FMC Idaho LLC, Pocatello, Idaho

SFS Technology Screening Memorandum

Buried Railcar Evaluations
for the
FMC Plant Operable Unit

May 2009

MWH

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ACRONYMS/ABBREVIATIONS

AOC	Administrative Order on Consent
BAPCO	Bannock Paving
CDC	Center for Disease Control and Prevention
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	constituent of concern
CRREL	Cold Regions Research Engineering Laboratory
EMF	Eastern Michaud Flats
IRIS	Integrated Risk Information System
NPL	National Priorities List
OU	Operable Unit
POTW	publicly owned treatment works
RI/FS	Remedial Investigation/Feasibility Study
SFS	Supplemental Feasibility Study
SRI	Supplemental Remedial Investigation
SRI/SFS	Supplemental Remedial Investigation Feasibility Study
WWT	waste water treatment

SECTION 1.0 INTRODUCTION

1.1 OBJECTIVE AND SCOPE OF THIS REPORT

The Supplemental Feasibility Study (SFS) for the FMC Plant OU will present the identification, screening and evaluation of remedial technologies and alternatives for all of the COCs and media identified in the *Supplemental Remedial Investigation Report for the FMC Plant OU* (*SRI Report*; MWH, 2008). The SFS will include significant focus on options and technologies potentially effective to remediate elemental phosphorus (P4) in the subsurface and the unique P4 management risks associated with these options. This objective of this paper is to provide a summary of the evaluation and preliminary screening of removal/treatment options for addressing the railcars (RU 19c) buried in the slag pile (RU 19), both of which are included in Remediation Area F (RA-F). This paper is being submitted in advance of the SFS Report, to initiate discussion with EPA.

As described in *Identification and Evaluation of P4 Treatment Technologies – January 2009* (MWH, 2009), the excavation and treatment of any P4-impacted soil/fill presents significant challenges. The buried railcars, containing an estimated range of 200 to 2,000 tons of P4 sludge (depending on the amount of P4 in each railcar, as reported in Section 4.15.4 of the *SRI Report*), present a unique set of challenges, including:

- Depth of burial of the railcars;
- Accessibility with typical excavation equipment;
- Unknown condition of the railcars; and
- Access to required utilities (water, power, steam, etc.) during any removal effort.

1.2 REGULATORY BACKGROUND

The FMC Plant Operable Unit (OU) is a part of the larger Eastern Michaud Flats (EMF) Superfund Site, and is located in southeastern Idaho, approximately 2.5 miles northwest of Pocatello, Idaho. The EMF Site was listed on the National Priorities List (NPL) on August 30, 1990. The EMF Site includes two adjacent production facilities, a former FMC Corporation elemental phosphorus processing plant that ceased operation in 2001 and a phosphate fertilizer processing facility operated by the J.R. Simplot Company. The EMF Site encompasses both the FMC and Simplot plants and surrounding areas affected by releases from these facilities. FMC, Simplot and EPA entered into a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Administrative Order on Consent (AOC) in May 1991 under which the companies agreed to conduct a Remedial Investigation/Feasibility Study (RI/FS) for the site. During the RI/FS the site was divided into three "Subareas:" 1) the FMC Subarea, consisting of the FMC Plant Site (where elemental phosphorus production took place) and other FMC-owned properties at the site; 2) the Simplot Subarea, consisting of the Simplot plant and other Simplot-owned properties at the site; and 3) the Off-Plant Subarea, consisting of the remainder of the site. EPA changed these designations to the FMC Plant OU, the Simplot Plant OU, and the

Off-Plant OU after its June 1998 *Record of Decision for the EMF Site* (*1998 ROD*, EPA, 1998).

FMC ceased production of elemental phosphorus from phosphate ore at its Pocatello facility in December 2001. This led EPA and FMC to enter into an AOC in October 2003 for a Supplemental Remedial Investigation and Feasibility Study (SRI/SFS AOC) at the FMC Plant OU. This was driven primarily by EPA's finding that additional investigations and evaluations were needed at the plant areas that had been actively operated at the time of the RI/FS but where operations had terminated with the plant shutdown. The Supplemental Remedial Investigation (SRI) was performed during two periods, June through December 2007, and October through December of 2008. It should be noted that the SRI did not include an intrusive field investigation concerning the buried railcars. All information in this paper is based upon historical documents and knowledge of the FMC phosphorus manufacturing operations at the FMC Plant Site.

