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Our ref: HEM-11-110
Date: August 12, 2011

Subject: Final Remedial Design Work Plan, – Operable Unit 1, Hematite Former Fuel Cycle Facility, Hematite, Missouri, dated August 12, 2011

Reference: 1) MDNR (E. Gilstrap) letter to Westinghouse (E. K. Hackmann) dated July 11, 2011, "Westinghouse Response to the Department of Natural Resources' Comments on the Remedial Design Work Plan for Operable Unit 1"

2) Westinghouse (E. K. Hackmann) letter to MDNR (E. Gilstrap) dated July 21, 2011, "Potential delay in MDNR approval of the Final Remedial Design Work Plan – Operable Unit 1, Hematite Former Fuel Cycle Facility, Hematite, Missouri"

Dear Mr. Gilstrap and Ms. Warren:

This correspondence documents the transmittal of three (3) bound copies and one (1) electronic copy in the form of a Compact Disc (CD) of the revised Final Hematite Remedial Design Work Plan (RDWP) for Operable Unit 1 (OU-1), dated August 12, 2011. This revised document incorporates verbal comments received from the MDNR Project Manager to the Final RDWP dated July 11, 2011.

The changes are:

- Removed Table 5 – "Radiological Derived Concentration Guideline Levels". Section 2.2.2 now references the NRC approval of the Decommissioning Plan as the radiological limits.
- Revised Section 5.6 – "VOC Treatment" to incorporate the language from Reference 2, which identifies the commitments for using an on-site VOC treatment system, if needed.
- Minor grammatical corrections to the document (see document Revision Log).

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If you have any questions or are in need of any additional information, please feel free to contact Kevin Harris, Hematite Environmental Health and Safety Manager, at (314) 810-3375.

Sincerely,

E. Kurt Hackmann
Director, Hematite Decommissioning Project

Enclosure: 1) EO-10-002 Final Remedial Design Work Plan, August 12, 2011

cc. Michele Gutman, Westinghouse (w/o)
Tim Duggan, Esquire (w/o)
Terry Hawkins, MDNR (electronic)

ENCLOSURE

Final Remedial Design Work Plan -- Operable Unit 1
Hematite Former Fuel Cycle Facility,
Hematite, Missouri

Dated August 12, 2011

Westinghouse Non-Proprietary Class 3

Remedial Design Work Plan
Operable Unit 1

Westinghouse Electric Company LLC
Former Fuel Cycle Facility, Hematite, Missouri

August 12, 2011

3300 State Road P, Festus, MO 63028

EO-10-002
Revision 1

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CERTIFICATION

This Remedial Design Work Plan has been prepared under the direction of the registered Professional Engineer in the State of Missouri whose signature and seal are affixed below.

Kevin M. Harris

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Missouri PE Registration No. E-2001018748
Date: 8/12/2011

STATE OF MISSOURI
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Appendix B Railroad Spur Design

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ACRONYMS AND ABBREVIATIONS

AEC	Atomic Energy Commission
AOC	Area of contamination
ARAR	Applicable or relevant and appropriate requirement
ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COE	U.S. Army Corps of Engineers
COPC	Constituent of potential concern
CSR	Code of State Regulations
CQAP	Construction Quality Assurance Plan
DCGL	Derived Concentration Guidance Level
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DP	Decommissioning Plan
DQO	Data Quality Objective
ECC	Environmental Chemical Corporation
EEMP	Effluent and Environmental Monitoring Plan
EPA	U.S. Environmental Protection Agency
FR	Federal Register
FS	Feasibility Study
FSP	Field Sampling Plan
ft^3	Cubic feet
gpm	gallons per minute
GWS	Gamma Walkover Survey
HAP	Hazardous air pollutant
HASP	Health and Safety Plan
HDPE	High-density polyethlyene

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HEPA	High efficiency particulate air (filter)
HEU	Highly enriched uranium
in. H_2O	Inches of water (vacuum)
LDR	Land Disposal Restriction
LLDPE	Linear low-density polyethylene
LLMW	Low-level mixed waste
LLRW	Low-level radioactive waste
MARSSIM	Multi-Agency Radiation Surveys and Site Investigation Manual
MDNR	Missouri Department of Natural Resources
mg/kg	Milligrams per kilogram (equivalent to parts per million in solid)
µ	Micron
$\mu g/m^3$	Micrograms per cubic meter
MoDOT	Missouri Department of Transportation
MRBCA	Missouri Risk-Based Corrective Action
NAAQS	National Ambient Air Quality Standards
NCP	National Oil and Hazardous Substance Contingency Plan
NESHAPS	National Emissions Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
OSHA	U.S. Department of Labor, Occupational Safety and Health Administration
PAH	Polycyclic aromatic hydrocarbon
PCE	Tetrachloroethylene (also known as perchloroethylene)
pCi/g	Picocuries per gram
pCi/L	Picocuries per liter
PHASP	Project Health and Safety Plan
ppbv	Parts per billion by volume
PID	Photoionization detector
PPE	Personal protective equipment
PM_{10}	Particulate matter with an aerodynamic diameter of 10µ

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psi	Pounds per square inch
PSP	Physical Security Plan
PVC	Polyvinyl chloride
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RA	Remedial Action
Ra-226	Radium 226
RACM	Regulated Asbestos-Containing Material
RAO	Remedial Action Objective
RASS(s)	Remedial Action Support Survey(s)
RCRA	Resource Conservation and Recovery Act of 1976
RD	Remedial Design
rem	Roentgen equivalent man
RG	Remediation Goal
RI	Remedial Investigation
ROD	Record of Decision
RSMo	Revised Statutes of Missouri
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act of 1986
scfm	Standard cubic feet per minute
SNM	Special Nuclear Material
SVOC	Semi-volatile organic compound
SWPPP	Storm Water Pollution Prevention Plan
TBC	(Guidance) to be considered
Tc-99	Technetium 99
TCA	1,1,1-trichloroethane
TCE	Trichloroethylene
TCLP	Toxicity characteristic leaching procedure
Th-232	Thorium 232
UF_4	Uranium tetrafluoride

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UF_6	Uranium hexafluoride
UHC	Underlying hazardous constituent
UO_2	Uranium dioxide
U.S.C.	United States Code
USCS	Unified Soil Classification System
USFWS	U.S. Department of the Interior, Fish and Wildlife Service
UTS	Universal treatment standard
VOC	Volatile organic compound

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REVISION LOG		
Revision No. / Date	**Change(s)**	
0 07/11/2011	Initial issuance.	
1 08/12/2011	List of Tables	Table 5 "Radiological Derived Concentration Guideline Levels" has been removed.
	Section 1.4, third sentence of the first paragraph	Grammatical change. The sentence now states"… will serve as a final design plan for the Operable Unit 1 remedy."
	Section 2.2.2	Removed reference to Table 5 "Radiological Derived Concentration Guideline Levels".
	Section 3.3.2.1 Last two Bullets	Added "; and" to the penultimate bullet and removed "and" from last bullet.
	Section 3.4.3.2, Second Paragraph	Removed last sentence of second paragraph.
	Section 5.6	Revised section to incorporate the language from Westinghouse letter to MDNR (dated July 21, 2001), which contains the commitments for using an on-site VOC treatment system.
	Tables	Table 5 removed and later tables renumbered accordingly.

1.0 INTRODUCTION

Westinghouse Electric Company LLC (Westinghouse) has prepared this Remedial Design (RD) Work Plan to describe the activities to be undertaken to implement the Selected Remedy for Operable Unit 1 at the Westinghouse Former Fuel Cycle Facility in Hematite, Missouri. The Selected Remedy is defined in the Record of Decision (ROD) for Operable Unit 1 issued by Westinghouse on May 18, 2009 and approved by the Missouri Department of Natural Resources (MDNR) on July 21, 2009.

This RD Work Plan has been prepared pursuant to the provisions of the Consent Decree entered between Westinghouse and MDNR, effective July 3, 2008, which specifies preparation and submittal of a work plan in accordance with U.S. Environmental Protection Agency (EPA) Superfund RD guidance (EPA, 1995). Per the provisions of the Consent Decree (Section I, Paragraph 29), this RD Work Plan addresses the following:

- Waste and contaminated media sampling, characterization, and management, including on-site treatment of soils containing volatile organic compounds (VOCs);
- Contamination controls;
- Water management; and
- Residuals sampling and management.

This RD Work Plan also presents RD at approximately 90-percent completion (pre-final design), details the proposed approach to implement the selected remedial action (RA) for the Site, and presents the following key project documents:

- Health and Safety Plan (HASP);
- Sampling and Analysis Plan (SAP); and
- Construction Quality Assurance Plan (CQAP).

The HASP updates and revises the earlier plan prepared in support of the Remedial Investigation (RI) and previously approved by MDNR. The Site-specific HASP addresses employee training, protective equipment, medical surveillance requirements, standard

operating procedures, and a contingency plan in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) at 40 Code of Federal Regulation (CFR) 300.150 and U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) regulations (29 CFR 1910.120).

The SAP provides both the Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP). The FSP component of the SAP defines sampling and data collection methods to be used in the Operable Unit 1 RA. The FSP addresses sampling objectives, sample locations and frequency, sampling equipment and protocols, and sample handling. The QAPP updates and revises the earlier plan prepared in support of the RI and previously approved by MDNR. The QAPP portion of the SAP describes the Data Quality Objectives (DQOs) and the quality assurance and quality control (QA/QC) protocols to be used to achieve these DQOs. The SAP also describes ongoing procedures to be implemented during the RA to confirm the assumptions used to develop sampling frequencies remain valid.

The Construction Quality Assurance Plan (CQAP) is incorporated as a section of this RD Work Plan.

Westinghouse has also prepared other planning documents that complement the RD Work Plan (*e.g.*, Project Management Plan, Effluent and Environmental Monitoring Plan [EEMP], Waste Management and Transportation Plan) as well as other related project documents as part of the Site decommissioning under U.S. Nuclear Regulatory Commission (NRC) requirements. These project planning documents are listed in Section 6.0 and cited in the text, where appropriate. NRC has provided MDNR an opportunity to review these and other planning documents associated with Site decommissioning.

1.1 SITE NAME AND LOCATION

The Westinghouse Hematite Former Fuel Cycle Facility is located at 3300 State Road P in Jefferson County, Missouri near the unincorporated village of Hematite (Figure 1). The Westinghouse Hematite property consists of 228 acres, with the primary operations for

nuclear fuel manufacturing historically being conducted within approximately 8 acres of the property. As used throughout this RD Work Plan, and consistent with the RI Report and ROD, the "Hematite Facility" refers to the historical primary operations area as well as Site Pond and Burial Pit Area, while the "Hematite Site" refers to the Hematite Facility plus other areas that were the focus of investigations based on potential impacts by previous Facility operations. Figure 2 shows the Hematite Site, the extent of Westinghouse property, and the former primary operations area.

