 5, and 6)	This area of the FMC Plant OU is north of the Plant Site and includes all land owned by FMC (Parcels 1, 2, 4, 5, and 6) with exception of Parcel 3. It was not used for plant production activities, but was used for various agricultural, commercial and recreational activities. Some slag was applied to the surface for roads and parking. RA-I does not encompass any identified or potential sources of COC releases to groundwater. **Sources Considered for HHRA and ERA Exposure Scenarios:** Fugitive dust and stack emissions deposited on land surface.	None

[1] RCRA SWMUs do not necessarily contribute to the Remediation Area (RA) risk, but are identified here to integrate RCRA corrective action into the SFS under the "one clean-up" initiative.
[2] Risks associated with exposure to the contents of underground piping runs are evaluated separately from risks associated with exposure to other surface and subsurface fill/source materials identified in an RU.
[3] These RAs / subareas have not been identified as sources that have discernibly impacted groundwater (GWCCR, June 2009); however, based on historical knowledge and/or the SRI results, the SFS will consider these RAs / subareas as potential sources of COC releases to groundwater.

TABLE 1
SUMMARY OF RAs, RUs, DESCRIPTION OF FILL, AND ASSOCIATED RCRA SWMUs

(Page 6 of 6)

RAs Area	RUs	Description and Fill/Source Materials	Associated RCRA SWMUs [1]
RA-J 15 acres	Northern Properties (Parcel 3)	This area of the FMC Plant OU contains property (Parcel 3) north of Highway 30, but south of I-86 on State lands. It was not used for plant production activities, but was used for various agricultural and commercial activities. RA-J does not encompass any identified or potential sources of COC releases to groundwater. **Sources Considered for HHRA and ERA Exposure Scenarios:** Fugitive dust and stack emissions deposited on land surface.	None
RA-K (Railroad Swale) 2.4 acres	RU 22c	This sub-area is located along the northeastern border of the FMC Plant Site and was used for stormwater retention. In addition to stormwater, the Railroad swale (RU 22c) also received an intermittent flow of phossy water and is known to contain low levels of P4 and phossy solids. In the late 1980s, the railroad swale was excavated and backfilled with slag and ore. RU 22c is a potential source of COC releases to groundwater[3]. **Fill/Source Materials Considered for HHRA Exposure Scenarios:** Slag Phossy solids P4 Ore	SWMU# 18 Railroad Swale
UG Piping		This sub-area includes underground piping that remains in place and may contain P4, precipitator solids, and/or phossy solids. This UG piping is believed to exist in RUs 1, 2, 3, 8, 12, 13, 22b and 24. UG Piping is a potential source of COC releases to groundwater[3]. **Fill/Source Materials Considered for HHRA Exposure Scenarios[2]:** P4 Precipitator solids Phossy solids	SWMU# 64 Phossy Waste Pipeline Cleanout Areas SWMU# 65 Precipitator Slurry Pipeline Cleanout Areas
FMC Plant OU Groundwater		The nature and extent of the FMC Plant OU wide impacted groundwater and evaluation / identification of FMC (and non-FMC) sources of groundwater impacts are described in the Groundwater Current Conditions Report for the FMC Plant OU (MWH, June 2009).	

[1] RCRA SWMUs do not necessarily contribute to the Remediation Area (RA) risk, but are identified here to integrate RCRA corrective action into the SFS under the "one clean-up" initiative.
[2] Risks associated with exposure to the contents of underground piping runs are evaluated separately from risks associated with exposure to other surface and subsurface fill/source materials identified in an RU.
[3] These RAs / subareas have not been identified as sources that have discernibly impacted groundwater (GWCCR, June 2009); however, based on historical knowledge and/or the SRI results, the SFS will consider these RAs / subareas as potential sources of COC releases to groundwater.

TABLE 2: WASTE FILL PROFILE BY REMEDIATION AREA (RA)

RAs	Composed of RUs	Area (acres)	Fill Volume (yd^3)	Average Fill Depth (ft)	Predominant Fill Type[1]	Secondary Fill Type[1]
A	3, 4, 5, 6, 20, and portions of 24	103	1,203,234	7.2	Slag, Silica, Concrete, Asphalt	Underground Piping, Coke, Ferrophos, PCDT Water Residues, Fuel Spill Residues
B	1, 2, and down gradient to include P4-impacted capillary fringe	10.8	135,570	7.8	Slag, Silica, Concrete, Asphalt	P4, Precipitator Solids, Phossy Solids, Underground Piping
C	13, northern portion of 12, eastern portion of 22b, and small portion of 24	34.6	410,165	7.3	Slag, Concrete, Silica	P4, Precipitator Solids, Phossy Solids, Underground Piping, Ferrophos, PCDT Water Residues
D	Western portion of 22b	33.6	350,606	6.5	Slag	Precipitator Solids, Phossy Solids, PCDT Water Residue, Underground Piping, P4
E	8, southern portions of 9 and 16	21.2	171,423	5.0	Calcined Ore, Raw Ore, Slag, Concrete, Silica, Calcined Pond Solids	Kiln Pond Solids, Underground Piping, Coke
F	19, 11, and southern portion of 12 (including buried railcars)	171	14,841,591	Approximately 120	Slag	Precipitator Solids, Phossy Solids, Ferrophos, PCDT Water Residue, Buried Railcars (P4, Phossy Solids)
G	7, northern portion of 19, 10, 15, northern portion of 16, and portion of 24	65.9	1,078,092	10.1	Raw Ore, Slag, Concrete, Silica, Calcined Ore, Bullrock, Calcined Pond Solids	Coke, Precipitator Solids, Graphite/Carbon, Calcined Pond Solids
H	17 and 18	17.5	Approximately 6,500 (7,800 tons of waste, assume 1.2 tons/yd3)	0.23	Slag, Ore, Silica	Office Wastes, Packaging Materials, AFM, Asbestos, Carbon
I	Northern Properties (Parcels 1, 2, 4, 5, 6)	191	42,963	0.14	Fugitive Dust from Plant Operations	Slag for roads
J	Northern Properties (Parcel 3)	15	4,028	0.17	Fugitive Dust from Plant Operations	Slag for roads
K	Railroad Swale/22c	1.3	22,000	10.5	Slag	P4, Precipitator Solids, Phossy Solids, Underground Piping

[1] *Predominant Fill Type* describes the primary materials observed and *Secondary Fill Type* describes secondary materials observed in the fill.

TABLE 3: TYPICAL LEVELS AND CONCENTRATIONS OF CONTAMINANTS OF CONCERN PRESENT IN SOURCE MATERIALS

Contaminants of Concern	Ore	Slag	Precipitator Solids	Phossy Solids	Calciner Pond Solids	Calcined Ore	Ferrophos	Coke[1]	Soil	95th UCL Background Concentrations
Antimony (mg/kg)	-	-	146	194	-	-	-	-	-	0.28
Arsenic (mg/kg)	14.6	-	44.6	180	14.3	-	-	-	-	10.4
Cadmium (mg/kg)	125	-	5,240	2,010	538	-	-	-	-	0.72
Hydrocarbons (mg/kg)	-	-	-	-	-	-	-	3.75 – 31.1	-	-
Fluoride (mg/kg)	-	-	-	-	1,300	-	-	-	-	302
Lead (mg/kg)	-	-	1,073	-	-	-	-	-	-	23.9
Lead-210 (pCi/g)	36.3	13	1,140	409	34.1	21.9	-	-	-	2.02
Nickel (mg/kg)	-	-	-	-	-	-	1,150	-	-	18.7
Phosphine (mg/kg)	-	-	-	-	-	-	-	-	0 – 1.0[2]	0
Polonium-210 (pCi/g)	-	-	657	72.3	458	-	-	-	-	1.17
Potassium-40 (pCi/g)	-	-	152	27.4	70.4	-	-	-	-	15.0
Radium-226 (pCi/g)	29.6	25.1	11.3	-	17.4	26.7	-	-	-	0.953
Thallium (mg/kg)	-	-	-	-	340	-	-	-	-	0.13
Uranium-238 (pCi/g)	27.5	29.3	6.39	-	17.9	24.2	-	-	-	0.88
Vanadium (mg/kg)	-	-	-	-	-	-	6,330	-	-	19.6

[1] Coke contains polycyclic aromatic hydrocarbons, six of which were found to be in concentrations that pose risk. There is no "background" concentration for hydrocarbons.

[2] Phosphine may be present in soils where elemental phosphorus is known to be present, such as RAs B, C, D, K, and F1.

TABLE 4: MAXIMUM DETECTED GROUNDWATER CONCENTRATIONS AND MAXIMUM CONTAMINANT LEVELS

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

*Combined Ra 226 and Ra 228.

[a] 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.

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

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

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

TABLE 5: SUMMARY OF RISKS FOR THE FMC OU

RA Size	RUs	Exposure Scenarios[a]	Total Incremental Cancer Risks[b]		Total Incremental Non-Cancer Hazard Quotients[b]	P4 Hazard Quotients[c]	Acute Risks/ Hazards[d]	Risk Driverse
			Chemical	Radiological				
RA-A 103 acres	3, 4, 5, 6, 20, and portions of 24	Outdoor Commercial/Industrial Worker	2 E-04	9 E-04	1	-	-	Ra-226, Benzo(a)pyrene
		Indoor Commercial/Industrial Worker	5 E-05	4 E-04	1			
		Construction Worker	1 E-05	2 E-05	5			
		Utility Worker	1 E-06	2 E-06	0.4			
		Offsite Resident (RU 20 only)	5 E-08	5 E-08	0.005			
RA-B 10.8 acres	1, 2, and down gradient to include P4-impacted capillary fringe	Outdoor Commercial/Industrial Worker	1 E-04	4 E-03	7	132	P4	Pb-210, Ra-226, P4, Cd
		Indoor Commercial/Industrial Worker	5 E-05	2 E-03	3	73		
		Construction Worker	8 E-05	3 E-04	25	25		
		Utility Worker	6 E-06	2 E-05	2	2		
RA-C 34.6 acres	RUs 13, northern portion of 12, eastern portion of 22b, and a small portion of RU 24 between RUs 1 and 2 and RU 22b	Outdoor Commercial/Industrial Worker	1 E-04	4 E-03	7	132	P4	Pb-210, Ra-226, P4, Cd
		Indoor Commercial/Industrial Worker	5 E-05	2 E-03	3	73		
		Construction Worker	8 E-05	3 E-04	25	25		
		Utility Worker	6 E-06	2 E-05	2	2		
RA-D 33.6 acres	Western portion of RU 22b, including former Pond 9S	Outdoor Commercial/Industrial Worker	1 E-04	4 E-03	8	132	P4 P4 in piping Phossy solids	As, Cd, Pb-210, Ra-226, P4, Cd
		Indoor Commercial/Industrial Worker	5 E-05	2 E-03	4	73		
		Construction Worker	8 E-05	3 E-04	29	25		

RA Size	RUs	Exposure Scenarios[a]	Total Incremental Cancer Risks[b]		Total Incremental Non-Cancer Hazard Quotients[b]	P4 Hazard Quotients[c]	Acute Risks/ Hazards[d]	Risk Driverse
			Chemical	Radiological				
		Utility Worker	6 E-06	3 E-05	2	2		
RA-E 21.2 acres	RU 8, southern portion of RU 9, and southern portion of RU 16.	Outdoor Commercial/Industrial Worker	4 E-06	1 E-03	5	-	P4 in piping	Ra-226, K-40, Po-210, Tl, Cd
		Indoor Commercial/Industrial Worker	2 E-06	7 E-04	3			
		Construction Worker	7 E-06	7 E-05	3			
		Utility Worker	5 E-07	6 E-06	0.1			
RA-F 171 acres	RA-F1 and RA-F2, RUs 19, 11, and southern portion of 12	Outdoor Commercial/Industrial Worker	4 E-06	1 E-03	0.1	-	-	Ra-226
		Indoor Commercial/Industrial Worker	2 E-06	5 E-04	0.07			
		Construction Worker	2 E-06	4 E-05	0.5			
		Utility Worker	1 E-07	3 E-06	0.05			
RA-F-1 (buried railcars) 2.7 acres	RU 19c	-	-	-	-	-	P4 Phossy solids	P4
RA-G 65.9 acres	RUs 7, northern portion of 9, 10, 15, northern portion of 16, and portions of 24	Outdoor Commercial/Industrial Worker	3 E-05	4 E-03	6	-	-	Pb-210, Ra-226, Cd
		Indoor Commercial/Industrial Worker	1 E-05	2 E-03	3			
		Construction Worker	7 E-05	3 E-04	23			
		Utility Worker	5 E-06	2 E-05	2			
RA-H	RU 17	-	None				-	-

RA Size	RUs	Exposure Scenarios[a]	Total Incremental Cancer Risks[b]		Total Incremental Non-Cancer Hazard Quotients[b]	P4 Hazard Quotients[c]	Acute Risks/ Hazards[d]	Risk Driverse
			Chemical	Radiological				
17 acres	(construction debris landfill) and 18 (solid waste landfill)							
RA-I 191 acres	Northern Properties (Parcels 1, 2, 4, 5, and 6)	Resident	5 E-08	4 E-04	25.6[e]	-	-	Cd, F
		Outdoor Commercial/Industrial Worker	-	1 E-04	0.2			
		Indoor Commercial/Industrial Worker	-	8 E-05	0.2			
		Construction Worker	-	5 E-06	-			
		Utility Worker	-	5 E-07	-			
RA-J 15 acres	Northern Properties (Parcel 3)	Resident	1 E-03	7 E-04	62[e]	-	-	As (GW), Ra-226, Cd
		Outdoor Commercial/Industrial Worker	2 E-04	3 E-04	1.6			
		Indoor Commercial/Industrial Worker	2 E-04	1 E-04	1.8			
		Construction Worker	2 E-06	1 E-05	3.7			
		Utility Worker	1 E-07	8 E-07	0.3			
RA-K (Railroad Swale) 2.4 acres	RU 22c	Outdoor Commercial/Industrial Worker	1 E-04	2 E-03	4	132	P4 Phossy solids	Pb-210, Ra-226, P4, Cd
		Indoor Commercial/Industrial Worker	5 E-05	9 E-04	1	73		
		Construction Worker	4 E-05	1 E-04	10	25		
		Utility Worker	3 E-06	8 E-06	0.9	2		

[a] For each scenario, exposure pathways for chemical contaminants include incidental soil ingestion, dermal absorption, inhalation of volatiles, and fugitive dust inhalation; exposure pathways for radiological contaminants include external gamma radiation, incidental soil ingestion, radon inhalation, and fugitive dust inhalation.
[b] Total cancer risks or non-cancer hazard quotients are the highest for any of the RUs contained within the respective RA; incremental risks are risks above those related to background concentrations.
[c] Hazard quotients are the highest total non-cancer hazard quotients associated with P4 at any RU within the respective RA.
[d] Acute risks/hazards include those associated with exposures to acutely hazardous or explosive contaminants, or asbestos, and are not quantified.
[e] Resident exposures include ingestion of homegrown produce and ingestion of groundwater.