1.3 FMC SITE DESCRIPTION AND OPERATIONAL HISTORY

1.3.1 FMC Site Description

The FMC Plant Site is located approximately 2.5 miles northwest of Pocatello, Idaho, and 1 mile southwest of the Portneuf River, a tributary of the Snake River. The FMC Plant Site is south of Highway 30, covers approximately 1,150 acres, and historically contained all of the process operations used for the production of elemental phosphorus. The Plant Site adjoins the western boundary of the Simplot Don Plant. There are an additional 212 acres owned by FMC located north of Highway 30 (excluding the 9-acre Tesco property) that are also part of the FMC OU, but which have not been identified as areas with P4 contamination. The FMC Plant OU is on privately-owned fee land, most of which is located within the exterior boundaries of the Fort Hall Indian Reservation.

A more detailed description of the site's physical characteristics can be found in Section 2.0 of the *SRI Report*. Additional detailed information on the geology and hydrogeology of the EMF Site study area and the FMC Plant OU is presented in Sections 3.1 and 3.3, respectively, of the *EMF RI Report* (BEI, 1996), as well as Section 2.0 of the *Groundwater Current Conditions Report for the FMC Plant Operable Unit* (MWH, 2008a).

1.3.2 Historic FMC Plant Process Description

The FMC Plant Site produced elemental phosphorus (P4) from phosphate-bearing shale ore mined regionally. Ore was shipped to FMC via the Union Pacific Railroad 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 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 P4, CO gas, slag, and ferrophos. Slag and ferrophos were "tapped" out of the bottom of the furnace through tapping holes in a molten state. Once cooled, the ferrophos was stockpiled and sold intermittently for metal recovery. For most of the life of the plant, slag was allowed to cool and harden, then was loaded into haul trucks and either hauled to the slag pile or to Bannock Paving, also located on site. Bannock Paving (BAPCO) crushed and sized the slag, which was sold primarily for use in road construction. The slag that was placed on the slag pile remains to this day. At full capacity, the process would generate approximately 1.7 million tons per year of slag. Approximately half of the slag was sold to BAPCO until the early 1990s when FMC discontinued sale of slag to BAPCO. The remaining slag was stockpiled on the slag pile and/or used on site for fill/roads. It is estimated that the slag pile currently contains over 14 million cubic yards of slag.

The P4 product was removed as a gas, along with CO gas, from the furnaces using vacuum pumps. This gas stream first passed through a pair of electrostatic precipitators, then through a water condenser that cooled the gas stream to below the P4 boiling point, thus condensing the P4 to a liquid. The liquid P4 collected in a sump in the furnace building floor. The liquid P4 was subsequently pumped to the phos dock where it was loaded into railcars for shipment. P4 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 for transit off-site. To minimize shipping weight, water on top of the P4 in the railcar was pumped off prior to shipping and nitrogen gas was injected, again to keep air from contacting the P4 during transit.

1.3.3 Description of P4 Sludge Generation and Management

P4 was typically very pure, white phosphorus. However, due to a number of process variables, ore, silica and/or coke dust, along with other condensables would pass through the electrostatic precipitator in trace amounts and end up with the liquid P4 product. These insolubles would rise to the top of the liquid P4 as it was stored in a liquid state and eventually concentrate to form what was referred to as P4 sludge. The sludge typically ranged from 75 to 95% P4. The P4 sludge was much more viscous and would not easily pump from the sumps and tanks. Therefore, over time P4 sludge would build up within the storage vessels and railcars.

Given the high percentage of P4, every effort was made to remove and recover P4 sludge from sumps, tanks, and railcars. A process was installed at the phos dock to process the sludge through hydroclones and a centrifuge, which to a large degree separated the P4 from the insolubles. The insolubles along with some P4 were then pumped from the phos dock to the phossy water ponds where it would settle and accumulate. The processed, recovered P4, known as centrifuge product, was still not pure enough to ship as product. The centrifuge product was therefore pumped at a very low rate into the furnaces where it would be re-distilled into saleable P4.