1.2 SITE HISTORY AND DESCRIPTION

Nuclear-related operations at the Hematite Facility began in 1956 after the purchase of the property by Mallinckrodt Chemical Works (Mallinckrodt). In addition to Mallinckrodt, various entities owned and operated the Hematite Facility over the years before Westinghouse acquired it in 2000.

Throughout its history, the primary activity at the Facility was producing uranium metal and compounds from enriched uranium. The uranium metals and compounds were used to produce nuclear reactor fuel. Secondary activities included uranium scrap recovery and limited work with thorium compounds. Before 1974, most Facility operations were related to work for the U.S. Government, some of which was classified. After 1974, Facility operations focused on commercial fuel production.

The Atomic Energy Commission (AEC) issued the original Special Nuclear Material (SNM) license for the Hematite Facility (License No. SNM-33) on June 18, 1956, and AEC, and later the NRC, have regulated licensed operations throughout the history of the Facility. AEC/NRC licensing regulations applicable to Hematite operations from 1956 to present include those contained in 10 CFR 30 through 36, 40, 70, 71, 73, and 74. In 2001, Westinghouse ceased fuel production at the Hematite Facility and requested from NRC an amendment of its nuclear materials license to change the scope of activities to those focused on decommissioning. NRC issued the requested license amendment in 2002.

The State of Missouri has been involved in regulatory and remedial aspects at the Hematite Site for over a decade. The state's initial involvement with groundwater characterization began in 1996. In 2002, Westinghouse and MDNR entered into a Letter Agreement, which, among other things, provided for MDNR oversight of certain studies and response actions in accordance with the NCP under the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 United States Code (U.S.C.) §§ 9601 *et seq*. In 2008, Missouri and Westinghouse entered into a Consent Decree, and the Letter Agreement was terminated. The Consent Decree provides for MDNR oversight of those portions of the investigation and selection of the remedy for Operable Unit 1 that are not preempted by the Atomic Energy Act of 1954, as amended. This RD Work Plan has been prepared pursuant to the provisions of the Consent Decree.

Beginning in 2004, Westinghouse, with oversight by MDNR, prepared an RI, a Human Health Risk Assessment, and a Screening-Level Ecological Risk Assessment. MDNR approved these reports as they relate to Operable Unit 1 on July 19, 2007. Using these studies as a basis, Westinghouse then prepared a Feasibility Study (FS) for Operable Unit 1, which MDNR approved on December 21, 2007. Westinghouse developed a Proposed Plan from the approved FS, which, following public review and comment, served as the basis for selecting a Site Remedy in the Operable Unit 1 ROD.

1.3 SUMMARY OF SELECTED REMEDY

The Selected Remedy for Operable Unit 1 at the Hematite Site is comprised of the following:

- Exhumation of buried waste to meet the chemical Remediation Goals (RGs) and radiological Derived Concentration Guideline Levels (DCGLs) that support unlimited use and unrestricted exposure and disposal of the removed impacted materials at permitted off-site facilities;
- Exhumation of impacted soil to meet the chemical RGs and radiological DCGLs that support unlimited use and unrestricted exposure and either treatment of removed soils to standards that allow on-site reuse or disposal of impacted soils at permitted off-site facilities; and

- Exhumation of impacted sediment to meet the chemical RGs and radiological DCGLs that support unlimited use and unrestricted exposure and disposal of removed sediments at permitted off-site facilities.

To the extent practicable, the Selected Remedy provides for treatment of the source materials constituting principal threat waste and associated impacted soils. The Selected Remedy provides the flexibility to allow treatment of low-level mixed waste (LLMW) that is both hazardous and radiologically contaminated at permitted off-site facilities if such off-site treatment is proven to be technical feasible and cost-effective.

Demolition of the Facility process buildings will be conducted in advance and is not part of Operable Unit 1. The demolition activity involves razing structures to grade, but the scope of that work does not include floor slab or subsurface (*i.e.*, utility or foundation) removal. The exposed floor slabs of the process buildings will be sealed following building demolition and prior to the implementation of Operable Unit 1.

Groundwater, as well as subsurface soils containing VOCs and situated below the groundwater table, are not addressed as part of Operable Unit 1. These media will be addressed in future response actions.

1.3.1 CONSTITUENTS OF POTENTIAL CONCERN

Constituents of potential concern (COPCs) at the Hematite Site include both radionuclides and chemical constituents, as summarized in the following subsections.

1.3.1.1 Residual Radioactivity

The primary radiological contaminants expected to be encountered in remediating the Hematite Site include uranium-234, uranium-235, and uranium-238. In addition, the U.S. Department of Energy (DOE) had previously supplied the Hematite Facility with uranium hexafluoride (UF_6) from reprocessed spent nuclear fuel, which resulted in the introduction of technetium-99 (Tc-99) to the Site. The use of the UF_6 from reprocessed fuel also raised the potential for the presence of trace quantities of uranium-236 and transuranic radionuclides, including plutonium-238, plutonium-239/240, americium-241, and neptunium-237.

Thorium-232 (Th-232) has been identified above the background threshold value at four locations within the Burial Pit Area, and radium-226 (Ra-226) has been identified at two locations within the Burial Pit Area. Th-232 is most likely the result of the limited processing that was performed for the production of thorium fuel. Based on information from an interview with a former plant employee, the Ra-226 may be attributed to the receipt and use of contaminated equipment from the Mallinckrodt St. Louis facility.

1.3.1.2 Volatile Organic Compounds

At the Hematite Facility, chlorinated VOCs were used in a variety of production and other plant applications. Table 1 presents a summary of the information obtained from interviews with former plant employees regarding the facility uses of trichloroethylene (TCE) and tetrachloroethylene (PCE). These chemicals were reportedly purchased in 55-gallon drum quantities, with incoming product drums typically stored outdoors in gravel or paved areas. No vapor degreasing operations or on-site distillation or recovery of spent TCE or PCE was reported.

In addition to the plant uses listed in Table 1, TCE is a degradation by-product of PCE. Accordingly, the source of TCE found in environmental media could be from previously disposed materials containing or other spills or releases of PCE.

According to former plant personnel, most of the VOCs used in fuel manufacturing processes were evaporated in processing or subsequent oven drying steps, although incidental spillage, pump leakage, and other releases were reported. Such leakage would have entered the environment through cracks and joints in concrete floors, especially those associated with the Red Room and Green Room in Building 240. Former plant employees also reported that, when used in cleaning and degreasing, the TCE would very quickly evaporate, decreasing the chance of the material being released to the environment.

The liquid process wastes that were produced, including those containing TCE and PCE, were typically disposed of in the Evaporation Ponds. Such liquid wastes included filtrates from wet recovery operations associated with both the Red Room and Green Room in

Building 240. Some TCE and PCE liquids were also likely released when waste storage drums leaked or spilled.

Solid wastes containing TCE and PCE may have been disposed of in the Burial Pits, and the Burial Pit logs reportedly contain entries describing "TCE rags" and similar wastes. Some liquid TCE and PCE wastes may also have been disposed of in the Burial Pits.

1.3.1.3 Other Chemicals

Other chemicals related to past industrial activity at the Hematite Site that contribute to potential human health or ecological risks include heavy metals (*e.g.*, arsenic) and polycyclic aromatic hydrocarbons (PAHs). Arsenic and PAHs were found in certain surface soil samples, and PAHs were detected in the sediments contained in Site Pond.

1.3.2 AREAS OF CONCERN AND REMEDIATION AREAS

Operable Unit 1 addresses buried waste, soils, and sediments at the Hematite Site, including those associated with the following areas of concern:

- Burial Pits;
- Evaporation Ponds;
- Former Septic System Leach Field
- Soils Beneath Buildings;
- Limestone Storage and Limestone Fill Areas;
- Outdoor and Shallow Soil Areas;
- Red Room Roof Burial Area; and
- Site Pond.

As additional Site characterization and remedial planning have been completed, the delineation of remedial areas evolved somewhat from the descriptors used in the RI/FS. Remediation areas are shown in Figure 3.

Table 2 lists the current volume estimates for buried waste and impacted soils or sediments associated with each of these areas of concern. Table 2 also provides the current estimate of the quantities of VOC-impacted materials.

1.3.2.1 Burial Pits

From 1965 to 1970, on-site burial was used as a disposal method for waste materials generated by the fuel fabrication processes at the Hematite Facility. Logbooks of waste burial indicate that 40 unlined pits were located east of the process buildings and used for such disposal (Figure 3). These on-site burials were conducted under the governance of AEC regulations that described the spacing of the pits, the thickness of the cover, and the quantity of radioactive material that could be buried in each pit. The nominal dimensions of each Burial Pit were 20 feet wide by 40 feet long by 12 feet deep, and the regulations provided the pits were to be covered with approximately 4 feet of clean soil.

The Burial Pit logs show a wide variety of wastes buried in the pits, including radiologically contaminated trash, waste drums, pails, bottles, and rags. Additional waste materials that are listed include uranium process metals of various enrichments, metal wastes, liquid and solid chemical wastes, and air filters.

Over the period in which the Burial Pits were used, certain facility processes involved the use of chlorinated organic compounds (Section 1.3.1.2). The disposal logs for the Burial Pits suggest that at least some of the waste from these processes was placed in the on-site Burial Pits, and such waste is considered the most likely and prevalent source of VOCs, especially TCE and PCE, associated with the pits. In the RI, the Burial Pit Area was determined to be a primary source of VOCs, and, to a lesser degree, radiological constituents in groundwater. Groundwater modeling and subsequent monitoring data suggest that TCE and PCE concentrations in off-site bedrock groundwater are largely attributable to releases of these constituents from the Burial Pits. On this basis, the waste contained in the Burial Pits was identified as “principal threat” waste, as defined in EPA (1991) guidance, in the FS and ROD.

Interviews with former Hematite Facility employees indicate that, prior to 1965; three or four burials may have been performed each year for disposal of general trash and items that may have been slightly contaminated relative to the radiological free release standards of that

period. Accordingly, Westinghouse estimates that 20 to 25 undocumented burials pits may exist in the area between the documented Burial Pits and the Site buildings (Figure 3).

1.3.2.2 Evaporation Ponds

The Hematite Facility has two evaporation ponds that were used between 1958 and 1978 for the disposal of liquid process wastes. The evaporation ponds consisted of a primary pond and a secondary, larger overflow pond with a 1.5-foot berm around each. The primary pond is approximately 30 by 40 feet in plan, and the secondary pond is about 30 by 85 feet in plan. Figure 3 shows the locations of these ponds.

Liquid wastes historically routed to the Evaporation Ponds included radiologically contaminated liquids as well as acidic cleanup solutions, TCE and PCE wastes, oils, building sump contents, and mop water. Remediation efforts undertaken at the Evaporation Ponds between 1979 and 1999 resulted in the removal of 10,700 cubic feet (ft^3) of sludge, rock, and contaminated soil.