TABLE 6: SUMMARY OF GROUNDWATER RISKS FOR THE FMC OU

Area	Exposure Scenario	Highest Total Incremental Cancer Risks[a]	Highest Total Incremental Non-Cancer Hazard Quotients[a]	Risk Drivers[b]
Western Pond Area	Worker	9 E-04	5.7	As
Central Plant Area	Worker	1 E-03	61.3	As, Elemental phosphorus
Joint Fenceline/Calciner Ponds Area	Worker	2 E-03	11.3	As

[a] Total cancer risks or non-cancer hazard quotients are the highest for any of the wells located within the respective area; incremental risks are risks above those related to background concentrations.

[b] Risk drivers are those contaminants with incremental cancer risks > 1 E-04 or Hazard Quotient > 1, under current conditions.

TABLE 7: SUMMARY OF ECOLOGICAL RISKS FOR THE NORTHERN PROPERTIES, WESTERN UNDEVELOPED AREA, AND SOUTHERN UNDEVELOPED AREA

RA	Location	Ecological Receptor Group	Ecological Receptor[a]	Highest Incremental NOAEL-Hazard Quotient[b]	Highest Incremental LOAEL-Hazard Quotient[b]	Risk Drivers[e]
RA-I	Northern Property Parcel 1	Mammals	Deer Mouse	0.22	0.13	-
			Pygmy Rabbit	0.22	0.13	
			Mule Deer	0.02	0.01	
			Coyote	0.17	0.1	
			Townsend's Big-Eared Bat	0.23	0.14	
		Birds	Sage Grouse	0.75	0.18	-
			Red-Tailed Hawk	0.86	0.21	
			Bald Eagle	0.66	0.16	
			Horned Lark	0.84	0.2	
		Plants	Sagebrush	-	0.89	-
			Thickspike Wheatgrass	-	0.47	
	Northern Property Parcel 2	Mammals	Deer Mouse	0.52	0.31	-
			Pygmy Rabbit	0.48	0.29	
			Mule Deer	0.05	0.03	
			Coyote	0.49	0.29	
			Townsend's Big-Eared Bat	0.54	0.32	
		Birds	Sage Grouse	1.9	0.47	Fluoride
			Red-Tailed Hawk	2.5	0.6	
			Bald Eagle	1.9	0.46	
			Horned Lark	2.2	0.55	
		Plants	Sagebrush	-	1.5	Fluoride, Vanadium
			Thickspike Wheatgrass	-	1.1	
	Northern Property Parcel 4	Mammals	Deer Mouse	0.28	0.17	-
			Pygmy Rabbit	0.28	0.16	
			Mule Deer	0.03	0.02	
			Coyote	0.22	0.13	
			Townsend's Big-Eared Bat	0.29	0.18	

RA	Location	Ecological Receptor Group	Ecological Receptor[a]	Highest Incremental NOAEL-Hazard Quotient[b]	Highest Incremental LOAEL-Hazard Quotient[b]	Risk Drivers[e]
		Birds	Sage Grouse	0.96	0.23	Fluoride
			Red-Tailed Hawk	1.1	0.27	
			Bald Eagle	0.85	0.21	
			Horned Lark	1.1	0.26	
		Plants	Sagebrush	-	1.1	Fluoride
			Thickspike Wheatgrass	-	0.58	
	Northern Property Parcel 5	Mammals	Deer Mouse	0.15	0.09	-
			Pygmy Rabbit	0.16	0.1	
			Mule Deer	0.02	0.01	
			Coyote	0.1	0.06	
			Townsend's Big-Eared Bat	0.16	0.1	
		Birds	Sage Grouse	0.49	0.12	-
			Red-Tailed Hawk	0.51	0.12	
			Bald Eagle	0.4	0.1	
			Horned Lark	0.53	0.13	
		Plants	Sagebrush	-	0.72	-
			Thickspike Wheatgrass	-	0.37	
	Northern Property Parcel 6	Mammals	Deer Mouse	0.5	0.3	-
			Pygmy Rabbit	0.46	0.28	
			Mule Deer	0.05	0.03	
			Coyote	0.47	0.28	
			Townsend's Big-Eared Bat	0.52	0.31	
		Birds	Sage Grouse	1.9	0.45	Fluoride
			Red-Tailed Hawk	2.3	0.57	
			Bald Eagle	1.8	0.44	
			Horned Lark	2.2	0.52	
		Plants	Sagebrush	-	1.4	Fluoride
			Thickspike Wheatgrass	-	0.83	
RA-J	Northern Property	Mammals	Deer Mouse	0.79	0.47	-
			Pygmy Rabbit	0.7	0.42	

RA	Location	Ecological Receptor Group	Ecological Receptor[a]	Highest Incremental NOAEL-Hazard Quotient[b]	Highest Incremental LOAEL-Hazard Quotient[b]	Risk Drivers[e]
	Parcel 3		Mule Deer	0.07	0.04	
			Coyote	0.84	0.5	
			Townsend's Big-Eared Bat	0.81	0.48	
		Birds	Sage Grouse	3.1	0.76	Fluoride
			Red-Tailed Hawk	4.2	1	
			Bald Eagle	3.2	0.78	
			Horned Lark	3.7	0.9	
		Plants	Sagebrush	-	2.1	Fluoride, Selenium, Vanadium
			Thickspike Wheatgrass	-	2.1	
Southern Undeveloped Area (SUA)		Mammals	Deer Mouse	0.08	0.04	-
			Pygmy Rabbit	0.09	0.05	
			Mule Deer	0.01	0.005	
			Coyote	0.05	0.03	
			Townsend's Big-Eared Bat	0.07	0.04	
		Birds	Sage Grouse	0.24	0.06	-
			Red-Tailed Hawk	0.25	0.06	
			Bald Eagle	0.2	0.05	
			Horned Lark	0.25	0.06	
		Plants	Sagebrush	-	0.34	-
			Thickspike Wheatgrass	-	0.16	
Western Undeveloped Area (WUA)		Mammals	Deer Mouse	0.03	0.02	-
			Pygmy Rabbit	0.04	0.02	
			Mule Deer	0.004	0.002	
			Coyote	0.02	0.01	
			Townsend's Big-Eared Bat	0.03	0.02	
		Birds	Sage Grouse	0.09	0.02	-
			Red-Tailed Hawk	0.08	0.02	
			Bald Eagle	0.06	0.01	
			Horned Lark	0.09	0.02	

RA	Location	Ecological Receptor Group	Ecological Receptor[a]	Highest Incremental NOAEL-Hazard Quotient[b]	Highest Incremental LOAEL-Hazard Quotient[b]	Risk Drivers[e]
		Plants	Sagebrush	-	0.15	-
			Thickspike Wheatgrass	-	0.07	

[a.] Hazard quotients are the highest NOAEL-based or LOAEL-based HQ for any of the contaminants for the respective ecological receptor; incremental hazard quotients are those above background hazard quotients.

[b.] Risk drivers are those contaminants with Hazard Quotient > 1.

TABLE 8: CONTAMINANTS OF CONCERN IN GROUNDWATER AND CLEANUP LEVELS FOR THE FMC OU

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]		1,355 pCi/l	-	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.

TABLE 9: CONTAMINANTS OF CONCERN IN SOIL AND CLEANUP LEVELS FOR RISK DRIVERS FOR THE FMC OU

Contaminants of Concern	Units	Cleanup Levels
		Industrial[1,2]
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.
[2] 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 10: SOIL ALTERNATIVES SUMMARY OF COMPARATIVE RANKINGS

EVALUATION CRITERION	SOIL ALTERNATIVE 1	SOIL ALTERNATIVE 3	SOIL ALTERNATIVE 4	SOIL ALTERNATIVE 5	SOIL ALTERNATIVE 6	SOIL ALTERNATIVE 7	SOIL ALTERNATIVE 8
Overall Protection of Human Health and the Environment	Low	High	Medium to High	Medium to High	Medium to High	Medium to High	Medium to High
Compliance with ARARs	No	Yes	Yes	Yes	Yes	Yes	Yes
Long-Term Effectiveness *- Reliability of overall remedy* *- Adequacy of controls* *- Magnitude of residual risk*	Low	Medium to High	Medium to High	Medium to High	High	High	High
Reduction of Toxicity, Mobility or Volume through Treatment	Low	Low	Low	Medium	Medium to High	Medium to High	High
Short-Term Effectiveness *-Time to achieve protection* *-Protection of the community, workers, and environment*	Low	High	High	Medium	Low to Medium	Low	Low
Implementability *- Administrative difficulty* *- Technical Challenges* *- Availability of Services*	High	High	High	Low	Low	Low	Low
Capital Cost	$0	$43.6M	$76.8	$353M	$474.5M	$720.9M	$3.32B
Annual O&M Cost	$0	$602K	$547K	$4.5M	$8.9M	$16.8M	$13M
NPV Cost	$0	$47.2M	$81.6M	$405.1M	$591.1M	$949.6M	$3.5B

Ranking: **HIGH =** Good performance in the category. **MEDIUM** = Satisfactory performance in the category. **LOW** = Unsatisfactory performance in the category.
All cost estimates are in 2009 dollars. NPV is based on 7% discount rate over a 30-year period for Soil Alternatives 3–5, 37 years for Soil Alternative 6, and 44 years for Soil Alternatives 7 and 8.

TABLE 11: GROUNDWATER ALTERNATIVES SUMMARY OF COMPARATIVE RANKINGS

EVALUATION CRITERION	NO ACTION GROUNDWATER ALTERNATIVE	GROUNDWATER ALTERNATIVE 1	GROUNDWATER ALTERNATIVE 2	GROUNDWATER ALTERNATIVE 3
Overall Protection of Human Health and the Environment	Low	Low	Medium	Medium
Compliance with ARARs	No	Yes	Yes	Yes
Long-Term Effectiveness *- Reliability of overall remedy* *- Adequacy of controls* *- Magnitude of residual risk*	Low	Unknown	Medium	Medium
Reduction of Toxicity, Mobility or Volume through Treatment	Low	Low	Medium to High	Medium to High
Short-Term Effectiveness *-Time to achieve protection* *-Protection of the community, workers, and environment*	Low	Low	Medium	Medium
Implementability *- Administrative difficulty* *- Technical Challenges* *- Availability of Services*	High	High	High	High
Capital Cost	$0	$57K	$579K–$2.7M	$5.1M–$6.5M
Annual O&M Cost	$0	$71K	$552K–$712K	$1.1M–$1.4M
NPV Cost	$0	$960K	$9.6M–$11.2M	$24.2M–$25.1M

Ranking: **HIGH =** Good performance in the category. **MEDIUM** = Satisfactory performance in the category. **LOW** = Unsatisfactory performance in the category.
All cost estimates are in 2009 dollars. NPV is based on 7% discount rate over a 30-year period.

TABLE 12: KEY FEATURES, CAPITAL COSTS, AND O&M COSTS OF SOIL ALTERNATIVES

Soil Alternatives	Estimated Capital Cost ($)	Estimated O&M Cost ($)	Estimated Present Worth Cost ($)	Estimated Construction Timeframe (yr)	Estimated Time to Achieve RAOs and Cleanup Levels (yr)
Soil Alternative 1	$0	$0	$0	0	N/A
Soil Alternative 2	N/A	N/A	N/A	Unknown	N/A
Selected Interim Amended Soil Remedy (Soil Alternative 3)	$43,600,000	$602,000	$47,200,000	2–3	2–3
Soil Alternative 4	$75,800,000	$547,000	$81,600,000	2–4	2–4
Soil Alternative 5	$353,000,000	$4,500,000	$405,100,000	20–25	20–25
Soil Alternative 6	$474,500,000	$8,881,000	$591,100,000	37	37
Soil Alternative 7[1]	$720,900,000	$16,900,000	$949,600,000	44	44
Soil Alternative 8[1]	$3,323,700,000	$13,000,000	$3,499,700,000	≥ 44	≥ 44

[1]Soil Alternatives 7 and 8 are presented for informational purposes only, as discussed in Section 8.4.

TABLE 13: ESTIMATED AREAS FOR CAPPING AND CONSOLIDATION OF SOIL ALTERNATIVES

Soil Alternatives	Estimated Area of ET Caps (acres)	Estimated Area of Soil (gamma) Caps (acres)	Estimated Excavated Area with Onsite Consolidation (acres)	Estimated Excavated Area with Offsite Disposal (acres)
Soil Alternative 1	0	0	0	0
Soil Alternative 2	N/A	N/A	N/A	N/A
Selected Interim Amended Soil Remedy (Soil Alternative 3)	142	340	15	N/A
Soil Alternative 4	142	237	119	N/A
Soil Alternative 5	142	237	321	N/A
Soil Alternative 6	141	237	358	N/A
Soil Alternative 7[1]	141	237	419	N/A
Soil Alternative 8[1]	N/A	N/A	N/A	749

[1]Soil Alternatives 7 and 8 are presented for informational purposes only, as discussed in Section 8.4.