SECTION 2.0 DESCRIPTION OF THE BURIED RAILCARS

2.1 RAILCAR BURIAL

After several shipments of P4, most returning railcars accumulated enough P4 sludge to warrant railcar cleaning. This was a difficult, hazardous task during which sludge inside the railcar was removed using a combination of pumping, steam cleaning and scraping/shoveling, often requiring employees to enter the railcar to manually clean the inside walls of the railcar. Railcar cleaning was performed at the phos dock where platforms for entry, hot water, steam, nitrogen, and extensive safety systems were readily available. The P4-rich sludge would then be processed through the centrifuge at the phos dock as described above, and the railcar would be placed back into service.

During transit, the railcars would cool and the P4 would solidify. Steam was used at the recipient plant to melt the P4 to a liquid state and then pump out liquid P4. Typically, railcars were outfitted with external steam jackets which allowed heating of the railcar and for cleaning of the railcar internals as described above. According to a July 1, 1981 internal FMC memo (see Attachment 1) written by the phos area supervisor, 30 used railcars were purchased to store sludge over a three-year period, 1962 through 1964. That action implied that the plant was experiencing very high P4 sludge production during that period. With the addition of the centrifuge process at the phos dock and lower sludge production rates, sludge generated from the end of 1964 onward was reprocessed through the furnaces.

These railcars were equipped with internal steam coils which prevented cleaning of the railcars at the phos dock using normal car cleaning procedures. The 1981 memo states,

> "*….the internal coils had to be cut out since they were approximately 8 inches off the bottom and prevented cleaning. Several near-miss accidents occurred as result of P4 entering leaking coils and burning or cutting causing extreme pressure plus spraying P4. Cleaned cars were scrapped or sold intact.*
>
> *Because of safety, approximately 21 railcars were removed from their trucks and hauled to the south end of the slag pile and buried with clay and covered with slag. This was done in the late fall of 1964.*"

The 1981 memo indicates that all 30 railcars were first emptied of P4 sludge and processed at the phos dock through the centrifuge. This was completed by the end of 1964. Nine railcars were successfully cleaned and scrapped, and 21 were buried without being cleaned. Although it is impossible to know for sure, plant experience indicates that about 10 to 25% of the total sludge capacity would have remained in the 21 railcars at the time of burial. Figure 2.1 shows the railcars as placed south of the slag pile in 1964. Note that soil has been cleared under the burial site. It is presumed that this soil was used to cover the railcars with "clay" as described in the 1981 memo. The photo also confirms that the railcars were placed at or below the original grade, and thus would be at the bottom of the current slag pile.

2.2 UNKNOWNS CONCERNING THE BURIED RAILCARS

The depth and location of the railcars within the slag pile can be estimated to within a few feet, based upon the original vs. current surface elevations and historical aerial photographs. However, there are several unknowns concerning the buried railcars that significantly hinder potential remedial actions. These unknowns are discussed in the following subsections.

2.2.1 Condition of the Railcars

The physical condition of the railcars is unknown. Their condition is important in determining whether or not the railcars could be handled whole once excavated. 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 P4 sludge to air and a P4 fire. It is presumed that the railcars were in good physical working condition at the time of the burial in 1964. However, the level of deterioration due to corrosion is unknown.

Based upon experience with mild steel underground piping at the plant site, the soil conditions do not result in significant corrosion on the outside of the piping. However, corrosion from the inside of mild steel equipment in phossy water service was observed due to oxidizing P4 which creates phosphoric acid. The phosphoric acid could cause significant corrosion from the inside, weakening the railcar. This could make exhuming the railcars in one piece impracticable. As discussed in the next subsection, the amount of phosphoric acid formed within the railcars, and therefore, the amount of internal corrosion since burial, is impossible to estimate. The worst case, i.e., that the railcars are greatly weakened by corrosion, would have to be assumed in evaluating the “excavate and treat” alternative. The remedial action evaluation thus must address potential methods for decontaminating and dismantling the railcars in place.