In the RI, the Evaporation Ponds were determined to be a primary source of VOCs, and, to a lesser degree, radiological constituents in groundwater. Groundwater modeling and subsequent monitoring data suggest that TCE and PCE concentrations in unconsolidated materials between the Hematite Facility and Joachim Creek are largely attributable to releases of these constituents from the Evaporation Ponds. The Evaporation Ponds also contribute TCE and PCE concentrations to off-site bedrock groundwater.

1.3.2.3 Former Septic System Leach Field

The former Septic System Leach Field is located at the southwest corner of the Facility near Building 230 and is situated in part under the concrete pad west of the sanitary wastewater treatment plant and Evaporation Ponds. The septic system and leach field were used until 1977 when a sanitary wastewater (sewage) treatment plant was built and placed into service. The septic tank has since been removed, but the leach field/sand filter remains.

Historically, laboratory and facility drains discharged to a septic tank for anaerobic biological treatment, and this septic tank, in turn, discharged to a leach field/sand filter. Wastewater included sanitary and liquid wastes from the operation and maintenance of the facility, and there is a potential for subsurface soil contamination associated with the discharge of treated wastewater to the leach field/sand filter. Based on historical documentation, the leach field is described as a sand/gravel filter measuring about 34 by 74 feet in plan with estimated depths of 7 to 10 feet below the ground surface.

Borings were installed during the RI to evaluate potential contamination associated with the former Septic System Leach Field. Based on the results of this RI sampling, potential COPCs are radiological constituents. Only one sample exceeded the RG for arsenic in soil.

A unique safety and remediation issue related to excavation and removal of the sewage treatment plant is the potential for Site workers to be exposed to biological hazards in the form of raw sanitary waste. Personnel assigned to perform this work will receive specific training regarding such biological hazards, and Westinghouse will monitor potential exposures.

1.3.2.4 Soils Beneath Buildings

Spills and leaks that occurred in various areas within the process buildings resulted in radiological contamination of building floor slabs and underlying subslab soils. Sampling conducted as part of the RI targeted cracks and sump areas within the former process buildings, and the data documented some subslab soil areas containing radiological and VOC contamination.

1.3.2.5 Limestone Storage and Limestone Fill Areas

In 1967, dry scrubber columns were installed in Building 260 (Oxide Building) to remove hydrogen fluoride from the off-gas associated with the conversion of UF_6 to uranium dioxide (UO_2). These dry scrubber columns used limestone chips as the off-gas scrubber medium. The limestone was periodically replaced, and the spent limestone was stored outside Building 260 and used as on-site fill. During Hematite operations, the limestone scrubber media

became contaminated with Tc-99, presumably from the DOE-supplied UF_6 originating from reprocessed/recycled spent nuclear fuels.

The areas where spent limestone was known to have been placed are southwest of the tile barn and in the north east corner of the burial pits. In addition, in 1988 and 1989, spent limestone that met NRC-approved levels of radioactivity was used as fill under the floor slab during construction of Building 253, with the understanding that the fill may have to be removed upon facility decommissioning.

1.3.2.6 Outdoor and Shallow Soil Areas

Other outdoor soil areas to be remediated under Operable Unit 1 include locations where PAHs and arsenic were found in surface soil samples at levels that could contribute to potential human health risks. Where not associated with other remediation areas, these PAH and arsenic detections are generally isolated locations near the former process buildings.

Buried piping that may have transported radiological materials are present at the Hematite Site, including the sanitary sewerage system and the storm water conveyance system. In addition to the active piping networks, multiple sections of sanitary and storm water piping were previously abandoned in place. Buried piping associated with the sanitary and storm water systems will be removed in conjunction with the soil remediation activities.

1.3.2.7 Red Room Roof Burial Area

The Red Room was a controlled area within Building 240 used for the processing and handling of highly enriched uranium (HEU) products and materials. As part of shifting operations away from government projects employing HEU material to those associated with the manufacturing of commercial fuels, the Red Room area was partially remediated and the built-up roofing removed and replaced. Rather than being shipped for off-site disposal, the Red Room roof was radiologically surveyed and approved for on-site burial (Figure 3).

Based on sampling data and the known history of the Red Room operations, COPCs are radionuclides. In RI sampling, two soil sample locations exceeded the RG for arsenic.

Sampling and analysis has not identified the presence of Site-related VOCs in soil or associated groundwater.

The Red Room roof was of asphalt construction consisting of metal decking, potentially some insulation board, tar paper, asphalt, and gravel. Some of the roofing material, specifically the insulation board and tar paper, may have contained asbestos, which although may not be friable in its present form, may be regulated asbestos-containing material (RACM) if handled in a manner that could result in the release of asbestos fibers.

This burial area is near another identified Site feature, the Cistern Burn Pit, which was used to burn wood pallets that may have been radiologically contaminated. In 1993, radiological contamination within the cistern was removed to a residual level of 30 picocuries per gram of uranium (Leggette, Brashears, and Graham, Inc. and Cabrera Services, Inc., 2003). RI sampling and analysis did not identify the presence of Site-related VOCs or other chemical COPCs in soil or associated groundwater.

The Wood Barn (Building 120) was formerly used to store both clean and contaminated equipment, which has since been removed from the building. The Wood Barn has an earthen floor that contains residual radiological contamination in low concentrations.

1.3.2.8 **Site Pond**

The Site Pond is located west of the Hematite Facility and currently receives the permitted discharge from the Facility storm sewer system. A natural spring located at the northern end feeds the Site Pond. Treated sanitary wastewater is discharged to the Site Creek immediately downstream of the dam that creates the Site Pond. The Site Creek merges with the Lake Virginia tributary, and the combined stream then discharges to Joachim Creek.

The Site Pond and spring that feeds it have been features on the property since before the time of industrial development. The Site Pond, and its discharge to the south (*i.e.*, Site Creek), form a surface water boundary on the west side of the Hematite Facility. There is no

knowledge of facility related operations performed across (west of) the Site Pond, although areas of surface impacts have been identified and will be removed during remediation.

During the RI characterization of the Site Pond, four sediment samples were collected from within the pond (i.e., SW-01 and SW-05 through SW-07) and four soil samples adjacent to Site Pond (SW-01, SW-02, SW-03, and SW-04). Results of analysis of these RI samples indicated that elevated radioactivity due to radiologic compounds was present. PAHs were also detected in Site Pond sediments at levels that could potentially contribute to ecological risks. As part of the soil remediation, soils and sediments associated with the Site Creek downstream of the Site Pond will also be evaluated and removed as needed to meet DCGLs and chemical RGs.

1.4 ORGANIZATION OF PLAN

This RD Work Plan presents the RD at 90-percent completion and the proposed approach to implement the selected RA for the Site. The information presented in this RD Work Plan is based on the documents cited in Section 6.0. Once reviewed and approved by MDNR, this RD Work Plan, together with the NRC-approved Decommissioning Plan (DP) will serve as a final design for the Operable Unit 1 remedy. If, in the course of its review of the DP, NRC requires changes in the design or remedial approach, these changes would need to be incorporated into a revised or amended RD Work Plan.

The RD Work Plan format and content are consistent with Westinghouse's integrated, turnkey approach for the work. The RD Work Plan incorporates the necessary components for remedy implementation, including the engineering design, RA approach, figures, technical drawings with general specifications, and supporting plans. Following this introductory chapter, the remainder of this RD Work Plan is organized as follows:

- Section 2.0 presents the basis of design, including the objective specified in the ROD and the regulatory framework for the remedy;
- Section 3.0 presents the engineering design;

- Section 4.0 presents the implementation strategy for RD, including the project management structure, remediation schedule, and project plans;
- Section 5.0 describes remedial operations; and
- Section 6.0 lists references, including Westinghouse project plans, Westinghouse project supporting documents, and cited regulatory guidance documents.

The CQAP is provided in Section 4.3.3. The revised HASP and SAP (including both the FSP and QAPP) are provided in separate documents.

2.0 BASIS OF DESIGN

This section presents the basis of design, including the objectives and goals specified in the ROD and the other regulatory requirements that affect how the remedy is designed and implemented.

2.1 REMEDIAL ACTION OBJECTIVES

As defined in the ROD, the remedial action objectives (RAOs) for Operable Unit 1 are the following:

- Eliminate potentially unacceptable human health or environmental risks that could result from contact with the buried waste and impacted soils and sediment, including contact via direct exposure, ingestion, dermal contact, and inhalation of particulates or VOCs in soil gas;
- Eliminate potential ecological risks associated with impacted sediments in the Site Pond;
- Address the principal threat waste contained in the Burial Pits through active remediation;
- Comply with applicable or relevant and appropriate requirements (ARARs) and, to the extent practicable, to be considered (TBC) guidance that is pertinent to Operable Unit 1 activities; and
- Reduce the potential for buried waste and impacted soils to serve as a source of future groundwater contamination.

Table 3, which is adapted from Table 5 of the ROD, presents the final chemical-specific and location-specific ARARs and TBC guidance for Operable Unit 1 at the Hematite Site. The chemical-specific ARARs and TBC guidance provide the foundation for the RGs (*i.e.*, numerical cleanup standards) for Operable Unit 1.

2.2 REMEDIATION GOALS

The RGs, which are derived from the RAOs, define the desired endpoint concentrations of both chemical and radiological constituents.

2.2.1 CHEMICAL REMEDIATION GOALS

As described in the ROD, RGs for identified COPCs in soils and sediment are the Missouri Risk-Based Corrective Action (MRBCA) default target levels based on future residential use of the Hematite Site (MDNR, 2006). These chemical RGs for Operable Unit 1 at the Hematite Site are listed in Table 4.

The chemical RGs for Operable Unit 1 will be applied to soils above the groundwater table. Overburden at the Site consists of unconsolidated fine-grained clay and silt with an underlying sand and gravel unit (Figure 4). Clay in the vadose zone can be saturated, but the water is moving essentially vertically, infiltrating downward toward the sand and gravel unit. Lateral movement of groundwater in the overburden appears to be restricted to the sand and gravel layer. For purposes of applying RGs in Operable Unit 1, the groundwater table is defined by the phreatic surface associated with the groundwater within the sand and gravel unit and not by saturated fine-grained soils. Figure 5 provides a generalized overburden groundwater surface map, based on the December 2009 measurements. Based on this groundwater surface, the thickness of the vadose zone is typically 20 to 30 feet in the remediation areas.

Chemically impacted soils below the water table are not addressed under Operable Unit 1. Implementable and cost-effective remedial technologies applicable to such soils are not necessarily the same as those required to address radiologically impacted soils, buried waste, and shallow VOC-impacted soils. VOCs in deeper saturated soils are often most effectively remediated using technologies that treat both saturated soils and groundwater at the same time. Further feasibility evaluations are needed before the appropriate remedy for deeper VOC-impacted soils can be determined. Ongoing investigations and future remedy

assessments will address impacted groundwater and saturated soils below the groundwater table.