TABLE 14: KEY FEATURES, CAPITAL COSTS, AND O&M COSTS OF GROUNDWATER ALTERNATIVES

Soil Alternatives	Estimated Capital Cost ($)	Estimated O&M Cost ($)	Estimated Present Worth Cost ($)	Estimated Construction Timeframe (yr)	Estimated Time to Achieve RAOs and Cleanup Levels (yr)
No Action Groundwater Alternative	$0	$0	$0	0	N/A
Groundwater Alternative 1	$57,000	$71,000	$960,000	≤ 1	N/A
Selected Interim Amended Groundwater Remedy (Groundwater Alternative 2)	$579,000–$2,700,000	$552,000–$712,000	$9,600,000–$11,200,000	1–4	Unknown
Groundwater Alternative 3	$5,100,000–$6,500,000	$1,100,000–$1,400,000	$24,200,000–$25,100,000	2–4	Unknown

TABLE 15: KEY FEATURES, CAPITAL COSTS, AND COSTS OF O&M OF THE SELECTED INTERIM AMENDED REMEDY

Remedy	Time to Implement (Years)	Capital Costs ($)	Operation Costs ($/year)	Net Present Value ($)
Interim Soil Remedy	2–3	$43,600,000	$602,000	$47,200,000
Interim Groundwater Remedy	2–4	$2,400,000	$633,700	$10,000,000
Total for Selected Interim Amended Remedy	2–4	$46,000,000	$1,235,700	$57,200,000

APPENDIX A

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

1410 North Hilton • Boise, Idaho 83706 • (208) 373-0502

C.L. "Butch" Otter, Governor
Curt Fransen, Director

September 25, 2012

Mr. Daniel D. Opalski:
U.S. EPA
1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

Subject: State of Idaho Concurrence on the Selected Remedy for the Eastern Michaud Flats Interim Record of Decision Amendment for the FMC Operable Unit

Dear Mr. Opalski:

This letter notifies the Environmental Protection Agency (EPA) that the State of Idaho, Department of Environmental Quality (IDEQ) concurs with the selected remedy outlined in the Interim Record of Decision Amendment (IRODA) for the FMC Operable Unit of the Eastern Michaud Flats Superfund site. As outlined in the IRODA it appears the selected remedy will addresses metals, radionuclides, and other contaminants of concern identified in soils, fill and the ground water at the FMC OU.

IDEQ agrees the chosen remedy can meet all applicable or relevant and appropriate requirements (ARARs). However, we do not fully agree that all requirements have been properly listed in the IRODA. DEQ requests that Idaho's Ground Water Quality Rule (IDAPA 58.01.11) be included in section 11.2 of the IRODA.

IDEQ looks forward to implementation of this IRODA as the project moves to the design phase and working cooperatively with the EPA and the Tribes in meeting the mutual goal of protecting human health and the environment at the Eastern Michaud Flats site.

Sincerely,

Curt A. Fransen
Director

Cc: Bruce Olenick, DEQ-Pocatello
Darrell Early, AG-Boise
Beth Sheldrake, EPA-Seattle

APPENDIX B

The SHOSHONE-BANNOCK TRIBES

FORT HALL INDIAN RESERVATION
PHONE (208) 478-3700
FAX # (208) 237-0797

FORT HALL BUSINESS COUNCIL
P.O. BOX 306
FORT HALL, IDAHO 83203

September 6, 2012

The Honorable Dennis J. McLerran
Regional Administrator
U.S. Environmental Protection Agency, Region 10
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101-3140

RE: Interim ROD Amendment, Eastern Michaud Flats Contamination Site, August, 2012

Dear Administrator McLerran:

As you know, the Shoshone-Bannock Tribes have grave concerns about EPA's Interim Record of Decision Amendment (IRODA) for the FMC Operable Unit (OU) at the Eastern Michaud Flats Superfund Site, which is largely within the exterior boundaries of the Shoshone-Bannock Tribes' homeland. EPA's IRODA allows hazardous waste ponds and other areas containing elemental phosphorus (P4) to remain on our reservation, untreated. These wastes will continue to react within the soils with the possibility of EPA's actions exacerbating the reactions and creating unknown consequences to environmental media. We understand that the cost of removal would be prohibitively expensive, but we firmly believe that the waste should be treated. We believe that the IRODA does not go nearly far enough to clean up this site nor meet the basic standards required by the CERCLA National Contingency Plan. Implementation of this selected interim amended remedy will not promptly address current exposures that exist throughout the FMC OU, but rather assumes, that phosphine and metal phosphide migration will be attenuated within the soils with no empirical data to support this assumption.

The measures in the selected interim amended remedy will not be protective of the environment, nor comply with federal and tribal requirements that are applicable or relevant and appropriate (ARARs), nor result in cost-effective action, nor utilize permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. The selected interim amended remedy does not satisfy the statutory preference for remedies that employ treatment as a principal element. While the IRODA does require extraction and treatment of groundwater this is but one of the affected media at the site. No treatment is being required for the affected soils. Moreover, EPA's own modeling indicates that treatment technologies

implemented for groundwater cannot achieve the basic requirements of CERCLA within a 100-year timeframe.

EPA has set Remedial Action Objectives (RAO) for elemental phosphorus that are not protective of soil biota. The RAO for elemental phosphorus are:

1) Prevent direct exposure to elemental phosphorus in shallow soils and underground piping at levels that, if encountered during intrusion into the subsurface, would support vigorous and sustained fire and resultant air emissions that represent a significant risk to human health and the environment. Elemental phosphorus has been designated a principal threat waste where present at such levels in shallow soils and underground piping and shall be remediated through removal and treatment unless a non-removal and treatment remedy is justified using the nine criteria in accordance with the NCP. Note this RAO only applies to areas with shallow P4 (i.e., RA B and underground piping containing P4);

2) Prevent inhalation of phosphoric acid aerosols resulting from combustion of P4 at levels that pose an excess non-cancer risk HQ of 1. Note this RAO only applies to areas with P4 (i.e., RA B, RA-C, RA-F1, RA-K and underground piping containing P4). This RAO does not address phosphine gas within the soils. It assumes phosphine gas will convert to phosphoric acid in the presence of water but does not address the gas, as a degradation product of phosphorus, directly. These RAO do not address the risk to the soil environment from phosphine gas. Because the RAO do not address these risks, the remedial actions or the monitoring to assure compliance with the remedial actions do nothing to either limit the reaction of elemental phosphorus to phosphine or monitor the effects of this reaction.

EPA plans to cap and cover areas within the FMC OU that contain elemental phosphorus through the use of an alternative cover (ET cap). EPA states this cover will allow for diffusion of air and moisture within the soil column, which in turn will allow a continuous source of oxygen to react with any upward migrating phosphine gas. EPA assumes this approach will convert the phosphine to phosphoric acid and other phosphate compounds before it reaches the surface in detectable quantities. Phosphine gas diffusion through soil is not, however, well understood, although it likely is dependent on barometric pressure fluctuations. Degradation pathways also are not fully understood nor are the long-term impacts to the biota within the soil columns or the physical and chemical changes that will occur as a result of the chemical reactions. EPA used studies that were performed on radon gas diffusion to provide an analogy for assessing the adequacy of soil covers to attenuate phosphine gas, but no direct empirical information was sought. Phosphine gas, metal hydrides, and other degradation products and pathways within the subsurface strata at the FMC site are completely ignored in the IRODA.

Hydrolysis of elemental phosphorus in the atmosphere can produce phosphine. The production of phosphine is inversely related to oxygen concentration and is thus favored by low oxygen pressures (Spanggord et al., 1985). Therefore, constructing a cover that "breathes" would allow for a continuous source of air that would favor the degradation of phosphine to phosphoric acid. Phosphine naturally decomposes to several lesser known intermediates such as P2H4 and finally to H2PO4 (phosphoric acid), salts, and water. In the presence of oxygen, these breakdown

products are formed rapidly from phosphine (Garry et al. 1989). EPA expects phosphine to react with oxygen in the cap and surrounding soils but has done nothing to date to document the rate of this reaction, the migration of this gas within the subsurface strata, or the impacts, both short- and long-term, from these reactions.

EPA has provided no support for its contention that P4 is rendered harmless when it remains in the soil. The risk assessments prepared for the FMC OU did not address the effects of P4 in the soils, and in fact did not address the risks of phosphine at all. Studies have shown that phosphine in soils suppresses fungal growth and the production of mycotoxins, indicating the toxic actions of phosphine on microorganisms in the soil. *See* Laitao, J., de Saint-Blanquat, G. and Bailly, J.R., "Action of phosphine on production of aflatoxins by various Aspergillus strains isolated from foodstuffs." Acute toxicity and mutagenic effects have also been observed in plants, insects, and rodents from the presence of phosphine in soils. *See* Appl. Environ. Microbiol. 53, 2328-2331; and Eismann, F. *et al*, "Effect of Free Phosphine on Anaerobic Digestion." Vol 31, no. 11, 2771-2774, 1997. Phosphine has been detected throughout the FMC OU, and at certain locations has been found in combination with hydrogen cyanide and hydrogen sulfide. In addition, P4-contaminated sediments have been shown to result in significant deaths of fish, waterfowl, and livestock. *See* Eagle River Flats Bibliography, Journal Articles, www.crrel.usace.army.mil/erf. *See also* Walsh, Marianne, "Remediation of P4 Contaminated Matrices at FMC, Pocatello, Idaho" (January 2009) ("Walsh Report"), at 3. The risks posed by the P4-contaminated areas at the FMC OU are not, therefore, limited to the risk of fire upon excavation or to inhalation, as EPA has stated as the Remedial Action Objective for elemental phosphorus, but also include the risks of continuous uncontrolled chemical reactions within the soils. These risks need to be studied and taken into account.

The Tribes disagree with EPA's assertion that it is too risky to excavate and treat the P4, and note that P4-contaminated media and materials have been treated in the past. For example, approximately 7500 cubic yards of P4-contaminated materials were successfully treated after a train derailment in 1986 in Miamisburg, Ohio, as discussed in the attached article. *See also* Walsh Report at 7-8. P4-contaminated soils were excavated and treated at the Rhodia Silver Bow Plant near Butte, Montana (Marianna Walsh Report at 5). In addition, at the Mount Pleasant, Tennessee site originally operated by Stauffer Chemical and transferred to Rhodia, Rhodia operated a drumming operation for their P4 material while the dismantling was taking place. Large drums with heating coils were used to liquefy the P4, which was pumped to tanks and transferred to roasters. Drums were 10 to 12 feet in diameter and operated by crane. (Communications with Robert Briggs, Consultant to Rhodia and Health and Safety Officer during plant operations.) In the spring of 2010, FMC, through its onsite contractors, excavated ferrophos, a material with a commercial value, which required digging into CERCLA Pond 7S. FMC also used an open air oxidation process throughout its operations to oxidize phosphorus and specifically, around 1997-1998, used this approach to treat P4-contaminated sediments in Pond 9E. This particular pond openly burned for weeks with no air controls. It is also noteworthy that the FMC plant operated for over 50 years, and apparently was able to address worker safety issues then.

EPA ignored repeated requests from the Tribes to conduct a Tribal Human Health and Ecological Risk Assessment throughout the FMC OU. Since the original ROD was drafted in 1998, the Tribes have requested that a Tribal risk scenario be conducted throughout the EMF OUs and specifically asked for monitoring of gases being generated at FMC. The Tribes thoroughly explained the differences between a Tribal Risk Assessment and the general Human Health and Ecological Risk Assessment that was performed. Now, fifteen years later, EPA blames the Tribes for neglecting this tribal component of a risk scenario. EPA did not evaluate ecological risks to animal receptors within the FMC OU, citing a lack of suitable habitat even though documented sightings of ecological receptors were provided for decades. EPA failed to consider a Tribal Risk Scenario within the FMC OU even though the property is within the interior boundaries of the Fort Hall Reservation. Grasses, forbs and other materials will be present at this site in perpetuity and the potential risks of exposure to trespassers, hunters, and gatherers should have been evaluated, even if those exposures are not currently occurring. Further, EPA failed to even consider phosphine and other gases within the soil environment in the risk assessments they did complete. These are serious gaps that render EPA's risk assessments out of compliance with basic requirements of the National Contingency Plan.

EPA's IRODA is based on monitoring of groundwater constituents selected as primary indicator parameters rather than monitoring of all contaminants present. EPA has not taken into consideration the impacts of multiple contaminants nor the changes within the soils that may impact the contaminants as they move through the soil column. EPA states that EMF-impacted groundwater essentially remained unchanged from 1991 through 2010 but justifies a remedial action that is not anticipated to meet Remedial Action Objectives for 100 years because assumptions used in their modeling may not be accurate and groundwater flow conditions will change significantly after implementation of the IRODA. Groundwater flow conditions have changed since the plant operations ceased and will continue to change. While the Tribes acknowledge that groundwater pumping and treatment is needed, we are concerned that EPA intends to argue that the selected groundwater treatment meets the NCP requirement of permanent treatment even though it is likely that this selected groundwater treatment and future requirements for permanent treatment will receive a waiver in the future. It is unclear how EPA will more definitively address groundwater restoration within a reasonable restoration timeframe or invoke the waiver provisions in CERCLA

EPA's Statement of Basis and Purpose of Amendment leaves out details the public should be aware of in understanding the history of this site. While the FMC Plant closure in 2001 triggered the need for further investigative work, legal challenges to the 1999 Consent Decree also led to further work. In an October 2000 Memorandum Decision and Order the EPA admitted that the data set forth in the ROD showed that the soils in the Off-plant OU may pose sufficient cancer risks to local residents to warrant active remediation, and the ROD does not adequately explain EPA's decision not to select active remediation. The United States District Court upheld EPA's decision to withdraw the Consent Decree, despite FMC's concerns, because EPA had neglected to adequately characterize the site

Section 4.2 of the IRODA states that the Conceptual Site Model conducted under CERCLA assumed that phosphine gas would not be produced in quantities that would pose a significant risk to human health and the environment. Because the CERCLA ponds were not lined, there are no significant levels of water that remain commingled with the waste. This assumption is ridiculous given the situation at FMC. The Tribes are certain that phosphine gas is being generated within the FMC OU area, at levels that are impacting the soil environment. See CERCLA Unilateral Administrative Order for Removal Action, Docket No. CERCLA 2010-0170 for EPA to fail to monitor for phosphine in areas where they would expect it to be migrating, deep within the soils, and then state that it was not necessary for the Conceptual Site Model to consider the risks from phosphine does not meet the basic CERCLA thresholds of protection of human health or the environment.

In summary, the Tribes believe the IRODA does not meet the following CERCLA requirements:

1) **CERCLA preference for treatment**. CERCLA § 121(b) (1) clearly states a preference for treatment, yet EPA failed to consider treatment technologies in anything beyond a superficial manner. *See also* 40 C.F.R. § 300.430(e) (5), requiring EPA to "*develop* one or more innovative treatment technologies for further consideration." There are numerous examples of possible treatment technologies in the record, as noted above and including the following:

- P4-contaminated materials were successfully treated after a train derailment in 1986 in Miamisburg, Ohio, as discussed in the attached article. *See also* Walsh Report at 7-8.
- P4-contaminated soils were excavated and treated at the Rhodia Silver Bow Plant near Butte, Montana. Walsh Report at 5.
- At a Mount Pleasant, Tennessee site originally operated by Stauffer Chemical and transferred to Rhodia, Rhodia conducted a drumming operation to remove P4 material while the facility was dismantled.
- In the spring of 2010, FMC through its onsite contractors excavated ferrophos, a material with a commercial value, which required digging into CERCLA Pond 7S.
- FMC used an open air oxidation process throughout their operations to oxidize phosphorus.