2.2.2 Contents of the Railcars

As described in Section 1.0, it is expected that the railcars contain about 10 to 25% of their total capacity as P4 sludge. However, it is not known if the railcars were filled with water or nitrogen prior to transportation to the slag pile area for burial. Nitrogen would have been a logical choice, given that it was present at the phos dock and used in railcar shipments. However, water may have also been used. The use of water would increase the likelihood that phosphoric acid would be formed, resulting in an increased rate of internal corrosion. The presence of water would also increase the amount of material to manage once the railcars were exhumed under an “excavate and treat” alternative. The worst case, i.e., that the railcars are filled with water, would have to be assumed in evaluating the “excavate and treat” alternative.

2.2.3 Whether the Railcars Have Already Leaked

The P4 sludge in the railcars would have been, and has remained, at subsurface soil temperatures since burial. These temperatures are below the melting point of P4. If P4 has leaked into soils at ambient temperatures, it would be assumed to have migrated no more than a foot from the point of the release and may have oxidized. However, upon removal of the railcar, any P4 that has accumulated in the soil outside the tank that has not oxidized would catch fire and burn. P4 can burn during most ambient conditions, including cold winter weather. The worst case, i.e., that the railcars have leaked and P4 is present in the soils near them, would have to be assumed in evaluating the "excavate and treat" alternative.

2.2.4 Remedial Action Site Worker

Site worker safety is one of the most difficult elements to resolve with respect to "active" ex-situ or in-situ handling and treatment of P4-contaminated soils. Exposure to P4 (solid, liquid, and vapor phases) and P4 reaction products (P_2O_5, other phosphorus oxides, phosphine, and phosphoric acid) present immediate physical hazards to site workers. These have been identified in the site-specific risk assessments performed by EPA (RI Report, 1996) and FMC (SRI Report, MWH, 2008) and by numerous medical, research, and environmental agencies including the Center for Disease Control and Prevention (CDC), the USEPA Integrated Risk Information System (IRIS), and the Cold Regions Research Engineering Laboratory (CRREL). These risks have been well documented by FMC and others that manufacture or formerly manufactured P4 in a commercial/ industrial setting, including Stauffer (Rhodia, 2007), Monsanto, and Albright and Wilson.

P4 is relatively safe when maintained under water and using well-engineered process equipment, experienced operators, and established procedures. However, P4 in the railcars and surrounding soils would present significant risks to remediation workers, especially given that the workers would be isolated within a large excavation with limited access/egress. The operations and maintenance personnel necessary for railcar excavation, removal and treatment would potentially be exposed to a wide range of health and safety risks due to the nature and extent of P4 that would have to be assumed in such an operation. The largely uncontrolled conditions during excavation could expose workers to fire, dermal, and respiratory hazards. Because of this concern, it is expected that the removal operations within the excavation would be limited to dismantling the railcars into manageable pieces. These pieces, stored under water, would then be transported out of the excavation site to be decontaminated in a separate structure located on site. This decon structure would be equipped with the necessary hot water, steam, nitrogen, safety systems and containment systems.

In most circumstances, it is expected that the excavation/dismantling and decontamination of the railcars would have to be managed in enclosed structures that would be vented to an air pollution control device to prevent releases to the ambient air. Workers within such structures would be required to wear Level A PPE, although significantly modified (if practicable) to protect them from P4 thermal exposure since most Level A protective suits do not protect against P4 burns. P4-protective suits worn at most P4 manufacturing plants are constructed with an aluminum coating, designed to be immediately shed in the event of P4 exposure. This approach would not be consistent with PPE decontamination procedures typically applied within remediation exclusion zones or contamination reduction zones. Well-designed processes, highly-trained site workers, and a comprehensive Environmental, Health, and Safety Management System (including extensive health, safety and environmental procedures) would be critical, but might not be sufficient to ensure adequate protection of site workers. Cost considerations also would be significant, requiring quantification of the capital and O&M costs associated with providing adequate site systems if indeed such systems could be designed and reliably implemented. As such, adequate site worker health and safety remains an unknown.