2.2.2 RADIOLOGICAL DERIVED CONCENTRATION GUIDELINE LEVELS

Chapter 5 of the Westinghouse Hematite DP, which was submitted to the NRC on August 12, 2009, describes the methods used to calculate Site-specific DCGLs for soil, buildings, and buried piping for the Hematite Site and provides the results of these calculations. The DCGLs represent the level of residual radioactivity above background in soil, on building surfaces, and in buried piping that would result in a total effective dose equivalent to an average member of the critical group of the public which does not exceed 25 millirem per year. Review and approval of these DCGLs will be conducted by NRC as part of its review and approval of the DP. Approved DCGLs will be incorporated in HDP NRC license.

2.3 REMEDY COMPONENTS

The Selected Remedy for Operable Unit 1 involves exhuming buried waste, impacted soil, and impacted sediment and disposing of these materials in licensed and permitted off-site facilities. To the extent practicable, the remedy relies on the on-site sorting, segregation, and treatment of exhumed materials to reduce the quantities of materials requiring off-site disposal and to maximize the quantity of material deemed suitable for reuse as on-site backfill. Sorting and segregation procedures are designed to properly classify the exhumed solid wastes and soils according to the material type, degree of radiological impacts, and whether the materials are hazardous waste under Resource Conservation and Recovery Act (RCRA) regulations due to the presence of VOCs. Following is a summary of materials handling and classification:

- Radiologically impacted wastes and soils impacted above DCGLs, but not VOC-impacted, will be packaged and sent off-site for disposal as low-level radioactive waste (LLRW).
- VOC-containing wastes and soils that are not radiologically impacted above DCGLs will be treated on-site. If treated soils meet RGs and backfill specifications after

treatment, they will be used as backfill. After treatment, the VOC-containing wastes, as well as any treated soils that do not meet RGs, will be disposed of off-site.

- VOC-containing waste and soils that are also radiologically impacted above DCGLs will either be: 1) treated on-site to reduce VOC concentrations to the extent practicable with the goal of rendering these materials non-RCRA-hazardous LLRW for off-site disposal (*i.e.*, not characteristic waste and compliant with Land Disposal Restrictions [LDRs]); or 2) transported off-site as LLMW for treatment and disposal. The decision of which option to employ will depend on the capabilities and requirements of the facilities used for off-site disposal.

Table 5 summarizes the potential categories of excavated materials and their disposition.

The primary treatment method for VOC wastes and soils will be by ex-situ soil vapor extraction that will be thermally enhanced except when treating materials that are RCRA characteristic hazardous waste.

After waste removal and Final Status Surveys confirm the completeness of removal, the excavations will be backfilled with treated soils that meet DCGLs and chemical RGs and clean imported fill, as needed. Disturbed areas will be regraded to promote surface water drainage and revegetated. Restoration of the Site Pond will depend on whether the existing dam needs to be removed to complete remediation and the needs for surface water retention in the final post-remedial Site configuration.

2.4 ACTION-SPECIFIC ARARs

Action-specific ARARs are technology- or activity-based requirements or limitations on response actions under CERCLA. Table 3, which is adapted from Table 5 of the ROD, presents the final action-specific ARARs for Operable Unit 1 at the Hematite Site. These regulatory requirements are triggered by the components of the Selected Remedy as identified in Section 2.3. For the Operable Unit 1 remediation of the Hematite Site, the principal action-specific ARARs are NRC regulations of licensed nuclear materials and Federal and state regulations for the management of hazardous wastes.

2.4.1 NRC DECOMMISSIONING REQUIREMENTS

The decommissioning requirements for a nuclear fuel cycle facility licensed under 10 CFR 70 are set forth in 10 CFR 70.38(h)(2). This regulation also contains the requirements for contents of a DP and references the radiological criteria for decommissioning contained in 10 CFR Part 20, Subpart E that form the basis for the DCGLs. NRC regulations in 10 CFR 71 establish requirements for packaging, preparation for shipment and transportation of licensed material. Off-site facilities receiving waste from the Site need to comply with current NRC or state regulations and be fully permitted and licensed to receive such waste.

Under the Atomic Energy Act and Energy Reorganization Act, as amended, the NRC has exclusive responsibility for regulating "source, special nuclear, and byproduct material" (42 U.S.C. §§ 2201(b) and (l)(3)). Accordingly, NRC has exclusive jurisdiction with regard to those radiological hazards that are present at the Hematite Site as a result of activity performed under licenses issued to the previous Site owners as well as those currently held by Westinghouse. The work undertaken to remediate those radiological hazards that resulted from activity under an AEC or NRC license at the Hematite Site is subject to the exclusive jurisdiction and oversight and to NRC's decommissioning and license termination requirements.

The DP provides the Site-specific basis for the completion of decommissioning activities. Westinghouse cannot proceed with decommissioning activities and the Operable Unit 1 remediation until NRC approves the DP. In addition, if in the course of reviewing the DP, however, NRC requires changes in the design or remedial approach, these changes would need to be incorporated into a revised or amended RD Work Plan.

2.4.2 HAZARDOUS WASTE REGULATIONS

RCRA regulations establish minimum national standards that define the acceptable management practices for both non-hazardous and hazardous waste. Federal regulations provide for delegation of Federal authority to States. Missouri has been delegated RCRA authority, including authority over LLMW, and the Missouri hazardous waste regulations (10

Code of State Regulations [CSR] 25) and solid waste management regulations (10 CSR 80) generally mirror the Federal requirements. The Missouri regulations are promulgated under the Hazardous Waste Management Law and the Solid Waste Management Law, both of which are provided in Chapter 260 of the Revised Statues of Missouri (RSMo).

The following subsections highlight key aspects of the hazardous waste regulations that define the basis for on-site waste handling. For simplicity, these discussions cite Federal regulations where State of Missouri regulations have adopted these requirements. Differences between Federal and State programs, or State-imposed requirements that are in addition to Federal requirements, are specifically noted.

2.4.2.1 **Waste Determination**

Remediation wastes are subject to RCRA Subtitle C requirements if they meet the specific listing or characteristic criteria defined in 40 CFR 261. At the Hematite Site, plant operations that produced VOC wastes included those which would generate non-listed (*i.e.*, process chemical) and listed (*i.e.*, solvent) wastes if such activities were conducted after the effective date of the RCRA regulations (Section 1.3.1.2; Table 1).

EPA regulations at 40 CFR 262.11 require that a generator of solid waste determine whether its waste meets the specific listing or characteristic criteria defined in 40 CFR 261 Subparts D and C, respectively, which would render such material hazardous waste under RCRA regulations. Westinghouse has conducted the necessary investigations and evaluations to make this determination. Appendix A provides a summary of Westinghouse's determination.

As discussed in Appendix A, the circumstances of the Burial Pits, Evaporation Ponds, soils under buildings, and other areas of contamination (AOCs) at the Hematite Site are those addressed by EPA guidance in which the origin of the constituent is unknown and for which it may be assumed that the constituents in the buried wastes and impacted soils did not originate from listed hazardous waste. Toxicity characteristic leaching procedure (TCLP) testing will be conducted to identify those wastes and impacted soils exhibiting

concentrations of VOCs in the TCLP leachate at concentrations that would render these materials RCRA characteristic hazardous waste.

2.4.2.2 Waste Generation

EPA policy usually considers solid wastes and associated impacted soils that were land-disposed prior to the effective date of the RCRA regulations to be generated under RCRA at the time such wastes and soils are excavated. EPA has, however, developed what is typically referred to as the AOC policy by which EPA interprets RCRA to allow consolidation and in situ treatment of hazardous waste to occur within the AOC without creating a new point of hazardous waste generation (EPA, 1998). The AOC interpretation may be applied to any land-disposed hazardous remediation waste, and EPA guidance provides that, "Although the AOC concept was initially discussed in the context of the CERCLA program, it applies equally to RCRA corrective action sites, cleanups under state law, and voluntary cleanups" (Shapiro, *et al.*, 1996). EPA guidance further provides that EPA approval in advance is not required for private parties to take advantage of the AOC concept, although state requirements and policies can vary, and coordination with the appropriate oversight agency is encouraged.

The remediation areas for Operable Unit 1 at the Hematite Site comprise a contiguous area that encompasses nearly all of the Hematite Facility plus the Burial Pit Area and Site Pond. Activities and facilities associated with the on-site management of excavated materials, including inspection, sorting, segregation, and staging, will occur within this AOC.

In accordance with EPA guidance and policy, these processing activities, of themselves, do not "generate" hazardous waste. Excavation and movement of soils or wastes that may be hazardous within an AOC does not trigger RCRA hazardous waste generator requirements under 40 CFR 262 (Lowrance, 1992). A hazardous waste generator is one who produces a hazardous waste or first causes the waste to be regulated as hazardous (40 CFR 260.10). In the circumstances of excavating and moving soil or waste within an AOC, the excavation does not produce the hazardous waste, nor does it subject the waste to hazardous waste

regulation because the activity within the AOC does not constitute treatment, storage, or land disposal of hazardous waste. The waste is generated, and subject to the generator requirement to determine whether or not such material is hazardous in accordance with 40 CFR 262.11, once it leaves the AOC.

2.4.2.3 Waste Analysis

The RCRA regulations and supporting EPA guidance do not provide strict timetables or frequencies for testing solid wastes to make the determination of whether such waste is characteristically hazardous. Instead, the regulations and guidance provide that such sampling and analysis be performed in advance of specific actions so that such actions, whether treatment, storage, or land disposal, can be conducted in accordance with the regulations.

In accordance with 40 CFR 268.7(a)(5), the analysis must also determined whether the waste needs to be treated in advance of land disposal to meet the applicable treatment standards under the LDRs given at 40 CFR 268.40(e). Characteristic waste must meet the universal treatment standards (UTS) given in 40 CFR 286.48 for all underlying hazardous constituents (UHCs) before the waste is land disposed. UHCs include all constituents listed in 40 CFR 268.48 (except fluoride, selenium, sulfides, vanadium, and zinc) which are reasonably expected to be present at the point of waste generation (40 CFR 268.2(i)). For contaminated soil with UHC concentrations greater than 10 times the corresponding UTS, the required level of UHC concentration reduction is capped at 90 percent.

2.4.2.4 Conditional Exemption for Low-Level Mixed Waste

LLMW is waste that satisfies the definition of LLRW in the Low-Level Radioactive Waste Policy Amendments Act of 1985, including radioactive wastes generated from SNM licensed by the NRC, and which contains RCRA hazardous waste. In May 2001, EPA amended its hazardous waste regulations to provide a conditional exemption for the storage, treatment, transportation, and disposal of LLMW that is generated and managed under an NRC license (40 CFR 266 Subpart N). Missouri has adopted the LLMW exemption provided at 40

CFR 266. Furthermore, 40 CFR 261.3(h)(1) provides that "hazardous waste containing radioactive waste is no longer a hazardous waste when it meets the eligibility criteria and conditions of 40 CFR part 266, Subpart N."