Moreover, CERCLA § 121(b) (2) states that EPA "may select an alternative remedial action . . . whether or not such action has been achieved in practice at any other facility or site." The Walsh Report lists many possible alternatives.

2) **Treatment "to the maximum extent practicable."** CERCLA 121(b) (1) requires treatment "to the maximum extent practicable." Instead EPA used an all-or-nothing approach and only considered treatment of the entire site, which it considered to be too expensive and risky. However, treatment may be selected for certain portions of a site if treatment of the entire site is not practicable. Unfortunately, at an April 12, 2012 government-to-government consultation between EPA and the Tribes, EPA reneged on its prior commitment to perform a treatability study as part of a third-party review of its remedial action selection.

3) **Protection of the environment.** EPA violated the basic CERCLA requirement to select a remedial action that assures protection not just of human health but also of the environment. *See* CERCLA § 121(d). The definition of "environment" in CERCLA § 101 includes the soil ("land surface or subsurface strata"). EPA acknowledges that it did not consider the risks of P4, phosphine, and other toxic gases present at the site on soils and soil biota. Moreover, EPA has limited monitoring to the top inches of soil in order to rule out migration to the breathing zone only.

4) **Deference to Tribal standards.** The Tribes promulgated Soil Cleanup Standards that would require the contaminated soils at the site to be treated or removed. EPA's amended Interim Record of Decision, at 19, states that EPA is evaluating these Tribal standards to determine whether they are ARARs which, under normal circumstances, EPA would be required to implement. Instead, EPA issued an interim RODA in part because it does not trigger compliance with ARARs. EPA's Statement of Basis and Purpose of Amendment further justifies the interim nature of its action because of the pending question of whether the December 2010 Shoshone-Bannock Soil Cleanup Standards constitute ARARs.

The Tribes also believe that the IRODA does not comport with EPA's policies on environmental justice. Although the FMC site is on non-Indian land, it is within the Reservation and is surrounded by tribal land that is used for industrial, agricultural, and residential purposes. Moreover, it is adjacent to the Fort Hall Bottoms, which hold significant cultural, ceremonial, and medicinal value to the Shoshone-Bannock people. The Portneuf River flows through the Reservation north of the EMF Site, and resources along the river have been severely impacted due to contamination from the site. Significantly, FMC's waste disposal practices would have violated the RCRA Land Disposal Restrictions had they been in effect at the time, demonstrating that reservation land is not being protected. We cannot help but ask ourselves, if this site were located in a wealthy, non-Indian community would EPA still allow the waste to remain untreated?

The FMC Site can be distinguished from other P4 sites across the country, not only due to the sheer amount of P4 it contains but also because of its location on an Indian reservation. EPA has a heightened duty to protect health and the environment on Indian reservations in light of its trust obligations, and environmental justice concerns also are raised by allowing a site in Indian country to remain contaminated for what is essentially perpetuity. Thus, even if EPA continues to select capping as the preferred remedy at other P4-contaminated sites, there are good reasons for treatment of the P4 waste to take place here.

EPA is allowing "perpetual liability for tons of untreated ignitable, reactive, and very toxic material." *See generally* Walsh, Marianne, "Remediation of P4 Contaminated Matrices at FMC, Pocatello, Idaho" (January 2009) ("Walsh Report") There is no assurance that liners or caps can last 10,000 years, the time that P4 remains active, or that monitoring or land restrictions can be maintained for such a period. FMC made millions of dollars at this site, and it is a multi-billion dollar corporation. It should be required to set aside some fraction of those profits to clean up the mess it created, not just leave the contamination in the ground and cover it over with "caps." For the reasons identified above, the Shoshone-Bannock Tribes cannot concur with the EPA Interim Record of Decision for the FMC OU at the Eastern Michaud Flats Contamination Site.

Sincerely yours,

Nathan Small

Nathan Small
Chairman, Fort Hall Business Council

cc: **US EPA**
Bob Perciasepe, Deputy Administrator
Mathy Stanislaus, Assistant Administrator, OSWER
Dan Opalski, Region X Environmental Clean Up Director
Jim Woods, Region X Senior Tribal Liaison

Shoshone Bannock Tribes
FHBC (7)
LUPC (3)
Arnold Appenay, Land Use Director
Bill Bacon, Legal Counsel
Jill Grant, Legal Counsel
Susan Hanson, LU-Environmental Waste Management Program
Kelly C. Wright, LU-Environmental Waste Management Program Manager

ADDENDUM

FOR

SHOSHONE BANNOCK TRIBES'

INTERRIM RECORD OF DECISION

NONCONCERENCE LETTER

EASTERN MICHAUD FLATS,
FMC OPERABLE UNIT POCATELLO, IDAHO
PROPOSED PLAN COMMENTS RESPONSIVENESS SUMMARY
September 2012

1.2 Opposition to the Preferred Alternative
Comment Summary: EPA received 118 comments generally opposed to the Preferred Alternative. Most comments opposing the Preferred Alternative were in favor of excavation and treatment or removal of subsurface elemental phosphorus.

EPA Response: After evaluating all the data, analysis, and reports contained in the Administrative Record in terms of the nine criteria for CERCLA remedy selection, EPA believes the record not only strongly supports the Preferred Alternative presented in the Proposed Plan, it does not support any alternative that would excavate subsurface ignitable elemental phosphorus waste-containing soils.

Tribal Response: *It should be noted that EPA provides information for the record and determines what data to collect and what information to include in the Record. EPA had assumed capping would be the preferred alternative, see comments surrounding the Feasibility Study where the Tribes had to insist EPA include excavation in the range of alternatives. EPA had sent communications they were not including because excavation would not pass the cost test. Because EPA did not plan on completing any action other than capping, they did not adequately characterize the extent of elemental phosphorus within the soils, nor collect information surrounding the migration of gases, the uncontrolled chemical reactions within the soils and other information necessary to document risks to ecological soil receptor or human health impacts from uncontrolled reactions. Because this information was not collected, it is not in the record to support action beyond what EPA had presumed would be the capping remedial action.*

EPA Response In December 2010, the Shoshone Bannock Tribes (the Tribes) promulgated stringent soil cleanup standards (SCS), which require, among other things, excavation and/or treatment of all buried elemental phosphorus on the Fort Hall Reservation. Among the Tribes' stated goals in promulgating the SCS is to restore all land within the Reservation to its original state, prior to the contamination that the standards are designed to address. This selected interim amended remedy does not meet these standards. However, due to the interim nature of this action, Applicable or Relevant and Appropriate Requirements (ARARs) do not have to be met at this time. EPA is evaluating the Tribes' standards to determine whether these regulations may be ARARs. This evaluation will require careful federal review in order that these unique and potentially precedential SCS be fully evaluated prior to a decision as to whether all or a part of the SCS are ARARs. CERCLA requires that ARARs must be met or waived upon completion of remedial action. At the time that EPA selects a final remedy, EPA will more definitively address groundwater restoration within a reasonable restoration timeframe, will determine whether all or a part of the Tribal SCS are ARARs, and will if necessary determine the applicability of the ARAR waiver provisions in §121(d)(4) of CERCLA

Tribal Response: *The Tribal Soil Cleanup Standards (SCS) are not particularly unique. Many governments, including Federal, State and Tribal regularly develop and implement regulations needed to protect their constituents and resources. EPA provided resources to the Tribes to develop their own protective cleanup standards. The EPA reviewed and commented on the regulations throughout the process. It is odd they now do not want to support the implementation of these regulations.*

EPA Response: The FMC Pocatello facility was the largest elemental phosphorus manufacturing facility in North America. FMC has estimated that there are 5,050 to 16,380 tons of elemental phosphorus in approximately 780,000 cubic yards of contaminated material within the FMC OU alone. This volume does not include elemental phosphorus-contaminated wastes associated with the RCRA units (see Comment 1- 21). There are significant unknowns beyond the actual volume of contaminated soils, including the horizontal and vertical gradients in the concentrations of elemental phosphorus, the total mass of elemental phosphorus, and the form of elemental phosphorus in the soil. Further uncertainties associated with elemental phosphorus waste retrieval include unknown debris in the soils that would have to be separated, feed stock preparation (typing, sizing, elemental phosphorus concentration), rate of phosphine gas generation, and design of the toxic gas management system. Any excavation and treatment process typically requires substantial amounts of water to control elemental phosphorus combustion, and that water could drive contaminants further into the soil column. All of this handling would create significant hazards to remediation workers and the environment, and it is not clear that known treatment technologies would ultimately be effective on all or even most of the elemental phosphorus contaminated soils that may be excavated from the FMC OU. The elemental phosphorus contamination within the FMC OU alone is at a scale unprecedented anywhere in the United States and would therefore require the use of unproven technologies if the elemental phosphorus wastes are to be removed.

Tribal Response: *EPA cites significant unknowns to justify their decision to cap the site. These unknowns go beyond the actual volume of contaminated soils, and include the form of elemental phosphorus in the soil. The basics of a Remedial Investigation serve to collect data so one can characterize site conditions; determine the nature of the waste; assess risk to human health and the environment; and conduct treatability testing to evaluate the potential performance and cost of the treatment technologies that are being considered (see EPA website Superfund Cleanup). It appears after 20 plus years EPA failed to gather the basic information needed to appropriately remediate this site and now uses these unknowns to justify a pre-determined decision to cap. EPA should have and adequately characterized the soils where elemental phosphorus was located and determined what form the phosphorus was in. It would be only then EPA could scientifically determine capping will mitigate any risk to human health or the environment. EPA does not provide any evidence there is no risk to ecological receptors within the soils from uncontrolled reactions generating phosphine and other gases. EPA further justifies the position to cap by stating the elemental phosphorus contamination within the FMC OU alone is at a scale unprecedented anywhere in the United States and would therefore require the use of unproven technologies if the elemental phosphorus wastes are to be removed. However, EPA is proposing to cap elemental phosphorus at this site, which is equally unprecedented anywhere in the United States. Further, their own experience with capping elemental phosphorus at the RCRA ponds has proven disastrous with the need to implement Time Critical Removal Actions requiring the*

companies immediately inject nitrogen blankets over the waste and begin extracting gases. While containment may be the current industry standard for managing wastes, it has proven ineffective at the RCRA portion of the site and regulatory requirements today prohibit capping ignitable and reactive wastes.

EPA's cost analysis of treating wastes was flawed. EPA only considered the cost of treating the entire site and after the Tribes indicated there were possibilities of using multiple treatment technologies or excavating only a small portion of the site, scaled back the costs. EPA has not included the costs of managing caps, the extensive gas extractions systems and costs associated with those systems. EPA expects the capped areas to "breath" allowing the reactions to continue unchecked, with no monitoring in the deep soil horizons to determine where the gases are migrating.

1.5 Support and Opposition for a Pilot Study for Treatment and Excavation of Elemental Phosphorus

Comment Summary: EPA received comments from 66 individuals requesting a pilot study be performed to treat and/or excavate subsurface elemental phosphorus beneath the furnace building, while comments were received from 277 individuals opposing a pilot study for the excavation and/or treatment of subsurface elemental phosphorus.

EPA Response: EPA evaluated multiple proposed treatment methods for elemental phosphorus, including in-situ and ex-situ methods. No methods were identified to successfully treat elemental phosphorus contaminated wastes in place (in-situ). EPA did identify two potential ex-situ technologies that could potentially treat elemental phosphorus waste. These two methods are thermal treatment (incineration) and anoxic caustic hydrolysis. While both technologies have been shown to be effective on a small scale, there are no examples where these (or any other treatment technologies) have been used on a scale posed by contamination within the FMC OU. A pilot study, even if successful, would only provide a third potential unproven technology and would not address the risks posed to remediation workers, the public, and adjacent property employees associated with excavation and treatment of elemental phosphorus wastes.

EPA has determined that capping the elemental phosphorus and implementing land use controls is the safest and most practicable method for protecting human health and the environment while balancing implementability, risk to remediation workers, the public, and Simplot employees, and cost. Despite EPA's multiple excavation and treatment technology reviews, in deference to the Tribes' continuing advocacy for excavation and treatment, EPA has offered to further explore these issues by facilitating an independent review of excavation and treatment technologies.

Tribal Response: *EPA evaluated multiple treatment methods but for the entire site and for the large volume. A pilot study could evaluate the technology options and could address potential risks to remediation workers EPA continues to cite. EPA determined that capping the elemental phosphorus and implementing land use controls is the safest and most practicable method for protecting human health and the environment but did not conduct basic characterization to make these comments. Instead, EPA assumes if there is no phosphine gas within the breathing zone, there is no risk. EPA does not know the form of elemental phosphorus within the soils, how*

much gaseous products are being generated, such as phosphine and sub-oxides of phosphorus, the vertical or horizontal extent of the phosphorus or where migration is occurring. Had EPA required this data be collected, the risks from uncontrolled gas generation to the ecological soil environment and or human health may have required remedial options beyond capping.

1.6 Overall Protection of Human Health and the Environment

Comment Summary: EPA received 63 comments expressing concern that the Preferred Alternative is not protective of human health or the environment. Specifically, there were comments stating that EPA is covering waste and is not performing a cleanup or remedial action through capping. 5 comments expressed that the Preferred Alternative was protective.

EPA Response: The selected interim remedy will be protective of 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. Evapotranspiration caps, caps to protect against gamma radiation, land-use restrictions, and a groundwater pump and treat system are projected by EPA to provide full protection of human health and the environment. Evapotranspiration caps prevent the leaching and migration of COCs (such as arsenic and phosphorus constituents) in fill and soil to groundwater by preventing precipitation from infiltrating contaminated fill and soil. Properly maintained evapotranspiration caps, when combined with institutional controls, achieve all remedial action objectives for protection of human health and the environment with respect to potential soil exposure pathways including: 1) gamma radiation emission; 2) incidental ingestion; 3) direct dermal exposure; 4) the threat of elemental phosphorus fire; and 5) inhalation of fugitive dust.

Soil caps eliminate exposure to gamma radiation ("gamma caps"). Properly maintained gamma caps, when combined with institutional controls, achieve all remedial action objectives for potential human exposure pathways for: 1) gamma radiation; 2) incidental ingestion; 3) direct dermal exposure; and 4) inhalation of fugitive dust. Land-use restrictions limit activities to commercial/industrial uses, prohibit activities that may disturb the selected remedial alternative, and restrict use of groundwater. Land-use restrictions would also strictly manage when, where, and how excavation could occur (for example, digging to access utility lines)….