2.2.5 Public Health and Safety

During operation of the FMC plant, public health and exposure often were controlled by the same measures that FMC put into place to keep plant workers safe. Typical engineering controls, such as fencing, prevented public access to hazardous areas throughout the site. Air monitoring and scrubbers were installed to meet Clean Air Act requirements to control phosphorus-related and other air emissions from the plant site. During any remedial action that involved the handling of P4-contaminated soils, engineering controls also would be in place to protect site workers. However, unlike controlled manufacturing processes, the excavation, removal, and decontamination of P4 sludge in (and potentially around) the buried railcars could cause uncontrolled releases, especially to the air, due to the widely varying site conditions and difficulty in designing appropriate engineering controls. Some of these difficulties are discussed in other reports (Rhodia, 2007). Short-term public exposures to airborne contaminants including P_2O_5, phosphine gas, and phosphoric acid also might occur, due to the many unforeseen circumstances that could arise. Therefore, the excavation, removal and treatment of the railcars may require an enclosure to contain potential air emissions, which would then be vented to large scrubbers or other air pollution control devices. As such, adequate protection of public health and safety remains an unknown.

2.2.6 Environmental Impacts

Environmental concerns related to the handling of P4-contaminated equipment and soils as would likely be encountered during railcar excavation, removal, and treatment include potential impacts to air and water/groundwater. The above discussion identifies possible worker risks from direct exposure to pure P4, phosphorus gases and contaminated process water, and risks to the public from air emissions and impacted groundwater. The following discussion addresses the release mechanisms potentially triggered by active or intrusive remediation of P4-containing railcars and soils.

<u>Air Impacts:</u> Intrusive remediation into P4-impacted soils or equipment, such as the buried railcars, could result in fire and P4 combustion products being released to the atmosphere. Their concentrations would depend in large part on the amount of P4 encountered during railcar excavation and the effectiveness of the engineering controls at the excavation, storage and treatment areas. If the gases were treated with activated carbon or dry filter systems, solid wastes would be generated. If these gases were to be captured and treated by a scrubber, the scrubber water would need to be treated in a waste water treatment (WWT) process. The WWT process typically would consist of neutralization (because of phosphoric acid capture by the scrubber), clarification, and sand filtration. Solids are removed by that process and consolidated by a filter press, then transported and disposed in a landfill depending on analytical testing. The water would be discharged for reuse in scrubber operations, directly discharged to the groundwater or surface water, or sent to a publicly-owned treatment works (POTW) for later discharge to surface water.

Water/Groundwater: Water would be necessary during most steps of a railcar excavation, removal and treatment process to prevent P4 exposure to oxygen in the air and resulting combustion. During railcar excavation and dismantling, water would likely be added to the excavation site as necessary to prevent/extinguish P4 fires. Water also would be necessary during the cleaning process in which P4 would be separated from the railcar structures.

Although water addition to simply “wet” the soil/slag in the excavation area (e.g., for dust control) would not be expected to represent a significant risk for mobilization of constituents to groundwater, the potentially significant water addition necessary to prevent or extinguish P4 combustion within the excavation/removal area could represent a risk for mobilization of constituents of concern (COCs) and impact to groundwater.

SECTION 3.0 PROCESS OPTIONS CONSIDERED

The following subsections provide a brief description of the different remediation process options considered and screened for the railcars at RU 19c.

3.1 CAP IN PLACE

This process option involves establishing the final grade of the surface of the slag pile and placement of a cap over the slag piles as well as the railcars. This process option has been retained.

3.2 INJECTION OF WET CONCRETE INTO THE RAILCARS AND LEAVE IN PLACE

This process option involves drilling down through the slag to each of the 21 railcars and injecting wet concrete into the railcar to stabilize and solidify the contents in place. The railcars would be left in place and capped.

The process option was rejected for the following reasons:

- While the location and depth of the railcars can be determined to within a few feet, it is unlikely that a drilling rig could accurately drill through 80 to 120 feet of slag and hit the top of each of the 21 railcars to allow for injection of the wet concrete. Due to the depth of burial of the railcars and the nature of slag placed in the pile (i.e., heterogeneous particle size distribution, slag 'monoliths' up to 20-feet in dimension and relatively high metals and radionuclide concentrations/activities in slag), remote sensing technologies such as ground penetrating radar, electromagnetic and/or density surveys would not be effective to refine the location and condition of each of the buried railcars.