Accordingly, radioactive waste containing VOCs that is generated in the Operable Unit 1 remediation of the Hematite Site must be managed in accordance with NRC requirements, but such materials are not hazardous waste and are not subject to RCRA regulations, provided that the eligibility criteria and conditions of the 40 CFR 266, Subpart N conditional exemption are maintained. For LLMW to qualify for the exemption, the NRC license holder must notify EPA in writing by certified delivery to claim a conditional exemption for the LLMW stored at the facility. The notification must be made within 90 days of when a storage unit is first used to store conditionally exempt LLMW.

With respect to on-site storage, 40 CFR 266.230 identifies the following conditions that must be met to qualify for and maintain a storage and treatment exemption:

- Store the LLMW waste in tanks or containers in compliance with the requirements of the NRC license that apply to the proper storage of LLRW (not including those license requirements that relate solely to recordkeeping);
- Store the LLMW in tanks or containers in compliance with chemical compatibility requirements of a tank or container in 40 CFR 264.177, or 264.199 or 40 CFR 265.177, or 265.199;
- Certify that facility personnel who manage stored conditionally exempt LLMW are trained in a manner that ensures that the conditionally exempt waste is safely managed and includes training in chemical waste management and hazardous materials incidents response that meets the personnel training standards given in 40 CFR 265.16(a)(3);
- Conduct an inventory of stored conditionally exempt LLMW at least annually and inspect it at least quarterly for compliance with Subpart N requirements; and
- Maintain an accurate emergency plan and provide it to all local authorities who may have to respond to a fire, explosion, or release of hazardous waste or hazardous constituents. The plan must describe emergency response arrangements with local authorities; describe evacuation plans; list the names, addresses, and telephone

numbers of all facility personnel qualified to work with local authorities as emergency coordinators; and list emergency equipment.

40 CFR 266 also provides administrative requirements with respect to notification and record keeping.

The regulations at 40 CFR 266.235 further allow treatment of LLMW at the facility within a tank or container in accordance with the terms of the NRC license. Treatment that would not otherwise be allowed in a tank or container without a RCRA permit (*e.g.*, incineration) is not allowed under this exemption.

When the conditionally exempt LLMW is removed from storage, it is no longer eligible for the storage and treatment exemption. The waste may then, however, be eligible for the transportation and disposal conditional exemption at 40 CFR 266.305. The two exemptions (storage and treatment versus transportation and disposal), however, are distinct and severable. Westinghouse does not plan to seek the transportation and disposal exemption under 40 CFR 266.305 for the Hematite Site.

A key aspect of the 40 CFR 266, Subpart N storage and treatment exemption is the requirement to store and treat LLMW in tanks or containers. The RCRA regulations at 40 CFR 260.10 define a tank as a "stationary device, designed to contain an accumulation of hazardous waste which is constructed primarily of non-earthen materials (*e.g.*, wood, concrete, steel, plastic) which provide structural support." A container is defined in 40 CFR 260.10 as "any portable device in which a material is stored, transported, treated, disposed of, or otherwise handled."

2.4.2.5 Generator Treatment in Accumulation Units

Treatment of non-radiologically impacted material will be accomplished under the provisions of 40 CFR 262. These provisions apply to materials that are not radiologically impacted to a degree requiring off-site disposal, are not conditionally exempt LLMW, and can potentially be used for on-site backfill upon achieving RGs.

40 CFR 262.34 and 40 CFR 270.1(c)(2) that allow for generators to store hazardous waste on-site for less than 90 days without a RCRA permit. EPA has interpreted these rules as allowing on-site generator treatment of hazardous waste without a RCRA permit, so long as applicable storage requirements, are observed (46 Federal Register [FR] 2806, January 12, 1981; 51 FR 10168, March 24, 1986). EPA's preamble statement of March 24, 1986 (51 FR 10168) is unambiguous:

> "Of course, no permitting would be required if a generator chooses to treat their hazardous waste in the generator's accumulation tanks or containers in conformance with the requirements of subsection 262.34 and Subparts J or I of Part 265. Nothing in subsection 262.34 precludes a generator from treating waste when it is in an accumulation tank or container covered by that provision. Under the existing Subtitle C system, EPA has established standards for tanks and containers which apply to both the storage and treatment of hazardous waste. These requirements are designed to ensure that the integrity of the tank or container is not breached. Thus, the same standards apply to a tank or a container, regardless of whether treatment or storage is occurring. Since the same standards apply to treatment in tanks as applies to storage in tanks, and since EPA allows for limited on-site storage without the need for a permit or interim status (90 days for over 1000 kg/mo generators and 180/270 days for 100-1000 kg/mo generators), the Agency believes that treatment in accumulation tanks or containers is permissible under the existing rules, provided the tanks or containers are operated strictly in compliance with all applicable standards."

MDNR has adopted this interpretation, and MDNR policy mirrors this Federal approach (see http://www.dnr.mo.gov/env/hwp/enf/treatment.htm). MDNR states that a generator may treat its own facility-generated waste in approved accumulation units as long as there is no thermal treatment of the waste (including burning, heating, or evaporation) and the requirements for accumulation units are followed. Approved containers include tanks, containers, drip pads, and containment buildings. The container must remain closed unless adding or removing waste, and the unit cannot be kept open while mixing or reacting the contents, so as to prevent the use of passive evaporation to treat hazardous waste. A hazardous waste generator that treats its own waste in accumulation units must develop and follow a written Waste Analysis Plan that describes the procedures to be used to meet treatment standards for the waste. The timeframe over which the waste may be accumulated

and treated to render it non-hazardous must be less than 90 days. MDNR guidance specifies that a generator who plans to treat its waste in accumulation units contact MDNR in advance of such treatment.

2.4.2.6 Water Treatment System

40 CFR 264.1(g)(1) excludes wastewater treatment units as defined in 40 CFR 270.10 from hazardous waste permitting requirements. MDNR hazardous waste regulations mirror the Federal requirements. Meeting the regulatory definition of a wastewater treatment unit requires the following:

- The unit is part of a wastewater treatment system that is regulated under the Clean Water Act;
- The unit is used to manage hazardous wastewater or hazardous wastewater treatment sludge; and
- The unit meets definition of tank or tank system as defined in 40 CFR 260.10.

The treatment system to be installed in support of Operable Unit 1 is designed to meet the conditions necessary to qualify for the RCRA exemption under 40 CFR 264.

2.4.2.7 Reuse of Treated Soil

As shown in Table 5, the project operations plans calls for reuse of treated soils as excavation backfill, provided that such soil exhibits radioactivity concentrations that do not exceed the applicable DCGLs and VOC concentrations are below RGs. The provisions allowing on-site treatment under 40 CFR 266.230 for LLMW and under 40 CFR 262.34 for RCRA hazardous waste do not specify allowable uses.

EPA guidance provides that, if a hazardous contaminated soil exhibits a toxicity characteristic when it is generated, then once this soil meets LDR treatment requirements and is de-characterized, the soil may be disposed in a Subtitle D landfill or placed back on the land (EPA, 1999).

This guidance on the reuse of treated materials is also consistent with EPA's contained-in policy whereby contaminated environmental media, of itself, is not hazardous waste subject to RCRA regulations but can become subject to RCRA if they contain hazardous waste. EPA considers a contaminated environmental medium to no longer contain hazardous waste under the following conditions:

- The medium no longer exhibits the characteristic of a hazardous waste; and
- The concentrations of hazardous constituents from listed hazardous wastes are below health-based levels.

For the characteristic hazardous wastes at the Hematite Site, once the characteristic is eliminated (*i.e.*, through treatment), the impacted soils no longer "contain" hazardous waste. Because this determination can be made through relatively straightforward analytical testing, EPA requires no formal contained-in determination for characteristic wastes. Treatment to RGs, as specified in the ROD, goes beyond the RCRA requirements for containing-out characteristic hazardous waste and ensures that these materials are acceptable for reuse as backfill. In addition, because the quantitative values of the RGs are well below corresponding RCRA LDRs, treatment to RGs also assures that such reuse complies with EPA policy that contaminated environmental media that contained hazardous waste when first generated (*i.e.*, first removed from the land or AOC) remain subject to LDRs even after they no longer contain hazardous waste but continue to contain hazardous constituents.

2.5 PERMITS, AUTHORIZATIONS, AND APPROVALS

In addition to NRC decommissioning and MDNR hazardous waste management requirements, implementation of Operable Unit 1 will trigger the need for certain Federal, state, and local permits or modification of existing facility permits. Westinghouse intends to seek these permits and permit modifications and not seek administrative exemptions (where applicable) under CERCLA.

2.5.1 PERMITS

2.5.1.1 National Pollutant Discharge Elimination System Permit

The installation and operation of the treatment system for construction water will require a modification of the existing National Pollutant Discharge Elimination System (NPDES) permit issued by MDNR, Water Protection Program (MO-0000761).

The Hematite Facility NPDES permit, issued by the MDNR Water Pollution Branch on February 24, 2006, identifies six outfalls at the Site and establishes monitoring requirements and effluent limitations for each of these six locations. These six outfalls include the locations from which point sources discharges of Site runoff could occur during implementation of Operable Unit 1. One outfall was relocated due to the construction of the rail spur on the southern portion of the facility.

In addition, on November 7, 2003 MDNR provided a list of ARARs (MO-ARAR013) to address the discharge of the system installed by Westinghouse to treat wastewater generated in Site investigations (*e.g.*, monitoring well development water, purge water). MO-ARAR013 addresses treatment processes, discharge rates, and effluent limitations for the former investigative derived treatment system. The treatment system to be installed for construction water will employ similar unit processes, but plant throughput will be greater.

Westinghouse applied for a permit modification in June 2010. This modification addressed the treatment system and outfall locations and proposes transitioning the effluent limitations from drinking water standards to standards based on surface water quality standards and those contained within 10 CFR 20, Appendix B.

2.5.1.2 Section 404 Permit and Water Quality Certification

For the remediation of the Site Pond, Westinghouse intends to secure a permit from the U.S. Army Corps of Engineers (USACE) under Section 404(e) of the Clean Water Act (33 U.S.C. 1344). In conjunction with that application, Westinghouse will review with the USACE the

permitting requirements, if any, associated with the relocation of Northeast Site Creek and, if needed, remediation of the Site Creek downstream of the Site Pond.

Under the program administered by the USACE, such remedial activities are permitted under Nationwide Permit 38 (72 FR 11092 *et seq.*, March 12, 2007), which requires that actions be conducted in a manner that minimizes or mitigates impacts to the water of the United States, especially sensitive ecosystems. Pursuant to the USACE permitting process, Westinghouse will file a Preconstruction Notice with the USACE and request from MDNR a certification under Section 401 of the Clean Water Act that the planned activity will comply with state water quality standards and other aquatic resource protection requirements under MDNR's authority. If it deems necessary based on the submitted information, the USACE could consult with the U.S. Department of the Interior, Fish and Wildlife Service, regarding potential impacts and mitigation.