In summary, the remedy will utilize institutional controls, engineering controls (i.e., evapotranspiration caps and gamma caps), and a groundwater pump and treat system to provide protection of human health and the environment.

Tribal Response: *EPA's claim that soil caps eliminate gamma radiation is an inaccurate statement. Gamma radiation is present in various levels due to a variety of natural causes and especially man-made activities. The US Department of Energy's National Laboratories have demonstrated that fall-out has played a significant role in adding gamma radiation levels world-wide even here in Southeast Idaho, cesium-137 (a gamma radionuclide) concentrations were noted during the Chernobyl Accident. Therefore, for EPA, to claim that placing a soil cap over the existing contaminants will eliminate gamma exposures is simply misleading or false.*

1.7 Design of the Groundwater Extraction System

Comment Summary: EPA received 67 comments expressing concern that contaminated groundwater from the FMC OU will be allowed to discharge into the Portneuf River, the Bottoms Area, and the American Falls Reservoir, and that only a portion of the contaminated groundwater will be captured by the groundwater containment system. Some comments expressed concern that radionuclides within the groundwater cannot be treated and will be released into groundwater or the Portneuf River. Questions were also received inquiring why arsenic and orthophosphate are the primary contaminants of concern (COCs). 1 comment was received supporting the groundwater remedy.

EPA Response: The groundwater pump and treat system will be designed to capture all contaminated groundwater prior to that groundwater exiting the FMC OU and thus provide total hydraulic containment of all contaminated groundwater. Extraction wells will be located in the northeastern corner of the former operations area to capture impacted shallow groundwater before it can migrate downgradient beyond the former operations area boundary. Although precise specifications will be developed in the Remedial Design, groundwater modeling indicates that 5 extraction wells would be sufficient and a total combined extraction rate of approximately 530 gallons per minute (gpm) would fully capture contaminated groundwater migrating beyond the former operations area.

Arsenic, fluoride, nitrate, radium-226, selenium, thallium, elemental phosphorus, gross alpha, and gross beta have been detected in FMC OU groundwater at concentrations that exceed the groundwater MCLs (drinking water standards) and are the COCs for this Interim ROD Amendment. While the treatment system will be designed to treat all contaminants of concern, for the following reasons, EPA considers arsenic and phosphorus to be the primary groundwater COCs for this OU and the primary groundwater COCs for the EMF Site. Arsenic is the only groundwater COC that has been shown to be migrating beyond the FMC OU boundary in concentrations that would be a concern to human health. Arsenic is responsible for most of the human health risks associated with groundwater ingestion. Only phosphorus has been shown to be migrating beyond the FMC OU boundary in concentrations that would be a concern for the environment. Phosphorus is responsible for most of the calculated ecological risks associated with groundwater at the FMC OU and EMF Site. Gross alpha and gross beta levels will be addressed by precipitating and filtering radioactive metals from the groundwater within the treatment system. Extracted groundwater must be treated to meet MCLs for all COCs, and groundwater monitoring will monitor for all COCs.

Tribal Response: *Preventing migration of stormwater runoff is important to limit the further migration of contaminants; but as we all know, East Idaho is an arid climate with limited precipitation. The Tribes believe too much emphasis has been placed on limiting stormwater from furthering migration of contaminants when geochemistry within the soils, including uncontrolled chemical reactions, the changes in pH are going unmonitored. Acidic environments mobilize many metals. EPA is focusing limiting stormwater runoff because that's what an evapotranspiration cap will do. What it will not do is limit chemical reactions going on within the soil, in fact, we don't know what affect the caps will have on the elemental phosphorus because we have no data regarding the form elemental phosphorus is in, only best guesses.*

EPA's proposed groundwater pump and treat system will not treat all the contaminated groundwater. According to EPA's Supplemental Feasibility Study Report and FMC's Groundwater Model Report for the FMC plant, the aerial extent impacted by arsenic is 431 acres and after 100 years of treatment, the aerial extent is predicted to be 311 acres. That is a 28% decrease after 100 years of treatment. For phosphorus, the aerial extent of contamination is 292 acres and expected to be 104 acres or a 64% decrease and radioactive potassium is currently 420 acres and expected to be 185 acres or a 56% decrease. So after 100 years of pump and treating groundwater, the best we can expect is to have a 311 acre footprint of arsenic.

FMC and EPA are relying on advective mixing or dilution to remedy this mess. According to published reports mixing of affected groundwater with large volumes of unaffected groundwater within the EMF aquifer system substantially reduces the concentrations of all constituents. (Ground Water Current Conditions Report, Oct. 2008 pg 6-7) These same reports state the most significant factor affecting the fate and transport of EMF related constituents (contaminants) in groundwater is advective mixing. Advective mixing occurs when water with high contamination mixes with water having low concentrations. The mixing results in a decrease of the contamination.

1.9 Groundwater Compliance Zone

Comment Summary: EPA received 10 comments requesting the groundwater compliance zone for the groundwater monitoring program to be within the FMC OU instead of where groundwater discharges as surface water in the Portneuf River.

EPA Response: The 1998 ROD required that groundwater ultimately meet groundwater restoration cleanup goals throughout the plume (without specifying how beyond controlling contamination sources to groundwater), and this requirement remains unchanged. The Interim ROD Amendment requires immediate containment of contaminated groundwater by requiring that these groundwater cleanup goals be met for all COCs at the line of extraction wells within the FMC OU (their precise locations to be fixed during remedial design). The interim groundwater pump and treat system will prevent contaminated groundwater from migrating beyond FMC OU boundary, into the Simplot OU, potentially impacting that remedy, and to nearby springs or the Portneuf River.

EPA has selected an interim rather than final groundwater remedy because of uncertainty as to whether groundwater restoration can be achieved within 100 years. In addition to stopping contaminated groundwater migration beyond the FMC OU boundary, the interim remedy allows for the collection of more site specific data (to avoid relying only on modeling) to determine with greater confidence if groundwater restoration can be achieved within a reasonable timeframe. It also avoids any further delay in initiating a pump and treat system in an area which EPA now believes will likely require a pump and treat system as part of the final groundwater remedy. A groundwater monitoring program will be developed for the FMC OU to monitor the performance of the pump and treat system using the EPA *Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems*. Monitoring wells for this monitoring program will be placed near the former FMC operations area as well as beyond the FMC OU boundary.

Groundwater will continue to be monitored along the flow paths toward the Portneuf River and groundwater quality will also be monitored prior to flowing into the Portneuf River.

Tribal Response: *EPA states it has selected an interim rather than final groundwater remedy because of the uncertainty as to whether groundwater restoration can be achieved within 100 years and allows EPA to collect site specific data. Data has been collected at this site for over 20 years with only several special sampling events that measured all metals and contaminants. In December, 1993 EPA allowed FMC to reduce the list of contaminants they monitored for. Because this reduction, we do not have data trends on the full suite of contaminants at this site.*

1.11 Human Health and Ecological Risk Drivers

Comment Summary: EPA received 3 comments requesting the identification of the contaminants that pose the greatest health risks at the FMC OU, and identification of what those risks are.

EPA Response: The remedy will address several risk-creating contaminants associated with specific receptors and exposure pathways. Although the remedy addresses all contaminants of concern (COCs) identified in the risk assessments and Supplemental Feasibility Study (SFS), a subset of the COCs are identified as presenting the highest concern to human health and ecological receptors, and are referred to as "risk drivers." The remedy consists of Soil Alternative 3 and Groundwater Alternative 2 from the Proposed Plan. The remedy reduces risks to both human and ecological receptors by reducing their exposures to COCs at the FMC OU. The COCs for human health risks are radionuclides, radon, several metals (specifically arsenic), and elemental phosphorus. Orthophosphate is identified as the COC for ecological receptors in the aquatic environment of the Portneuf River. No COCs were identified for ecological exposures in the terrestrial environment.

Radionuclides in surface soils and fill material within the FMC OU pose a risk to human health through direct gamma radiation exposure, inhalation, and ingestion which pose a cancer risk. In areas where there is no elemental phosphorous, the risk driver COC is radium-226, which also produces radon gas, another COC. The primary human receptors are current and future workers. Current and future workers can be exposed to gamma radiation through the following pathways:

- Direct gamma exposure from slag and other waste materials (includes: phossy solids, precipitator solids, kiln scrubber solids, industrial waste water sediments, baghouse dusts, and plant/construction landfill debris);
- Incidental inhalation of slag dust; and
- Incidental ingestion of slag dust.

To reduce exposure to gamma radiation, the soil remedy will consist of soil covers or caps (composed of at least 12 inches of soil) to prevent exposure to gamma radiation and inhalation and ingestion of slag dust and other waste.

Elemental phosphorus in the subsurface of the FMC OU is also a risk driver for human health. The primary human receptors are current and future workers. The pathways for exposure of these workers to elemental phosphorus are:

- Dermal contact with elemental phosphorus;

- Ingestion of soil contaminated with elemental phosphorus; and
- Inhalation of combustion gases of elemental phosphorus.

Tribal Response: *EPA did not identify ecological exposures in the terrestrial environment at FMC because they determined the FMC OU was unlikely to provide suitable habitat for ecological receptors, and did not carry out an updated Ecological Risk Assessment. Instead, they used data from a 1995 Risk Assessment that did not attempt to identify Ecological risks within the Operating area. Despite repeated requests by the Tribes to conduct a complete ecological risk assessment using a Native American scenario that would identify plants grown within the FMC OU that could potentially be used for subsistence in future years. EPA did not evaluate risks to burrowing animals within the FMC OU that may be exposed to toxic gases being generated within the soils. EPA lists radon gas as a COC but does not have any remedial components to address COC.*

Evapotranspiration caps will be constructed over soils which contain elemental phosphorus and other phosphorus constituents. These caps are designed to reduce infiltration of precipitation, which may leach elemental phosphorus and phosphorus constituents into the groundwater. While these may prevent water from leaching into the soils, water is not the only ingredient necessary to create a reaction. In fact, EPA is hoping these caps will allow air into the soils so the phosphorus will react but has no data that these caps will not exacerbate the reactions or cause additional harm.

1.12 Health and Safety of Handling Elemental Phosphorus

Comment Summary: EPA received 62 **c**omments stating FMC and members of the surrounding community have extensive experience safely handling elemental phosphorus. They questioned why EPA considers the excavation of elemental phosphorus too dangerous to perform, given the extensive experience of individual former FMC employees, and FMC as a corporation. Several comments suggested employing KASE/Warbonnet to perform excavation of elemental phosphorus due to their extensive experience handling elemental phosphorus wastes. 5 comments were received agreeing with EPA regarding the risks posed by handling elemental phosphorous.

EPA Response: Although FMC has experience excavating and managing small quantities of elemental phosphorus-contaminated soils and wastes within its former facility, FMC never attempted to excavate large quantities of elemental phosphorus-contaminated soils, or soil with high concentrations of elemental phosphorus. While operating, FMC developed techniques to excavate comparatively small quantities of elemental phosphorus-contaminated soil and waste, which were drummed and transported for off-site treatment and disposal, placed in one of the operating ponds or sumps, or transported and buried at an alternate on-site location. FMC also developed techniques for controlled aeration of elemental phosphorus-contaminated soils and wastes. The smoke and gases that were generated and the fires that at times resulted from FMC's handling of these comparatively small quantities, and from FMC operations more generally, posed potentially significant risks to human health. EPA is neither willing nor able to allow handling even such small quantities of elemental phosphorus-contaminated soils in a manner similar to the way FMC handled them, much less attempt the vastly larger quantities buried at the FMC OU, in these ways. To do so, particularly in significantly larger quantities, would

expose cleanup workers, adjacent facility employees, and nearby residents to what EPA considers unacceptable risks. No one nationally or internationally, including FMC, has ever attempted to excavate large quantities of elemental phosphorus-contaminated soils.

The *Identification and Evaluation of P4 Treatment Technologies* report (MWH, 2009c), examines the additional risks and mitigation procedures which would be required if large volumes of elemental phosphorus-contaminated soils were excavated. This report discusses the known significant challenges and safety issues associated with excavating large volumes of soil contaminated with elemental phosphorus, above and beyond what FMC had experience with. Section 2.2.1.1 of this report discusses how conventional excavation might be used and the extensive adjustments that would have to be put into place to prevent fire, smoke, and gas generation. These potential adjustments are based on a combination of knowledge of the physical properties of the materials and previous experience managing smaller volumes.

EPA evaluated an excavation cleanup alternative and determined that a large scale excavation would pose significant risks to workers and nearby residents. As mentioned earlier, for safety reasons elemental phosphorus is usually handled under water. Therefore, any hydraulic or wet dredging excavation would require saturating a significant area with large quantities of water to prevent combustion. Adding significant quantities of water to contaminated soils will produce enough hydraulic head to drive additional contaminants down to groundwater. Once the contaminants are in groundwater, they mix with regional groundwater before migrating toward to the Portneuf River. The significant volume of additional contaminated water generated would have to be contained and extracted. Designing a groundwater containment system to capture all of the additional groundwater contamination that extracting a significant quantity of buried elemental phosphorus-containing waste underwater would generate would be difficult. As a result, it is likely that additional contaminants would be released into the environment via the groundwater pathway.

Tribal Response: *EPA should not steer away from a remedial design that may be superior to others because the engineering may be "difficult" (See EPA response above). A containment system to capture groundwater contamination from extracting buried elemental phosphorus is possible. Information is being presented to lead the public to believe all the elemental phosphorus would be removed or treated at once. This is just not so, any treatment or excavation would be done in a phased approach and would not require containment for the total estimated volumes at once. Not all elemental phosphorus would be removed or treated at once so*

Although FMC used inert gas blankets during operations (within controlled and engineered environments) to prevent liquid elemental phosphorus from coming in contact with air, no current technologies have shown an inert gas blanket could be used to excavate large quantities of elemental phosphorus-contaminated soils. In addition to uncertainties associated with the implementability of constructing an inert gas blanket enclosure, there are significant work related risks associated with storing and using large quantities of asphyxiant gases, such as nitrogen or argon.

Tribal Response: *EPA has provided oversight at the RCRA ponds, and the Time Critical Removal Action required because of uncontrolled reactions generating dangerous levels of*

phosphine. The emergency situations at these ponds required FMC blanket these ponds with nitrogen. EPA provided recommendations on these actions and oversight. It is unclear why they would now question the implementability of such actions.