- The expected reaction between the caustic concrete mix and the P4 inside the railcars would likely create a significant, uncontrollable reaction, including P4 or phosphine combustion and release of gases. This option would be expected to result in a scenario similar to what happened at the Tarpon Springs, Florida site where in-situ stabilization was attempted.

- If the railcars are filled with water, this could create or exacerbate leakage from the railcars to the surrounding soil.

- Without adequate mixing within the railcar, much of the P4 would likely remain un-reacted and therefore unstabilized although the contents would be encapsulated within the cured cement.

3.3 INJECTION OF WET CONCRETE AROUND THE RAILCARS AND LEAVE IN PLACE

This process option involves drilling down through the slag alongside each of the 21 railcars and injecting wet concrete around the railcar to encapsulate the contents in place. The railcars would be left in place and capped.

The process option was rejected for the following reasons:

- While the location and depth of the railcars can be determined to within a few feet, it is unlikely that a drilling rig could accurately drill through 80 to 120 feet of slag to accurately inject concrete around all 21 railcars to fully encapsulate the railcars. This would be especially difficult given the railcars were reportedly covered with soil. Due to the depth of burial of the railcars and the nature of slag placed in the pile (i.e., heterogeneous particle size distribution, slag 'monoliths' up to 20-feet in dimension and relatively high metals and radionuclide concentrations/activities in slag), remote sensing technologies such as ground penetrating radar, electromagnetic and/or density surveys would not be effective to refine the location and condition of each of the buried railcars.

- The expected reaction between the caustic concrete mix and any P4 that has leaked from the railcars would likely create a significant, uncontrollable reaction, including P4 or phosphine combustion and release of gases. This option would be expected to result in a scenario similar to what happened at the Tarpon Springs, Florida site where in-situ stabilization was attempted.

- Without adequate mixing in the soils around the railcars, likely much of the P4 would remain un-reacted and therefore unstabilized.

3.4 EXCAVATION, REMOVAL, AND TREATMENT OF THE P4 IN THE RAILCARS

This option involves excavation of the slag and soil over the railcars to expose them. The railcars would then be removed, either whole or by dissection, and cleaned. The P4 sludge would be containerized and treated off-site by incineration. This process option would include the following steps:

1. Excavation of slag down to the railcars. The railcars currently are buried beneath 80 feet (toward the western edge of the railcars) to 120 feet (toward the eastern edge of the railcars) of slag. Assuming that a 3:1 slope would be required for the excavation to safely allow equipment and personnel into the excavation working area, approximately 300,000 yd^3 of slag would have to be removed and stockpiled. Once the removal and treatment of the railcars was complete, the slag would likely have to be placed back into the excavation to allow for the appropriate final grading of the slag pile prior to capping.

2. Removal of soil covering railcars. As the railcars are reportedly covered with soil, the soil would have to be carefully removed from around all the railcars to

provide access. If the railcars have leaked, this soil could contain P4 and the P4-contaminated soil would have to be excavated and containerized.

3. Enclosure of the railcars. To prevent releases of P4 oxidation products, it is expected that the railcars would have to be enclosed in a structure to contain emissions. The structure would have to be equipped with a scrubber to capture and control those emissions. Therefore, a significant temporary electrical power source would be required within the excavation area. Water for firefighting would also have to be provided in that area.

4. Removal and containerizing water in railcars. Because it must be assumed that the railcars are filled with water, a pumping system would be required to remove and containerize that water. The water, approximately 15,000 gallons per railcar and 315,000 gallons total, would have to be temporarily stored, characterized, and potentially packaged in 55-gallon containers and shipped offsite for incineration (approximately 6,000 drums).

5. Dismantling the railcars into manageable pieces. Uncertainty regarding the extent of corrosion or other deterioration of the railcars requires an assumption that the railcars could not be removed in one piece. Thus each railcar would have to be cut up into pieces small enough to be placed in a drop bin filled with water. Although P4-contaminated equipment sometimes was cut up for decontamination within the decon building during plant operations, it is uncertain how this would be done on the scale of a railcar.