2.5.1.3 Jefferson County Land Disturbance Permit

Prior to the initiation of earthwork associated with the Operable Unit 1 remediation, Westinghouse's remediation contractor will secure a Jefferson County Land Disturbance Permit. Westinghouse will prepare and submit the required information, including Site mapping, a Storm Water Pollution Prevention Plan, a soils engineering report, and description of soil erosion and sedimentation control measures.

2.5.2 ACCESS TO OFF-SITE PROPERTIES

Operable Unit 1 can be implemented entirely on property owned by Westinghouse. No access to off-site properties is needed.

2.5.3 PROTECTION OF PUBLIC HIGHWAYS

The use and protection of public roadways involved in the Operable Unit 1 remediation will be in accordance with applicable state, county, and local requirements. Traffic warnings and controls will be provided for each point of equipment ingress and egress from State Route P

to the Site. Such warnings and controls may include warning signs and the use of a flagman when heavy equipment exits the Site.

3.0 ENGINEERING DESIGN

Operable Unit 1 primarily involves removal and off-site disposal of impacted materials, and this remediation will be performed on a turnkey basis. As a result, the engineering design can be streamlined and still provide sufficient detail to achieve the following:

- Define the scope of work;
- Identify the materials, equipment, and standards to be used in remedial construction;
- Specify required conformity with regulatory requirements;
- Meet industry standards for materials and workmanship; and
- Coordinate activities with elements of decommissioning.

The engineering design presented in this section primarily addresses what is necessary to construct the facilities to be employed during the Operable Unit 1 remediation for on-site materials handling and treatment (*e.g.*, temporary materials handling facilities, VOC treatment units, and construction water treatment facility). The design requirements for long-term installations, which are limited to the backfill, regrading, and revegetation of disturbed areas and the rail spur (Section 3.3.3), are also addressed. Section 5.0 presents the Site operations procedures that describe how this design will be implemented, especially with respect to excavation, on-site management, and off-site disposal of exhumed materials.

3.1 CLEARING AND GRUBBING

The following paragraphs describe Westinghouse's design approach for clearing and grubbing as needed for construction of temporary facilities and to access impacted soils for excavation. Westinghouse has already completed some clearing and grubbing activities under approvals from MDNR and NRC.

3.1.1 CLEARING LIMITS AND METHODS

Clearing of existing vegetation is primarily needed in locations to the east and southeast of the Hematite Facility where the controlled access area and restricted area fencing will be relocated and temporary materials handling areas (*i.e.*, clean soil stockpile) will be constructed. Some clearing is also required in conjunction with the remediation of the Site Pond. The planned limits of clearing are shown in Figure 6.

Westinghouse will define the limits of clearing and grubbing based on the requirements for the controlled access area and restricted area fencing, allowing sufficient room on either side to provide clearance for security patrols and fence maintenance vehicles. Limits will be marked in the field by surveyor's stakes and flagging. Wherever practicable, these limits provide for a buffer between cleared areas and State Route P and between cleared areas and the McKee residence to the east. Trees and other vegetation designated to remain undisturbed will be protected from damage throughout the duration of the construction period.

Trees, logs, underbrush, and shrubs will be removed from areas designated to be cleared. In these areas, trees are to be cut off no more than 12 inches above grade. In areas designated to be grubbed, stumps are to be removed. No clearing and grubbing will be conducted until necessary soil erosion and sedimentation controls (Section 5.2.1.3) are in place and inspected and approved by Westinghouse. Areas that are cleared and grubbed will be maintained per the requirements of the Jefferson County Land Disturbance Permit obtained by Westinghouse.

3.1.2 HANDLING OF DEBRIS

In general, the contractor will size and shred debris generated in clearing and grubbing. Shredded materials will be staged with contaminated soils or wastes for off-site disposal.

3.2 SOIL AND BURIED WASTE EXCAVATION

3.2.1 EXCAVATION LIMITS

Figure 7 shows the initial limits of excavation for each of the remediation areas at the Hematite Site. These limits are based on results of RI and other characterization testing and investigations of historical Site operations. Because of the relatively large areal extent, the plan is to excavate the Burial Pit Area using two separate excavation teams working simultaneously. One excavation will begin in the northwest corner of the Burial Pit Area and proceed in a serpentine manner to the southeast. A second, independent excavation will begin further to the northeast and also proceed in a serpentine manner to the southeast (Figure 7).

In each area, excavation and removal of impacted materials will proceed downward and outward as needed until field monitoring instruments indicate that radiological contaminants in residual soils are at levels below DCGLs. Excavations will likewise proceed downward and outward as needed to remove VOC-impacted buried wastes and soils, but excavations do not need to be extended below the local groundwater table to remove soils that are solely impacted by VOCs. Field operations procedures for excavation, including the use and interpretation of field monitoring data, are presented in Section 5.4.

3.2.2 SIDEWALL STABILITY

For excavations that exceed four feet in depth, sidewall sloping, stabilization, or shoring will be in accordance with OSHA requirements (29 CFR 1926, Subpart P). Site soils are generally cohesive, and for most excavations, a one horizontal to one vertical (1:1) cut will provide a stable excavation side slope. If an excavation extends downward into the basal sand and gravel unit, side slopes may need to be reduced to 1.5:1 per OSHA requirements (see Figure B-1.4 of Appendix B, 29 CFR 1926 Subpart P).

Excavation within five feet of the natural gas pipeline that runs along the southern property boundary near the Evaporation Ponds will be coordinated with the natural gas pipeline owner

(*i.e.*, Missouri Natural Gas) and performed in accordance with the requirements of 29 CFR 1926.651. Shoring or similar protective systems may be used, as necessary, to allow for safe excavation without damage to this pipeline. If it is determined at the time of the work that additional excavation near the pipeline could result in an unacceptable risk to the workers, the environment, or the public, Westinghouse may propose to NRC that an independent dose assessment be considered as a basis for achieving the remedial goal for radiological contamination in this area without further excavation. If the additional excavation is driven by the presence of VOCs, Westinghouse would similarly consult with MDNR regarding the approach for completing remediation of the inaccessible area.

3.2.3 EXCAVATION DEWATERING

Excavation dewatering will be conducted as needed to maintain workable conditions for personnel access within the excavations. Sumps will be constructed as needed to collect groundwater infiltration and precipitation that falls in excavation areas, and collected water will be pumped to a 20,000-gallon holding tank (T-1) stationed near the active excavation. From this holding tank, the water will be pumped to the water treatment system (Section 3.5). Operational plans to minimize the quantity of water that needs to be handled within excavations are discussed in Section 5.2.1.

3.3 TEMPORARY MATERIALS HANDLING FACILITIES

Figure 8 shows the planned on-site materials handling facilities, including haul roads, materials staging areas, materials load-out, and on-site rail spur. The overarching design criteria for these facilities are to comply with criticality controls for radiological materials, minimize the potential for the spread of contamination during remediation, and allow for efficient on-site handling of excavated materials.

3.3.1 HAUL ROADS

Temporary haul roads will be constructed to allow movement of materials on-site using designated and control routes of ingress and egress. Haul road construction is also designed

to minimize construction downtime due to wet or soft ground conditions during and following periods of inclement weather.

The planned haul roads include both new construction and upgrading of existing Site roads (Figure 8). The alignment shown in Figure 8 provides for approximately 610 lineal feet of 25-foot wide roadway and 320 lineal feet of 15-foot wide roadway. Westinghouse will lay out the roadway alignments for construction.

Haul roads will be constructed according to the following general specifications:

- Where needed, existing vegetation will be cleared along the haul road route for a width that includes the roadway and shoulders and as might otherwise be needed to provide clear sight lines around curves.
- For roadways constructed over earthen areas, Geogrid® or non-woven geotextile fabric will be placed atop the graded subgrade, paying particular attention to areas that are soft or wet.
- Roadways will be constructed using imported (commercial) crushed stone.

Culverts will be installed to allow the haul road accessing the clean soil stockpile to cross the stream on the northeast end of the work area within the controlled access area. Additionally, a portion of the controlled access area fencing will run across the culverts parallel to the haul road. Culverts will also be required on the southeast run of the stream to allow the controlled access area fencing to securely cross the stream and maintain security. Riprap will be placed to stabilize embankments along the haul roads. Culverts under security fencing will be securely covered with removable grating that is locked in place compliant with NRC requirements for barriers given in 10 CFR 73.2 and NRC Information Notice No. 86-83.

Appendix B provides the design for Site haul roads, including the requirements for Geogrid® and geotextile foundation support, stone sizes and thicknesses, culvert design, and riprap selection. With approvals from MDNR and NRC, Westinghouse has already completed some haul road construction, using the designs specifications provided in Appendix B, to facilitate temporary facility construction.

3.3.2 MATERIALS MANAGEMENT AREAS

Materials management areas will be constructed to provide designated locations for placement of various excavated soil and buried waste materials. The soil staging areas provide materials staging in a manner that maintains the separation of materials for subsequent handling, treatment, and load-out. These areas are also designed to minimize construction downtime due to wet or soft ground conditions during and following periods of inclement weather.

3.3.2.1 Contaminated Materials Staging Areas

Contaminated materials staging areas will be located within the current controlled access area of the Hematite Facility. VOC contaminated materials will be placed atop the concrete slabs of the demolished process buildings. When material beneath the process building slabs are being excavated, a VOC treatment cell will be constructed on the slab of former Building 252 (south vault).

As described in Chapter 8 of the DP, multiple work areas are needed to ensure nuclear criticality safety and to properly inspect, sort, and segregate exhumed waste materials and soils. These work stations include the following; proposed locations are shown in Figures 8 and 10:

- A high-resolution gamma spectroscopy system will be used during excavation of the Burial Pits to measure radioactivity in soil as a part of the measurement process for qualifying soil for re-use as backfill. Currently, a location north of Building 115 and inside of the controlled access area fence has been identified for the installation of this system and the associated truck scale.
- A Collared Drum Buffer Store will be constructed to stage empty containers.
- A Fissile Material Storage Area will be established inside of the controlled access area fence. It is anticipated this storage will be provided in a specifically configured Sealand container or similar temporary structure.
- A Waste Evaluation Area will be established inside of the controlled access area fence. It is anticipated this Waste Evaluation Area will located inside Building 115 (the former Emergency Fire Pump building).

- A Waste Holding Area will be graded, compacted, lined and bermed to provide adequate drainage, and water run-off and run-on control; and
- A Waste Consolidation Area will be constructed adjacent to the Burial Pit Area. This area will be graded, compacted, lined and bermed, as necessary, to provide adequate water run-on and run-off control.