In comments on the Proposed Plan, KASE/Warbonnet noted that it performed decommissioning and decontamination at the FMC facility, and that based on its extensive knowledge and experience handling elemental phosphorus wastes, it would be reluctant to perform excavation of elemental phosphorus contaminated soils within the FMC OU. The following is an excerpt from the KASE/Warbonnet comments on the FMC OU Proposed Plan: "So, in conclusion, based on KASE/Warbonnet's extensive experience with phosphorus, any attempts of excavating the area underneath and around the former furnace building is fraught with peril and would be very dangerous.

Tribal Response: *There are many other professional and competent Contractors that could perform this work. For EPA to base their decision not to require treatment because one contractor, hired by the company responsible for contamination states they would be reluctant to perform the work is ridiculous.*

1.13 Risks Posed by Subsurface Elemental Phosphorus

Comment Summary: EPA received 10 comments expressing concern over the risks posed to human health and the environment by subsurface elemental phosphorus. Some comments questioned why elemental phosphorus within the storm drain pipes are proposed to be excavated while elemental phosphorus in subsurface soils and within the slag pile are proposed to be capped. 1 individual commented that there are no risks associated with elemental phosphorus in the subsurface.

EPA Response: Subsurface elemental phosphorus does not pose a risk to human health if left undisturbed. Subsurface elemental phosphorus is present beneath the furnace building, within the CERCLA ponds, within storm drain pipes, and potentially in railcars buried within the slag pile. Elemental phosphorus is pyrophoric and thus burns spontaneously upon contact with air. Burning elemental phosphorus generates a dense white smoke called phosphorus pentoxide which is a powerful irritant which can react with water in the atmosphere or within body tissues (eyes, nose, throat, and lungs) to form corrosive phosphoric acid. Because of its pyrophoric properties, excavation of elemental phosphorus creates the immediate hazard of auto-ignition and generation of highly irritating and corrosive gases. The largely uncontrolled conditions during excavation would expose workers to risks from fire, dermal, and respiratory hazards. Respiratory hazards could also affect downwind residents, adjacent facility employees, and travelers on Highways 30 and 86.

The remedial action targets removal of a limited amount of elemental phosphorus that is contained in storm water piping and can be managed utilizing techniques similar to those used in limited excavations in the past at FMC. The removal of elemental phosphorus from the underground pipes can be done with significantly less risk to workers than removal of all FMC OU elemental phosphorus-containing soils generally, because the material is contained in pipes, the specific location of the subsurface elemental phosphorus is known, and it is in relatively

small quantities. Even for this limited excavation however, elaborate preparation and safety measures would be necessary to protect site workers and the public.

The *SFS Report* documented that there are railcars buried approximately 80 to 100 feet below ground surface in the slag pile although the exact number and contents are not known. As part of the risk assessment and feasibility study process, EPA reviewed all pertinent information and

Tribal Response: *EPA has no evidence that subsurface elemental phosphorus does not pose a risk to human health if left undisturbed. EPA has failed to monitor the elemental phosphorus and chemical reactions that generate phosphine deep within the soils where one would expect phosphine. Phosphine is heavier than air so when EPA conducts monitoring of the surface of the soils, even a small amount of phosphine is evidence these reactions are taking place, generating enough phosphine that it is migrating through the soil columns and up to the surface of the soils*

EPA has found uncontrolled reactions within the RCRA ponds generating dangerous levels of phosphine and this waste has been capped and undisturbed for almost a decade.
EPA states removing elemental phosphorus from storm drains is possible due to known locations, quantities, and it is contained in pipes. Experiences at the RCRA ponds have elemental phosphorus and its' reaction by products corrode piping. It is expected contingency plans are in place to address phosphorus that has leaked from the pipes. If EPA can remove the elemental phosphorus within the storm drains safely, they can install safety measure to remove small quantities throughout the FMC OU and especially in areas where elemental phosphorus is known to be concentrated.

1.14 Long-Term Reactivity of Subsurface Elemental Phosphorus
Comment Summary: EPA received 4 comments expressing concern that elemental phosphorus will remain reactive for 10,000 years. Concerns were expressed that wastes left in place will contaminate the surrounding community if EPA is no longer acting as a regulatory authority.

EPA Response: Post-remedy implementation management is a necessary component of any remedial action and FMC will be required to implement an EPA-approved operations, monitoring, and maintenance plan. This plan will require regular monitoring of all components of the remedy and will include plans for maintenance and repairs as needed. EPA will provide oversight of ongoing regular monitoring and will review overall protectiveness of the remedy during 5-year reviews as required by CERCLA. Further, any Consent Decree (CD) or Unilateral Order (UAO) implementing the IRODA would also require FMC to provide financial assurance (such as a performance bond, letter of credit, trust account, etc.) to ensure the obligations outlined in the CD or UAO are fulfilled.

Subsurface elemental phosphorus does not pose a risk to human health if left undisturbed beneath properly maintained caps, and ET caps and the other soil covers selected for the FMC OU in the IRODA can be maintained indefinitely at relatively modest cost. Placing ET caps over the areas of known subsurface elemental phosphorus within the FMC OU is completely consistent with how EPA has addressed other elemental phosphorus-contaminated sites across the country. Further, engineered containment of wastes is a very common technique employed at many Superfund sites and solid and hazardous waste landfills throughout the country. When

designed, implemented, and monitored properly, containment or closures of this kind are considered protective of human health and the environment.

However, even if subsurface soils were treated to eliminate elemental phosphorus, due to other contaminants in the soil, much of the FMC OU would continue to require long-term management such as cap maintenance, institutional controls, monitoring, and a groundwater extraction and treatment system. Eliminating risks posed by elemental phosphorus does not eliminate risks posed by other COCs in the subsurface or surface soils, such as metals or radionuclides.

Tribal Response: *EPA has no evidence that subsurface elemental phosphorus does not pose a risk to human health if left undisturbed. EPA has failed to monitor the elemental phosphorus and chemical reactions that generate phosphine deep within the soils where one would expect phosphine. Phosphine is heavier than air so when EPA conducts monitoring of the surface of the soils, even a small amount of phosphine is evidence these reactions are taking place, generating enough phosphine that it is migrating through the soil columns and up to the surface of the soils. EPA has found uncontrolled reactions within the RCRA ponds generating dangerous levels of phosphine and this waste has been capped and undisturbed for almost a decade. EPA mentions nothing about risks to ecological receptors including soils. CERCLA defines soils as part of the Ecology but EPA continues to ignore the risks to ecological receptors from phosphine and other gases being generated. EPA does not know if placing ET caps over elemental phosphorus will exacerbate the conditions within the soils because no data has been generated to identify the conditions.*

Finally, EPA states that even if subsurface sols were treated to eliminate elemental phosphorus, due to other contaminants in the soil, much of the FMC OU would continue to require long-term management…. Eliminating risks posed by elemental phosphorus does not eliminate risks posed by other COCs in the subsurface or surface soils such as metals or radionuclides. The Tribes believe this is the crux of the issue. It is not that elemental phosphorus can't be removed or treated so it no longer reacts. What is driving this insistence is the fact that a cap will still be required to prevent risks from other COC's. EPA should require excavation and or treatment of the elemental phosphorus so it can no longer react. Elemental phosphorus remains reactive for up to 10,000 year and should be rendered non reactive. Then, the other contaminants can be handled. It seems EPA is trying to find a remedial option of a one size fits all when we should be evaluating multiple options for different contaminants.

1.16 Long-Term Effectiveness of Capping Versus Short-Term Effectiveness of Excavation

Comment Summary: EPA received 60 comments stating that the long-term risks of capping subsurface elemental phosphorus outweigh the short-term risks of excavating subsurface elemental phosphorus.

EPA Response: Through the RI/FS process, EPA has determined that risks associated with disturbing subsurface elemental phosphorus outweigh risks associated with capping subsurface elemental phosphorus. EPA compared the **long-** and **short-term effectiveness** of capping with the long- and short-term effectiveness of excavating subsurface elemental phosphorus as part of

the remedy selection process. The comparison of these criteria for the different soil alternatives can be found in Sections 8.1.3 and 8.1.5 and in Table 4 of the *FMC OU Proposed Plan* while additional details are provided in the *SFS Report* (MWH, 2010b).

Pursuant to CERCLA, criteria used to evaluate **long-term effectiveness** included comparing the reliability of the overall remedy, adequacy of controls, and the magnitude of residual risk. Capping subsurface elemental phosphorus met the long-term effectiveness criteria and was ranked "moderate to high" because:

- Residual risk levels after capping are very low;
- Elemental phosphorus in subsurface soil is solid, largely insoluble, and immobile;
- Capping creates a barrier to exposure and reduces surface water infiltration to increase stability and containment;
- Caps would be engineered for generally comparable long-term effectiveness and performance as well as storm water drainage, therefore no significant cap deterioration is expected to occur; and
- Long-term operation and maintenance includes monitoring and repair as necessary to maintain long-term cap integrity, and can readily be provided at modest cost.

Tribal Response: *The Tribes are concerned EPA believes the residual risk levels after capping are very low. The Tribes believe the residual risks remain very high. Elemental phosphorus remains reactive for 10,000 years. While capping may prevent dermal exposure to fires and limit infiltration, it does not prevent uncontrolled chemical reactions which generate phosphine and other sub- oxides of phosphorus. These caps will allow air into the soils and may actually exacerbate a chemical reaction when the barometric pressure changes. Information we have learned from the RCRA ponds has shown the elemental phosphorus reacts within caps and is expected to do so within the evapotranspiration caps. The Tribes do not believe capping provides a moderate to high effectiveness but rather a low effectiveness.*

EPA Response:
Excavating subsurface elemental phosphorus did not meet the short-term effectiveness criteria and was ranked as "low" because:

- Excavation and treatment takes substantially more time to implement than capping. Excavation and treatment is estimated to require 20-40 years to implement compared to capping which is estimated to require 3-5 years to implement; and
- During excavation and treatment of soils there would be significant risks to both onsite workers, adjacent facility employees, and the public….

Tribal Response: *The Tribes question EPA's cost estimate and estimated years to implement an excavation and treatment process. EPA has stated "For the purposes of the cost estimate, the hypothetical treatment facility was assumed to process 18% solid slurry at 82 gallons per minute, which is double the capacity of the Land Disposal Treatment facility that was built. For the purposes of the cost estimate, the total volume of known or suspected elemental phosphorus-contaminated soils onsite was calculated to be 2,400,239 cubic yards. The time to treat the volume of elemental phosphorus-contaminated soil, assuming that 18% solid slurry was processed at 82 gallons per minute, was calculated to be 44 years of continuous operations".*

On page 2 of the Responsiveness Summary EPA states there are 780,000 cubic yards of elemental phosphorus. When EPA calculated the cost, they inflated the volume of material by 1,620, 239 cubic yards. The cost and time to treat and or excavate this material is roughly 33% of what EPA has stated.

1.18 Phosphine Gas Generation

Comment Summary: 40 comments were received expressing concern over the generation of phosphine gas within areas where subsurface elemental phosphorus is present. Inquiries were made regarding the generation rate of phosphine within the soil, characterization and location of phosphine within the soil, and migration of phosphine within the soil.

EPA Response: Studies from the FMC OU indicate that phosphine is not present in ambient air above levels that cause a health concern. In 2010, EPA directed FMC to investigate the RCRA regulated ponds and CERCLA areas containing elemental phosphorus processing waste to evaluate the concentrations of phosphine and other gases in ambient air and in the soil column. This investigation was conducted during the summer of 2010 and the findings were presented in the *Gas Assessment Report* (MWH, 2010c). Soil gas samples were collected within areas of the former FMC operations area that, as a result of historical elemental phosphorus releases, have the potential to generate phosphine gas. The sampling encompassed both the FMC OU areas and areas where closed RCRA-regulated waste management units are located that are not part of the FMC OU. In general, soil gas samples were collected at locations 18 – 24 inches below ground surface. The phosphine surface flux (or generation) rates were measured in areas where significant quantities of elemental phosphorus in the subsurface were present, such as the furnace building, the slag pit, and the former railroad swale. The gas assessment showed the area with the most generation was under the furnace building with a generation rate of 4.01 x 10-7 mg/cm2 per hour (or 1.314 x 10-8 ounces/ft2 per hour). These results revealed that although low levels of phosphine gas, and to a lesser extent other gases, are generated in the subsurface as a result of the presence of elemental phosphorus within the FMC OU, levels in soil gas were all below 1 ppm.

The permissible exposure limit (PEL) for phosphine (PH3) is 1 ppm for 15 minutes or 0.3 ppm averaged over eight hours. Of the 420 total recorded soil gas readings, only 37 (9%) were nonzero (>0.00 ppm) and individual readings ranged from 0.02 to 0.15 ppm PH3. All phosphine gas measurements within soil gas were below the permissible exposure limit. No phosphine or other gases were shown to have migrated to the ambient air at measureable levels where a complete exposure pathway could occur.

Tribal Response*: As in previous responses, EPA ignores the impacts to ecological environment from phosphine gas being generated deep within the soils at the FMC OU. CERCLA calls for protection of human health and the environment and in this case, EPA is selecting a remedy that does not protect the environment. Phosphine gas is generated when elemental phosphorus reacts with either water and/or air, generating sub oxides of phosphorus including the toxic gas phosphine. Phosphine is heavier than air so if it has migrated to the surface of soils it is reasonable line of evidence a much larger volume is beneath the soils; not all the phosphine will migrate to the surface. The results of the gas monitoring revealed not only phosphine gas but other gases including hydrogen cyanide and hydrogen sulfide are being generated. EPA monitored generally at 18 to 24 inches, elemental phosphorus may be anywhere from 10 feet to*

80 feet below ground surface. Clearly phosphine is migrating within the soils and impacting the ecological environment. EPA's remedial options do nothing to prohibit the generation and in fact may exacerbate the current situation. Without adequate data identifying the nature and extent of elemental phosphorus, which we do not have, we cannot determine if the caps EPA proposes are causing greater or lesser reactions.

1.19 Phosphine Gas Monitoring

Comment Summary: EPA received 4 comments requesting monthly monitoring of phosphine gas rather than bi-annual monitoring of phosphine gas, as selected in the IRODA.

EPA Response: To ensure continued protectiveness, as part of this remedy EPA is requiring a robust phosphine and other gas monitoring program that will monitor both the soil column and ambient air. A combination of soil gas, flux measurements, and ambient air samples will be collected on a bi-annual basis. Should the sampling results show that gas is being generated at a rate or level that may pose a threat to human health or the environment, EPA will require additional action at the FMC OU.