6. Decontamination of the railcar pieces. As discussed in Section 2.2.4, it is expected that decontamination of the dismantled railcar pieces would not be performed in the slag pit excavation, but in a separate decon structure. The drop bin containing the cut-up railcar pieces would need to be hauled out of the excavation to the decontamination “building.” This building would have to be equipped with air pollution controls, a package boiler to generate steam (either electric or natural gas), water, electrical power, natural gas or propane heaters, a phossy water containment and treatment system to collect the removed P4 sludge, and safety systems typical of a P4 handling operation.

   The railcar pieces would be removed from the drop bin within the enclosure, steam cleaned, mechanically scrapped, and then heated to ensure all P4 was oxidized. The removed P4 would then be containerized and shipped off-site for incineration. Some of the railcar components, such as steam coils, would likely have to be cut up and placed into drums for shipment as the coils could not be effectively cleaned. While it is difficult to estimate the number of drums of P4 that would be shipped offsite for incineration, a conservative (low) estimate of 1,000 tons of P4 and P4-contaminated scrap would result in over 5,000 drums of P4 waste being generated.

7. Wastewater treatment and waste management. In order to minimize the amount of material to be shipped off-site for incineration, a wastewater treatment system would be required to separate P4-containing materials from water used in the cleaning process. In addition, there would be air pollution control wastes containing phosphoric acid, potentially P4, and other COCs that would have to be appropriately stored, transported, and disposed.

Based upon the difficulty of this process, the uncertainties involved, the potential for worker and public health and safety impacts, and the potential for impacts to the environment (air emissions and threats to groundwater) this process option has been rejected.

3.5 RECOMMENDED PROCESS OPTION

Given the above analysis and considering effectiveness, implementability and cost, the cap-in-place process option is selected for the following reasons:

- Given the depth of the railcar burial in slag, the railroad cars do not pose a human health or ecological risk. A remedial action decision to cap the slag pile, augmented by institutional controls prohibiting intrusive activities in the area of the rail cars, would provide additional protection against potential human health or ecological risks.

- No EPA exposure scenario anticipates human exposures to COCs at depths of 80 feet, or more, below grade. The final grading plan for the slag pile should continue to maximize total depth of coverage.

- Capping is a proven, accepted technology as shown in Table 1-1 of *Identification and Evaluation of P4 Treatment Technologies – January 2009* (MWH, 2009), including burial and capping of de-railed phosphorus product cars in Fairfield, California.

- The railcars, even if they have or will leak in the future, do not pose a threat to groundwater as P4 does not migrate when at ambient or subsurface soil temperatures. As documented in the Current Conditions Report for the FMC Plant OU, the slag pile (RU 19) and buried railcars (RU 19c) are not identified as sources of elemental phosphorus or elevated total phosphorus / orthophosphate in groundwater downgradient from these RUs. A final remedy for the slag pile is expected to include a focused groundwater monitoring program for this unit, as well as for the nearby old plant solid waste landfill (RU 19b).

- A cap placed on the graded slag pile, along with appropriate institutional controls, will assure protection against any potential threat to groundwater.

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ATTACHMENT 1

Gordon Scherbel Memorandum

Date: July 1, 1981

To: N. H. Sheffield

From: G. H. Scherbel

Subject: Sludge Tank Car Burial

During the years 1962, 1963 and 1964 a total of 30 railroad oil tank cars were purchased for sludge storage. Nearly all had been filled by early 1964. With the addition of the Centrifuge, S.D.U. and lower sludge production they had all been unloaded by November 1964.

Several of the tanks were cleaned by cutting large walk in openings in the ends. However, the internal coils had to be cut out since they were approximately 8" off the bottom and prevented cleaning. Several near miss accidents occurred as a result of P_4 entering leaking coils and burning or cutting causing extreme pressure plus spraying P_4. Cleaned cars were scrapped or sold to McCarty's intact.

Because of safety approximately 21 were removed from their trucks and hauled to the South end of the slag pile and buried with clay, then covered by slag. This was done in late fall of 1964. The June 1965 aerial photograph in the Maintenance Shop lunch-room shows the partially buried cars and the location.

Gordon