3.3.2.2 Clean Soil Stockpile

The clean soil stockpile will be located in an area remote from contaminated materials handling in an area northeast of the burial pits (Figure 10). Stockpiles will be maintained in accordance with the requirements of the Jefferson County Land Disturbance Permit obtained by Westinghouse. Stockpiles will either be seeded and maintained until vegetative cover exceeds 70 percent, covered with sheet goods (*e.g.*, tarp, Herculite® fabric), or sprayed with water augmented with surfactant or coating and maintained. Alternatively, Westinghouse may use water sprays for fugitive dust suppression.

3.3.3 RAILROAD SPUR AND LOADING AREA

A railroad spur and railcar-loading pad have been constructed near the southeast side of the impacted area of the Site to support bulk loading of waste from the Waste Handling Area. This construction was completed under approvals from MDNR and NRC. With installation of the rail spur, the security fence was relocated to encompass the area for security and radiological control purposes. The railcar-loading pad was constructed using materials purchased from approved off-Site sources. Appendix B provides the design.

3.4 VOC TREATMENT SYSTEM

The following paragraphs describe the system to be employed for on-site treatment of VOC-impacted soils and solid wastes. Addition detail on the design, installation, and operation of the VOC treatment system is provided in the Waste Management, Minimization, and Treatment Plan prepared by the proposed RA contractor. A Waste Analysis Plan that describes the procedures to be used to demonstrate compliance with treatment standards will be prepared in conjunction with the final SAP.

3.4.1 DESIGN CRITERIA

A treatment system will be installed to remove VOCs from excavated soils and buried wastes in advance of off-site disposal. Treatment goals vary depending on the specific type and characteristics of exhumed materials. Treatment goals for the various VOC-impacted materials are summarized as follows:

- VOC-impacted solid waste (soil-like matrix) and soil that exhibits the characteristics of a RCRA hazardous waste and is radiologically impacted above DCGLs: Treat in manner compliant with 40 CFR 266, Subpart N as needed to ensure material is not LLMW so that material can be disposed of off-site as LLRW. Successful treatment requires that the material is determined not to exhibit a characteristic of a RCRA hazardous waste under the TCLP test and meets UTS for UHCs.

- VOC-impacted soil that exhibits the characteristics of a RCRA hazardous waste, but is not radiologically impacted above DCGLs: Treat under the provisions of 40 CFR 262, 40 CFR 262.34, and 40 CFR 270.1(c)(2) as needed to ensure material is suitable for use as on-site backfill. Successful treatment requires meeting Site RGs.

- VOC-impacted solid waste (soil-like matrix) that exhibits the characteristics of a RCRA hazardous waste, but is not radiologically impacted: Treat under the provisions of 40 CFR 262, 40 CFR 262.34, and 40 CFR 270.1(c)(2) as needed to ensure material does not exhibit the characteristic of a RCRA hazardous waste so that material can be disposed of off-site as non-hazardous industrial waste. Successful treatment requires that the material is determined not to exhibit a characteristic of a RCRA hazardous waste under the TCLP test and meets UTS for UHCs.

- VOC-impacted soil that does not exhibit the characteristics of a RCRA hazardous waste and is not radiologically impacted above reuse criteria: Treat to remove the VOCs as needed to ensure material is suitable for use as on-site backfill. Successful treatment requires meeting Site RGs.

VOC-impacted materials that do not need to be treated on-site are the following:

- Soil and solid waste that is radiologically impacted above DCGLs but VOC levels meet the waste acceptance criteria for the off-site disposal facility; and

- Solid waste that that is not radiologically impacted above DCGLs and does not exhibit the characteristics of a RCRA hazardous waste.

These materials will be sent off-site for disposal without treatment. In addition, depending on the requirements of the specific disposal facility employed and the quantity of waste

generated, it may be more advantageous to ship LLMW for off-site treatment and disposal and forego the on-site treatment of this material for VOC removal.

VOC treatment will be conducted by ex situ soil vapor extraction conducted within enclosed, specially constructed cells that meet the regulatory definition of a tank. A network of perforated pipes will be placed inside the treatment cells and connected to a blower that will induce air flow. The air flow will volatilize and extract the VOCs from the material. Emissions from the blower exhaust will be treated through activated carbon to remove potential airborne contaminants. The VOC treatment is designed to comply with the air emissions standards for process vents at 40 CFR 265.1032(a), requiring total VOC emissions of no more than 3 pounds per hour or emissions control of greater than 95 percent efficiency.

The treatment cells will be situated atop former building slabs following demolition of these structures; the treatment area is initially planned for installation at the northeast end of the northern-most slab on the footprint of Building 255 (Figure 8). After building demolition, these slabs will be sealed to minimize the potential for rainwater infiltration through seams, joints, and cracks. The concrete building slabs will serve as the base and secondary liner. To access subsoils beneath Building 255, the VOC treatment cells will be reconstructed in an area to the south within the current controlled access area (*i.e.*, Building 252 slab). The treatment cell design will be reconstructed using the same basic design with new piping, liners, and other components.

Concrete New Jersey barrier or similar temporary structures will be installed to provide the structural sidewalls. The treatment cells will be lined and covered with flexible membrane liner material and outfitted for leachate detection. Figure 9 shows the design layout and details. This design achieves the following RCRA interim status standards for tank systems:

- Provide a structural foundation and properly design and install the tank system to be structurally stable and compatible with the wastes to be stored and treated (40 CFR 265.192); and
- Provide a secondary containment system that is designed, installed, and operated to prevent migration of wastes or accumulated liquid out of the system to soil,

ground water, or surface water and capable of detecting and collecting releases and accumulated liquids until the collected material is removed (40 CFR 265.193).

For any treatment unit that contains waste that is not exempt under 40 CFR 261.(3)(h)(1) and 40 CFR 266 Subpart N, the material in that unit will be accumulated, treated, and, if not rendered and confirmed to be non-hazardous, removed from the site within 90 days. For units containing material that is exempt under 40 CFR 261.(3)(h)(1) and 40 CFR 266 Subpart N,, the accumulation and treatment time will be as short as necessary to achieve the required degree of treatment, but could be extended to longer than 90 days, if needed.

Also, once it is determined that material within a specific treatment unit treating soil intended for re-use as backfill no longer exhibits the characteristic of a RCRA hazardous waste, subsequent treatment of that soil will involve the use of heated air injection to accelerate treatment and reduce VOC concentrations in the soil to below RGs.

3.4.2 SIZING OF TREATMENT UNITS

As shown in Table 2, Westinghouse estimates the following volumes VOC-impacted waste and soil requiring treatment:

Area of Concern	Total Volume (ft^3)	Off-Site Disposal (ft^3)	Potential Reuse On-Site (ft^3)
Burial Pits	60,000	36,000	24,000
Evaporation Ponds	4,210	4,210	0
Building Soils	18,330	10,330	8,000
Total Estimated Treatment Volume	82,540	50,540	32,000

Nearly 75-percent of the total volume is associated with the Burial Pits.

3.4.3 TREATMENT CELL DESIGN

The following subsections describe the design of the VOC treatment system.

3.4.3.1 Configuration

The basic design is to accumulate materials from the Burial Pit excavations in two treatment cells, sorting radiologically impacted from non-radiologically impacted materials. The accumulated material will be treated to remove VOCs to target levels, then, after completion of confirmatory testing, removed and either packaged for disposal or stockpiled for re-use. The cells will then be used for treatment of VOC-impacted materials associated with the Evaporation Ponds. A separate cell will be used for VOC-impacted soils removed from excavations beneath former building slabs.

3.4.3.2 Subbase

The treatment cells will be initially constructed atop building slabs following building demolition. The floor slabs will be coated with a sealant that fills cracks and minimizes permeability to allow the slab to serve as a secondary liner. The preferred areas are those that are flat or which have a uniform slope, thereby avoiding localized ponding and allowing proper functioning of the leachate detection system.

To access subslab soils beneath Building 255, the VOC treatment system will be relocated to an area to the south within the current controlled access area (*i.e.*, Building 252 slab).

3.4.3.3 Leachate Detection System

A leachate detection system will be installed atop the selected pavement area. A 200-mil geocomposite drainage fabric, atop the prepared, sealed pavement surface. The geocomposite is comprised of high-density polyethylene (HDPE) drainage net that is heat bonded to one layer or in-between two layers of geotextile to create a single-sided or double-sided geocomposite. The geocomposite will be laid with the non-woven geotextile (8 ounces per square yard) on the bottom to provide cushioning between the drainage fabric and the pavement.

A leachate detection well will be installed near each corner of each treatment cell. The wells will be constructed using a 4-inch solid polyvinyl chloride (PVC) casing that is installed to a

depth of approximately 1 foot below the pavement. The hole for the casing will be overdrilled (or dug) and the casing will be cemented in place using a water seal grout. A section of 2-inch PVC well screen and solid riser will then be used to complete the well construction. The 2-inch PVC well screen will penetrate through the geocomposite, allowing any water that enters the geocomposite drainage fabric to flow to and enter the leachate detection well.

3.4.3.4 **Primary Liner and Cover System**

The primary liner will be a 3-ply laminate combining two layers of linear low-density polyethylene (LLDPE) with a high-strength cord grid in between. The flexible membrane liner is about 10 mils in total thickness.

The LLDPE liner (approximately 40- by 100-foot sheet) will be rolled out atop the geocomposite to form a continuous impermeable liner. When the VOC treatment system is relocated to access Building 235 subslab soils, two layers of LLDPE liner will be employed with the geocomposite between these two layers to provide primary and secondary liner systems with an intervening leachate detection system. The cover system will similarly be constructed using 3-ply laminate LLDPE membrane. The liner and cover will be mechanically fastened at the limits of the cell (see detail Figure 9). Steel rings will be employed to hold the cover membrane approximately 12 inches from the soil surface, creating an air space used to facilitate air flow to the exhaust/collection pipe (Section 3.4.4.1).

3.4.4 AIR HANDLING

3.4.4.1 **Air Exhaust and Inflow Piping**

Air distribution piping will be installed in three layers within the treatment cell, each layer separated by 2 to 3.5 feet of the soil being treated.

The air distribution pipes will be constructed of 12-inch diameter perforated metal pipe. These pipes will be placed at 5- to 10-foot centers oriented longitudinally within the

treatment cell (Figure 9). The piping will connect to one or more solid-wall header pipes that leads to the hot air injection system to be used when treating materials that are not RCRA hazardous waste or LLMW. The solid-wall pipes will each be fitted with a pipe boot where they exit the cell.

The air exhaust pipe will consist of a 12-inch diameter perforated metal pipe oriented longitudinally along the centerline crown of the soil pile. The pipe will be in the open space above the soil below the membrane cover. The air exhaust pipe will connect to a solid wall pipe orientated at 90° from the air exhaust pipe that connects to the exhaust treatment system and blower. A pipe boot will again be used where this pipe penetrate the LLDPE cover membrane.

3.4.4.2 Blower System

The main components of the standard TEVET system are described below:

- **Blower System** – The vapor extraction system can also be run without any thermal addition. Air would be blown through the system and exhausted through the activated carbon filter. This could be done to treat characteristically hazardous waste to non-hazardous levels.