Tribal Response: *A bi-annual monitoring program, generally aimed at monitoring the top 12 inches of the soils is far from robust*.

1.27 Gamma Radiation and Radon-222

Comment Summary: EPA received 3 comments expressing that gamma radiation should be the primary risk driver and that airborne radiological emissions should be considered in the remedy. Concerns were expressed that radon-222, a daughter product of radium-226, could become airborne contaminating the surrounding community.

EPA Response: The contaminant of concern (COC) which poses the greatest potential health risks in soil is radium-226 (as long as elemental phosphorus is not exposed and does not migrate in any significant quantity). Cleanup levels for radionuclides like radium-226 are based primarily on radiological preliminary remediation goals, including federal regulatory requirements which specify media concentrations, formulae, or risk levels to be met unless they are more stringent than natural background levels. The Uranium Mill Tailing Radiation Control Act (UMTRCA) standard for radon flux is among these requirements.

The main objective of the selected remedial action with respect to radionuclides is to mitigate risks posed to human health or the environment to levels all Superfund site remedies are required to achieve. The presence of radium-226 could pose a risk to air quality by emitting radon-222gas and alpha, beta, and gamma radiation. Persons traversing the FMC OU could inhale or ingest contamination as slag dust.

The site-specific background mean for radium-226 is 1 pCi/g. The risk-based value, representing a 2 in 10,000 excess cancer risk, is 1.5pCi/g. Therefore, EPA proposes a cleanup level of 2.5 pCi/g (which is 1.5 pCi/g above the radium-226 background concentration of 1.0 pCi/g) and corresponds to an acceptable risk of 2 x10-4 for the residential scenario and 6 x10-5 for the industrial scenario. This site-specific cleanup level applies to all radiation emitting areas of

concern at the FMC OU. It has been selected because it is distinguishable from background and therefore measurable in the field, and is within the acceptable EPA excess cancer risk range.

The pathways for human exposure to radiation include windblown fugitive slag dust and direct exposures. Particulates from slag dust will be covered by gamma caps which will prevent or substantially inhibit windblown fugitive dust from coming in contact with future workers or surrounding residents. These caps, and the caps over elemental phosphorus contaminated soils, will also prevent direct exposure of radiation to workers or people traversing the FMC OU.

Radon-222 flux emissions were measured and are reported in the *SRI Report* (MWH, 2009a). The radon-222 flux measurements within the slag pile, the largest contributor of radon at the FMC OU, indicated that radon flux exposures were far below the acceptable levels defined by the UMTRCA. Since the radon-222 contribution from the slag pile is below acceptable levels, a topsoil cap that will block gamma radiation is expected to be protective of any radon that could otherwise be emitted to ambient air. Further, radon-222 has a half-life of 3.8 days and it eventually decays into lead-206 (a stable solid). Radon-222 is heavier than air and is not likely to be emitted through the topsoil cover….

Tribal Response: *Allowing for 2 excess cancers in 10,000 people for a residential scenario and 6 excess cancers in 100,000 people is not an acceptable risk the Tribes concur with for land within our homeland. Radon gas and phosphine gas are being generated and EPA is selecting a remedy of capping then only estimate or expect to work but cannot provide assurances. The Tribes believe this is not protective of human health or the environment.*

1.28 Health of Downstream Fish and Wildlife

Comment Summary: EPA received 15 comments expressing concern over the health of downstream fish and wildlife. Specifically there were concerns regarding fish and game consumption and the use of the Portneuf River and the American Falls Reservoir for recreational purposes. Some comments stated there has been a reduction in migratory birds at the American Fall Reservoir.

EPA Response: …After evaluating data related to mercury and the Portneuf River, it does not appear that mercury present in the fish, water, sediment, and soil are from the EMF Superfund Site. Mercury detected in ore used by FMC and Simplot is near background levels and as such, does not contribute significantly over background to mercury in soil or sediment associated with the Portneuf River and American Falls Reservoir. To date, no known studies have been performed to specifically assess the quantity of heavy metals in deer and elk in the vicinity of Pocatello. Therefore, it is unknown if ingesting meat from deer and elk pose a risk to human health. However, EPA, IDEQ, the Tribes, Simplot, and FMC are currently re-evaluating potential risks posed to wildlife and the environment in the area most likely to support deer and elk populations as part of the EMF Off-Plant OU.

Tribal Response: *The Tribes have not been informed of any effort to re-evaluate potential risks posed to wildlife and the environment in the area most likely to support deer and elk populations as part of the EMF Off-Plant OU. EPA recently required the Tribes amend proposed in the Off-Plant OU removing any reference to sampling or re-evaluation of risks.*

EPA Response:
The American Falls Reservoir is impacted by phosphorus contamination from the EMF Superfund Site. Phosphorus is primarily an environmental concern because it promotes the growth of aquatic plant life like algae within a water body, such as the Portneuf River or American Falls Reservoir. Decaying aquatic plants are consumed by bacteria which consume dissolved oxygen in the water body. Dissolved oxygen concentrations within the water body can drop too low for fish to breathe which can lead to reduced fish populations. The Human Health Risk Assessment performed in 1996 for the EMF Site demonstrated that no significant risk to human health would be incurred by swimming in the American Falls Reservoir. While the full extent of ecological effects in the American Falls Reservoir was not documented, the groundwater extraction and treatment system will prevent all FMC OU-related contamination from reaching the Portneuf River and the American Falls Reservoir.

Tribal Response: *The American Falls Reservoir and the Portneuf River leading to the reservoir are likely impacted from metals as well as radiation from the Eastern Michaud Flats Superfund Site. The Human Health Risk Assessment performed in 1996 did not evaluate risks from drinking water in the American Falls reservoir. EPA did not require a Ecological Risk evaluation including a Native American Scenario in the off-plant area nor the American Falls reservoir. EPA's statement that the groundwater extraction and treatment system will prevent all FMC OU related contamination from reaching the Portneuf River and American Falls Reservoir is not correct. The pump and treatment system or extraction system will not pump all contaminated water at the FMC site. The treatment system will be implemented in the shallow aquifer. The deep aquifer has contaminants associated with the EMF site and will not be treated at all.*

1.29 Public Health Concerns
Comment Summary: EPA received 23 comments expressing concerns that perceived declining health effects in the surrounding community are related to FMC and Simplot facility operations. Some comments requested epidemiological studies be performed on the surrounding community and former employees of the FMC plant.

EPA Response: The purpose of CERCLA remedial action is to address current and future risks posed by sites to protect human health and the environment. Health effects from past exposures are not assessed by EPA unless they may reasonably be expected to provide information to be used in remedy selection to address current and future risks at a site.

Implementation of the selected remedial action should eliminate all future exposures at or from the FMC OU above established EPA risk ranges and regulatory requirements for Superfund cleanups, which is the extent of EPA authority. It is generally challenging for epidemiological studies to relate specific exposures at Superfund sites to community health outcomes because there are many risk factors that contribute to cancer and other diseases in our society. As part of the 1999 RCRA FMC Consent Decree, FMC agreed to conduct a limited health study known as Supplemental Environmental Project #14. Its results will not have any impact on FMC OU decision making or remedy implementation.

Tribal Response: *SEP 14 is a result of a court agreement and has nothing to do with the EMF Superfund Site. It is narrowly limited to health impacts that resulted from hazardous waste violations at the FMC RCRA ponds. It is unclear why EPA would address this study in a CERCLA context. A study performed by the Agency for Toxic Substances and Disease Registry (ATSDR) in the mid 1990's identified a statistically significant increase in upper respiratory health impacts for people living within the Fort Hall Reservation compared to people living on the Duck Valley Reservation. This health study was done as part of the EMF Superfund Site Remedial Investigation.*

1.36 Tribal Soil Cleanup Standards as an ARAR

Comment Summary: EPA received 16 comments stating that EPA is not meeting Trust responsibilities nor recognizing Tribal sovereignty because the Tribal Cleanup Standards were not incorporated as ARARs for this Interim ROD Amendment.

EPA Response: Consultation, as the EPA in Region 10 use the term, means "the process of seeking, discussing, and considering the views of federally recognized tribal governments in a respectful, meaningful two-way communication that works toward consensus reflecting the concerns of the potentially affected federally recognized tribes before EPA makes its final decision or moves forward with its action." EPA has provided the Shoshone-Bannock Tribes funding throughout the development of the FMC OU Supplemental Remedial Investigation and Feasibility Study process to ensure full engagement in all activities. In addition, EPA arranged for a facilitated meeting between EPA and the Shoshone-Bannock Tribes to discuss tribal concerns related to the FMC OU on January 26 and 27, 2010, a government to government consultation on our proposed actions at the FMC OU on August 25th, 2010, and a meeting between senior EPA management and the Fort Hall Tribal Business Council on October 11th, 2011, just prior to first public hearing regarding the EPA's Proposed Plan for the FMC OU. Senior EPA officials again consulted with the Shoshone Bannock Tribes on the interim ROD Amendment on April 12, 2012.

In December 2010, the Shoshone- Bannock Tribes promulgated Soil Cleanup Standards for Contaminated Properties (SCS) as regulations under their Waste Management Act, and on December 3, 2010, sent a letter to EPA requesting that they be considered ARARs for the FMC OU. According to the SCS, the Tribes' goal in promulgating the SCS is to restore all land within the Reservation to its original state, that is, prior to the contamination that the standards are designed to address. In addition, the SCS provide cleanup levels for more than 100 contaminants for both unrestricted and commercial/industrial land use within the Fort Hall Indian Reservation. In some cases, the SCS requires the development and assessment of a site-specific conceptual site model and risk assessment that considers a Tribal exposure scenario reflecting the lifestyle which some tribes have argued treaties (and other agreements) were designed to protect, including environmental conditions or contaminant concentrations in various media reflecting the often pristine environmental conditions at the time the treaties were executed. However, since the Tribal Soil Cleanup Standards were promulgated after completion of most of the investigation and feasibility study work was conducted at the FMC OU, they were not taken into account in any of the data collection or remedy evaluations.

Section 121(d) of CERCLA mandates that upon completion, remedial actions must at least attain (or waive) all applicable or relevant and appropriate requirements (ARARs) of any Federal environmental laws, or more stringent promulgated State environmental or facility-siting laws (which EPA interprets to mean qualifying tribal requirements on Indian reservations). EPA is evaluating the Tribes' standards to determine whether these regulations may be ARARs. This evaluation will require careful federal review in order that these unique and potentially precedential SCS be fully evaluated prior to a decision as to whether all or a part of the SCS are ARARs. When EPA selects a final remedy, EPA will more definitively address groundwater restoration within a reasonable restoration timeframe, will determine whether all or a part of the Tribal SCS are ARARs, and will if necessary determine the applicability of the ARAR waiver provisions in §121(d)(4) of CERCLA. EPA will consult with the Tribes on the selection of the final remedy including consideration of any proposed waiver or waivers.

Tribal Response: *The Tribes appreciate EPA's resource support for capacity building, providing funding t o develop Tribal Soil Cleanup Standards. EPA was aware of the development and impending implementation of the Soil Cleanup Standards providing review and comment on them prior to the formal letter requesting the SCS be applied as ARARs. EPA asserts the uniqueness of the SCS and repeats throughout the Responsiveness Summary the Tribe's goal in promulgating the SCS is to restore all land within the Reservation to its original state. While this is a correctly stated as a goal, the SCS are clearly reasonable and provide for alternatives See SCS § 1.1: "The Tribes recognize, however, that there are situations where use of Commercial/Industrial Cleanup Standards rather than Unrestricted Use standards may be appropriate, or where attainment of the Cleanup Standards may be technically impracticable. The Cleanup Standards provide alternatives for these situations, as discussed further in Part 3 below*.

1.41 Cost Estimates for Excavation and Treat Elemental Phosphorus
Comment Summary: EPA received **a** comment inquiring how EPA determined treatment and removal of elemental phosphorus would cost more than $1 billion and take more than 40 years to perform.

EPA Response: EPA performed an independent review of the cost estimates of the 6 remedial alternatives presented in the *Supplemental Feasibility Study* developed by FMC. Two additional remedial alternatives were evaluated at the request of the Shoshone-Bannock Tribes and were also reviewed for cost.

The two additional alternatives were:

- Alternative 7 – Excavation and treatment of all elemental phosphorus contaminated soils within the FMC OU, including the RCRA Ponds.
- Alternative 8 – Excavation and treatment of all elemental phosphorus contaminated soils within the FMC OU, including the RCRA Ponds, and removal of all operational by-products and wastes from the FMC OU (clean closure).

EPA used cost estimating software called Remedial Action Cost Engineering and Requirements

(RACER) Version 10.3 to develop and verify the cost estimates for all the soil and groundwater alternatives, including these additional alternatives addressing removal and/or treatment of elemental phosphorus-contaminated soils.

FMC built a Land Disposal Treatment facility in 2001 which was intended to treat ongoing production wastes contaminated with elemental phosphorus, however it was never operational. The specifications from the Land Disposal Treatment facility were used in EPA's cost estimates for treatment of elemental-phosphorus contaminated soil in Alternatives 7 and 8.

For the purposes of the cost estimate, the hypothetical treatment facility was assumed to process 18% solid slurry at 82 gallons per minute, which is double the capacity of the Land Disposal Treatment facility that was built. For the purposes of the cost estimate known or suspected elemental phosphorus-contaminated soils onsite was calculated to be 2,400,239 cubic yards. The time to treat the volume of elemental phosphorus-contaminated soil, assuming that 18% solid slurry was processed at 82 gallons per minute, was calculated to be 44 years of continuous operations. Using a variety of default parameters established by RACER and also site-specific inputs, the cost of Alternative 7 was calculated at $949,600,000 and the cost of Alternative 8 was calculated at $3,499,700,000. The *Cost Estimate Addendum* (BAH, 2011) contains all the information used to evaluate and calculate the cost of excavation and treatment of elemental phosphorus contaminated materials at the FMC OU.

Tribal Response: *The Tribes question EPA's cost estimate and estimated years to implement an excavation and treatment process. EPA has stated "For the purposes of the cost estimate, the hypothetical treatment facility was assumed to process 18% solid slurry at 82 gallons per minute, which is double the capacity of the Land Disposal Treatment facility that was built. For the purposes of the cost estimate, the total volume of known or suspected elemental phosphorus-contaminated soils onsite was calculated to be 2,400,239 cubic yards. The time to treat the volume of elemental phosphorus-contaminated soil, assuming that 18% solid slurry was processed at 82 gallons per minute, was calculated to be 44 years of continuous operations".*

On page 2 of the Responsiveness Summary EPA states there are 780,000 cubic yards of elemental phosphorus. When EPA calculated the cost, they inflated the volume of material by 1,620, 239 cubic yards. The cost and time to treat and or excavate this material is roughly 33% of what EPA has stated.

1.45 Land Use Designation

Comment Summary: EPA received **a** comment requesting the cleanup goals for the FMC OU be changed from industrial use to long-term unrestricted use by people therefore "restoring the site to host vegetation which served as sustenance for the Native American people."

EPA Response: EPA sees no basis for projecting other than industrial uses for the former operations area of the FMC OU, and has overseen the development of the supporting Administrative Record and issuance of the IRODA accordingly. Similarly, residential or unrestricted use is not anticipated for any portion of the FMC OU south of I-86. Any proposed changes in future land use would be evaluated at that time or as part of the five-year review process and addressed, as appropriate, at that time. However, for the Northern Properties portion

of the FMC OU, estimated risks associated with potential future residential exposures to COCs in soil were evaluated and found to be very low.

A tribal subsistence user or Tribal Risk Scenario would be based on an exposure area that is much larger than the Northern Properties, and located further from FMC OU contamination sources than the residential use exposure area EPA used. Evaluation of a larger exposure area further removed from contamination sources typically results in lower average levels of COCs in vegetation and soil than concentrations associated with the smaller, closer to sources residential or unrestricted use scenario. For this reason, an evaluation using a future residential land use scenario was considered by EPA to be more protective of tribal members than a Tribal Risk Scenario. The residential scenario evaluated a protective garden produce consumption rate (95th percentile) over a smaller land area closer to contamination sources. EPA did not and could not conduct a Human Health Risk Assessment using a Tribal Risk Scenario because although EPA requested the information from the Tribes needed to develop such a scenario for risk assessment, it was never received

Tribal Response: *Clearly, EPA does not understand a tribal subsistence user or Tribal Risk Scenario process. To assume a Tribal Risk Scenario would be based on an exposure area that is much larger than the Northern Properties and located further from FMC OU contamination sources than the residential use exposure area EPA used shows a lack of Tribal understanding. Further, for EPA to assume a residential land use scenario is more protective of tribal members than a Tribal Risk Scenario again show lack of understanding of Tribes. Comparing a Tribal Risk Scenario to a eating garden produce is inappropriate and ignores cultural implications. Tribal risk scenarios take into account many factors, not just space and distance. Gathering can take place in a limited area. Larger exposure areas further removed from contamination sources do not always result in lower average levels of COCs in vegetation and soil. Wind, stack height, particle size, dispersion patterns, nature of the contaminant, uptake of the COCs into the plant and synergistic effects from multiple contaminants only begin to identify the means in which hazardous contaminants come to be located at areas other than the sources of contamination. EPA never conducted a Native American Risk Scenario characterizing the level of contamination, rather they assumed less contamination the further you move from the source. Further, EPA repeats throughout the Responsiveness Summary they did not and could not conduct a Human Health Risk Assessment using a Tribal Risk Scenario because although EPA requested the information from the Tribes needed to develop such a scenario for risk assessment, it was never received. This is not accurate. EPA failed to develop a process in which the Tribes could provide confidential and culturally sensitive information to them. Information was provided verbally, in qualitative terms regarding uses of plant species, possible routes of exposure including ingestions, inhalation, and adsorption. Finally, EPA refused to consider a Native American Risk Scenario at the FMC OU and only discussed the above in terms of the off-site OU.*

RESPONSES TO THE DECEMBER 2, 2011 COMMENTS FROM THE SHOSHONE-BANNOCK TRIBES REGARDING THE FMC OPERABLE UNIT PROPOSED PLAN

2.1 EPA Failed to Perform an Ecological Risk Assessment

The 1995 ERA for the EMF Site concluded that there was a potential for marginal risks due to fluoride within the Off-Plant OU and suggested that a fluoride monitoring program be developed and implemented as part of the remedy for the Off- Plant OU. The ERA did not identify any unacceptable risks for the FMC OU. However, consistent with EPA guidance, because the FMC operations area and the older non-RCRA regulated ponds were not found to be suitable habitat for wildlife in the area, the focus of the ERA was on ecosystems in the Off-Plant OU (known as the Off-Plant area at the time). In order to assess whether the 1995 ERA needed to be updated or amended as part of the supplemental remedial investigation/feasibility study (SRI/SFS) for the FMC OU following the closure of the FMC elemental phosphorus manufacturing facility in December 2001, EPA conducted a site tour and ecological risk assessment meeting with FMC, IDEQ, and the Shoshone Bannock Tribes in May 2003. At this meeting, consistent with EPA ERA methodology and guidance, the group identified and assessed areas of the FMC OU that were developed and/or disturbed and therefore unlikely to provide suitable habitat for ecological receptors, as well as the undeveloped areas that were more to provide habitat for ecological receptors. Based on this assessment and fully consistent with Section 300.430 of the NCP, EPA\ concluded that the 1995 ERA did not need to be formally amended.

Tribal Response: *The 1995 Ecological Risk Assessment did not identify unacceptable risks for the FMC OU because they did not evaluate any areas within the FMC OU that were operating. EPA determined this area was not suitable habitat for wildlife in the area, despite documented cases of bird deaths and large mammal sitings in and around the ponds. The RCRA program required FMC report wildlife deaths around the ponds as part of a Pond Management Plan. EPA documents meetings and site tours which the Tribes were present and states the group identified and assessed areas of the FMC OU that were developed and/or disturbed and therefore unlikely to provide suitable habitat for ecological receptors. Stating the Tribes were present leads the reader to believe the Tribes concurred with EPA's assertion and that is just not the case. The Tribes have maintained since the 1998 ROD the need to conduct an ERA at the FMC OU, and specifically detailed concerns regarding large mammals and burrowing animals. The FMC site borders the Bannock Range which is home to large mammals and an abundance of wildlife including fox, coyote, rabbits, deer, moose, and avian species. EPA has been provided this information for decades and despite clear evidence of wildlife presence, continues to discount the habitat and risks to receptors at the site.*

EPA Response: An appropriate remedial investigation (RI) to characterize any site (EPA's obligation pursuant to Section 300.430(d) of the National Contingency Plan (NCP)), including the baseline risk assessment, does not require a complete analysis of impacts to microorganisms in the soil regardless of whether EPA ultimately decides that these areas require remediation. Further, when designed, implemented, and monitored properly, effective containment is fully protective of human health and the environment without regard to risks posed to underlying soil biota by gases generated from the waste. Similarly, general populations of terrestrial mammalian and avian species would also be fully protected by any effective containment remedial action that eliminates all pathways to exposure to underlying material.

Tribal Response: *An appropriate remedial investigation (RI) to characterize any site includes a baseline risk assessment, (EPA's obligation pursuant to Section 300.430.(d) of the National*

Contingency Plan (NCP)). EPA failed to adequately characterize the nature and extent of contamination due to elemental phosphorus and it's byproducts within the soils. EPA prematurely assumed capping would be the remedial choice and developed data to support this action early on including cap delineation sampling instead of characterizing the generation and migration of toxic gases within the soils. Burrowing animals and small mammals are not protected by the selected remedy.

EPA Response: Based on all available information, EPA believes that the updated 2009 ecological conceptual site model contained in *SRI Report* is fully representative of current conditions at the FMC OU. Furthermore, EPA believes that the *FMC OU Site-Wide Gas Assessment Report* accurately characterizes the generation of phosphine and other gases, and shows that provided buried elemental phosphorus-containing material is not disturbed, phosphine and other gases pose no risk to human health and the environment in the FMC OU. Despite this finding, as part of the Selected Remedy, EPA is requiring long-term gas monitoring within the FMC OU. Should this monitoring reveal changes in gas generation rates or that gas is migrating in any way that may pose a threat to human health or the environment, EPA will consider additional action at that time.

Tribal Response: *The Tribes do not agree that the updated 2009 ecological conceptual site model is representative of current conditions at the FMC OU. Furthermore, the FMC OU Site – Wide Gas Assessment Report is not an accurate characterization of the generation and migration of phosphine and other gases within the soils at the FMC OU. The Site Wide Gas Assessment Study measured phosphine levels at the ground surface and generally 12 inches within the soils. Phosphine gas was measured. This indicates chemical reactions are taking place deep within the soils where elemental phosphorus has come to be located, generating phosphine gas which is heavier than air and should sink rather than rise to the surface. Elemental phosphorus is between 10 to 80 feet below the surface. EPAs explanation that elemental phosphorus containing material provided it is not disturbed phosphine and other gases pose no risk to human health and the environment. This is not accurate. Phosphine gas is being generated and migrating, constituting a risk to the environment.*

Another flaw in the EPA Site Wide Gas Assessment Report is the fact that the one-time study was done during the Summer months which based on the historical data collected from Pond 16S, phosphine gas generation is minimal and is impacted by seasonal fluctuations. Tribes requested that this sampling be done more than a single point in time to address these concerns noted from the RCRA Ponds. As mentioned earlier, phosphine gas was detected in the soil but not in the ambient air so accordingly EPA made the conclusion that no human health risks were present but neglected to consider the environment component.

2.3 Other Concerns with the Proposed Groundwater Remedy

EPA Response:
In the first paragraph of the comments under this heading, the Tribes point out that capping certain areas within the FMC OU is proposed, in part, to help prevent infiltration and percolation of storm water through soils containing contaminants of concern (COCs) and into groundwater.

The comments then go on to question whether capping is justified and will significantly reduce infiltration of stormwater. While caps may not necessarily be required to prevent infiltration and percolation of storm water through soils containing COCs and into groundwater in all areas, placement of the ET caps selected in the IRODA is a common engineered method used to ensure reduction in infiltration. In addition, the caps also provide the following benefits in order to meet the remedial action objectives (RAOs) for the FMC OU:

- Capping is a key element in preventing exposure via other potential pathways including preventing exposure to gamma radiation, incidental soil ingestion, dermal absorption, and fugitive dust inhalation.
- Capping will help prevent the direct exposure to elemental phosphorus under conditions that may cause it to spontaneously combust, posing a fire hazard or result in air emissions that present a threat to human health or the environment.

The comments express concern that the Proposed Plan didn't fully disclose for the public all contaminants of concern in the groundwater. However, the comments also state that "EPA has listed arsenic, fluoride, manganese, nitrate, selenium, vanadium and elemental phosphorus as contaminants of concern at the site" (presumably meaning the FMC OU). Further, page 34 of the Proposed Plan states that "arsenic, fluoride, nitrate, radium-226, selenium, thallium, gross alpha, and gross beta exceed groundwater MCLs" which is an accurate statement based on the extensive data collected for the FMC OU. In addition, all of the groundwater data collected since the original Remedial Investigation (RI) has been summarized in the *Groundwater Current Conditions Report (GWCCR)* which was reviewed and commented on by the Tribes and available in the Administrative Record.

Tribal Response: *The Groundwater Current Conditions Report (GWCCR) was not reviewed and commented on by the Tribes. The Remedial Project Manager Kira Lynch specifically requested the Tribes not continue writing comments surrounding their concerns with the COCs that were to be sampled. Ms. Lynch assured the Tribes if they "kicked the can down the road" and addressed this issue at a later date all COC would be addressed. This would assure the GWCCR was finalized in an acceptable timeframe. The Tribes did not provide final comments on this document.*

2.9 The Proposed Interim Soil Remedy Does Not Meet the CERCLA Primary Balancing Criterion of Long-Term Effectiveness and Permanence

EPA Response: The Tribes emphasize that phosphorous waste in particular may remain active for thousands of years. They appear to see this as necessarily all but mandating removal with or without treatment as soon as possible. EPA emphasizes in response that in our best professional judgment as long as containment remains protective, safe, reliable, and implementable, the risks over decades to remedial workers and the uncertainty and extraordinary costs associated with any current removal and/or treatment technology, make containment an overall superior choice.

Tribal Response: *The Tribes continue to question EPA's best professional judgment when it comes to capping elemental phosphorus. EPA capped elemental phosphorus within the RCRA caps, against repeated requests from the Tribes not to do so. A decade later, these ponds are generating such high quantities of phosphine emergency procedures and Unilateral Orders on*

Consent have been lodged by EPA in an effort to address the emergency presented by elemental phosphorus generating phosphine gas. EPA has no idea how the elemental phosphorus under the ET caps will behave.

2.11Other Concerns With the Proposed Soil Remedy

EPA Response*:* The second issue raised under this heading is a Tribal request that EPA conduct a Human Health Risk Assessment using a Tribal risk scenario. As set forth in a December 1, 2008, e-mail from K. Lynch (US EPA Region 10) to K. Wright (SBT), EPA described and requested, but never received information from the Tribes needed to develop a Tribal scenario for a risk assessment. A similar request was made by the Tribes prior to the issuance of the 1998 ROD for the EMF Site. At that time, the Tribes were concerned that EPA had not considered Tribal cultural and other uses of site vegetation. EPA agreed to addend or amend the human health risk assessment as may be necessary if the Tribes would identify specific plants its members used, how frequently, and in what way they consumed or otherwise were exposed to them. EPA did not receive this information and was ultimately told that the Tribes considered this information, which is essential to performing any meaningful assessment of associated risks, necessarily private and in some instances sacred, or both, and that revealing it risked commercialization by non-members among other undesirable consequences. EPA respected this Tribal decision not to reveal this information and was left with no means to evaluate a Tribal risk scenario.

Tribal Response: *EPA repeats throughout the Responsiveness Summary they did not and could not conduct a Human Health Risk Assessment using a Tribal Risk Scenario because although EPA requested the information from the Tribes needed to develop such a scenario for risk assessment, it was never received. This is not accurate. EPA failed to develop a process in which the Tribes could provide confidential and culturally sensitive information to them. Information was provided verbally, in qualitative terms regarding uses of plant species, possible routes of exposure including ingestions, inhalation, and adsorption. Finally, EPA refused to consider a Native American Risk Scenario at the FMC OU and only discussed the above in terms of the off-site OU. Prior to the issuance of the 1998 ROD, the Tribes and EPA had worked on developing a process in which information could be shared and used to develop accurate exposure scenarios but Remedial Project Managers changed and this process was never carried forward. EPA had promised to conduct a study to determine uptake of metals in culturally sensitive species used by the Tribes in the customs and cultures and similarly, EPA never completed this nor the fluoride monitoring program suggested in the 1998 ROD or the assessment of cattle or mammals in the area, both of which the Tribes requested.*