- **Heater System** – The heater system consists of a power flame model J30A-10 1,075,000 British Thermal Units (BTU) thermal oxidizer which is used with a propane fuel source. The system also contains combustion air fans, an automatic purge system, an electronic ignition, flame sensors, and automatic "shut-down" controls. The thermal oxidizer is steel jacketed and has a ceramic-lined oxidation chamber, stainless-steel baffles and turbulation grills.

- **Thermal Enhancement System** – The thermal enhancement system consists of a high pressure Dayton blower with a 7.5-horse power, 3-phase 230-volt motor. This is equipped with a heat shield and is mounted on 6 floor vibration isolators.

- **Exhausted Air Polishing** – The exhausted air follows through the following components:

  – Condensate trap;
  – Heat exchanger;
  – Condensate filter separator
  – HEPA filter; and

– Vapor phase activated carbon.

At a (maximum) porosity of 35 percent, the pore space associated with the VOC-impacted waste and soil in the treatment cell will be approximately 8,400 ft^3. The blower is sized based on an assume treatment of at least 100 pore volumes exchanges per day for the expected 14- to 21-day treatment period. This treatment basis is accomplished with a blower that produces at least 180 standard cubic feet per minute (scfm) under operating conditions. By using 12-inch piping, friction losses will be minimal (e.g., 2 inches of water [in. H_2O] per 100 feet of piping at 180 scfm), so the total friction losses will be less than 10 to 15 in. H_2O. Accordingly, if a single blower is employed, the minimum blower requirement is one that can produce 180 scfm at 15 in. H_2O.

The VOC treatment system is designed to run unattended, although some instrumentation and controls are needed:

- Interlock to shut off the blower if a high water level is detected in the moisture separator; and
- Remote telephone notification if the electrical power is off or if, for any other reason, air flow falls below a minimum set-point.

The blower system is trailer-mounted. Winterization will not be an issue, provided that the moisture separator is drained routinely (as needed). If winterization becomes necessary, a heat blanket or other suitable means will be provided for the moisture separator to prevent freezing.

3.4.4.3 Emissions Controls

The exhaust air is then treated to remove particulates and VOCs before it is emitted to the atmosphere. The exhaust air treatment consists of condensate trap, heat exchanger, condensate filter separator (condensate set to water treatment system), HEPA filter, and vapor phase activated carbon filter.

3.5 WATER TREATMENT SYSTEM

Westinghouse has designed and installed a water treatment facility system to provide treatment and discharge of water generated during the Operable Unit 1 remediation in accordance with the effluent limitations and other provisions of the applicable site license, NPDES permit, MO-ARAR013, 10 CFR 20, and 40 CFR 260.10. The water treatment facility is located in the high-bay area in the southeast corner of Building 230.

3.5.1 DESIGN CRITERIA

The water treatment system is sized with adequate capacity to allow remediation activities to proceed with minimal interruption due to accumulated water for a reasonable storm condition. Water will be generated from the following sources:

- Water that is within the buried waste that will be exhumed (leachate);
- Ground water that seeps into the excavation from surrounding soil;
- Precipitation that falls directly into an excavation; and
- Precipitation that falls into outdoor waste-processing areas.

The basis of the design flow is treatment of a 2-year return period storm (*i.e.*, 3.5 inches in 24-hours) falling on two acres of active open excavation and processing area. A treatment system throughput of 100 gallons per minute (gpm) will handle this 2-year storm event, assuming that 75 percent of the total water volume is collected and treated within 24 hours.

The objectives in designing the water treatment system were to develop a facility capable of the following:

- Efficiently handling highly variable influent flow rates from remediation activities ranging from 1 to 100 gpm;
- Removing VOCs from the influent water to meet effluent limitations;
- Removing radiological compounds from the influent water, including uranium isotopes and Tc-99, to achieved discharge water quality in compliance accordance with NRC requirements;
- Removing suspended solids and metals (*e.g.*, iron and manganese) from the influent to minimize fouling of the treatment system components.

- Providing redundancy into the system so that individual components can be taken off-line for servicing without compromising the availability or quality of treatment;
- Providing flexibility to allow for modification of the system based on performance monitoring results; and
- Providing for unattended or minimally attended operation, except for operator interaction for specific activities such as backwashing the carbon adsorption units, changing bag filters, and maintaining instrumentation and equipment components.

The water treatment system employs best available treatment technology to remove suspended solids, VOCs, and radiologic compounds prior to discharge to the receiving stream. The components of the water treatment system constitute for a system to remove suspended solids, VOCs, and radiologic compounds.

3.5.2 PROCESS DESCRIPTION

The water treatment system will employ multiple unit processes for removal of suspended solids, precipitated metals, VOCs, and radiologic compounds. Figure 11 provides the process flow diagram.

3.5.2.1 Flow Equalization and Settling

Water from the excavations will enter a locally staged 20,000-gallon holding tank (T-1) to provide initial settling of solids. From Tank T-1, water will be pumped through temporary, piping to the water treatment system located in Building 230. The water will then enter a mix tank where polymer will be added at a rate proportional to the influent flow rate to the treatment system. A flow meter (FM-1) installed on the influent line from the excavation area to the water treatment system will provide the input signal for control of the polymer feed rate. The polymer dosage will be in accordance with the results of bench-scale testing. A polymer dosage of about 1 to 10 parts per million is anticipated.

Water will flow by gravity from the flash mix tank into storage tank T-2 where settling of flocculated and other suspended solids will occur. The treatment stream will then overflow by gravity from the first storage tank (T-2) into the second storage tank (T-3) and then

sequentially to the third storage tank (T-4) for additional settling of solids. Effluent from the final equalization/settling tank (T-4) will be pumped through the treatment train to the effluent holding tank (T-5). A portion of the treated water from tank T-5, and backwash water from the carbon adsorption units will be re-circulated and added to the inflow of tank T-3.

3.5.2.2 Primary Filtration

Primary filtration for fine suspended solids removal will be achieved using a set of duplex bag filters. Initial bag filter size in the first bag filtration step (BF-1 through BF-4) will be 10 micron (µ) with adjustment up to 25µ as necessary for efficient operation. Pressure gauges across the bags will indicate when the filters are plugged and bag replacement is required. The system is designed to allow the operation of the bag filters up to approximately 10 to 20 pounds per square inch pressure drop.

3.5.2.3 Activated Carbon Adsorption

Water will flow under pressure from the bank of primary bag filters through dual granular activated carbon adsorbers operated in series. Each vessel will hold 2,000 pounds of carbon for a total empty bed contact time of 20 minutes at 50 gpm. The system is designed so that one set of two adsorbers can be taken off-line for servicing or backwashing while the system runs at capacity (50 gpm) with only the second set of adsorbers on-line. The carbon adsorption will remove VOCs to levels below the expected effluent permit limits.

3.5.2.4 Secondary Filtration

Effluent from the carbon adsorbers will flow under pressure through a second bank of four bag filters to minimize particulate influent to the ion exchange units. The second bank of bag filters will be the same housing units with initial bag size of 5µ adjusting up to 10µ if necessary for efficient system operation. Routine monitoring of pressure drop across the bag filters and periodic replacement of the filter bags will be required by the treatment system operator.

3.5.2.5 Ion Exchange

Effluent from the second bank of bag filters will flow under pressure into two ion exchange vessels operated in parallel. Each vessel will contain 2,000 pounds of Purolite® strong acid cation resin for removal of radiological isotopes.

3.5.2.6 Effluent Holding and Discharge

Effluent from the ion exchange units will flow under pressure into the effluent holding tank T-5 shown in Figure 11. Two 100-gpm pumps will be used to pressurize the effluent from tank T-5, splitting approximately 40-gpm of recycle back to the flash mix tank at the head of the system, and approximately l0-gpm to the regulated outfall under average operating conditions. During periods of higher storm water influent to the treatment system, the recycle rate will be reduced and the effluent to the outfall increased proportionally. Valves in tank T-5 and a recycle flow meter will proportion the system inflow and recycle rate with the effluent to the outfall. A flow indicating/totalizer/recorder will be installed on the effluent line to the outfall for permit recording purposes.

3.6 BACKFILLING AND SITE RESTORATION

3.6.1 EXCAVATION BACKFILL

Backfill requirements address replacing soils removed from excavated areas. At the Hematite Site all replaced backfill is classified as general fill; no special fill for structural foundations will apply.

3.6.1.1 Backfill Material

Backfill materials include both on-site soils determined to meet DCGLs and RGs (with or without treatment) and imported off-site soils. Imported backfill will consist of suitable soil materials from one or more sources approved in advance by Westinghouse. Such sources include Missouri Department of Transportation (MoDOT) approved commercial local

materials supplier or any excavated surface or subsurface soil that was tested for chemical and radioactivity content and found to be suitable for use as backfill material.

Suitable imported soil materials include acceptable cohesive and cohesionless materials defined under the American Society for Testing and Materials (ASTM) D-2487 Unified Soil Classification System (USCS) as SM, SC, ML, and CL. Borderline soils, as defined by USCS, which are a result of the combination of any soils classified as suitable, will be classified as suitable. USCS classification will be determined by geotechnical testing, as outlined in Table 6.

Unsuitable materials include soils that contain debris, roots, brush, sod, organic or frozen materials, or materials containing stones having a maximum dimension of greater than three inches. The presence of free liquids, chemical or radiological contamination will cause soil materials to be classified as unsuitable. Table 6 lists the requirements for chemical testing of imported backfill. Otherwise suitable material which is unsuitable due to excess moisture content will be classified as unsuitable material if it cannot be dried prior to placement by manipulation, aeration, or blending with other materials satisfactorily as determined by Westinghouse. Under no circumstances will frozen earth, snow, or ice be placed as fill. The restrictions on unsuitable soil apply to both imported materials and on-site soils to be reused.

3.6.1.2 **Compaction**

General fill will be placed in 9-inch (nominal) thick loose lifts and compacted with at least two passes of tracked heavy construction equipment (*e.g.*, bulldozer, track-loader) or roller. Low-ground-pressure track equipment or rubber-tired equipment will not be used for compaction.

3.6.1.3 **Grades**

General fill will be placed to within 6 inches of final grades as specified by Westinghouse. The upper surface will be graded smooth and uniform.

3.6.2 TOPSOIL

Topsoil includes select imported off-site soils and on-site soils specifically identified by Westinghouse that have been determined to meet DCGLs and RGs (with or without treatment) and exhibits characteristics of a suitable vegetative growth medium. Imported backfill will consist of suitable soil materials from one or more sources approved in advance by Westinghouse. Such sources include MoDOT-approved commercial local materials supplier or any excavated surface or subsurface soil that was chemically tested and found to be suitable for use as topsoil.

Suitable imported soil materials for topsoil include acceptable cohesive and cohesionless materials defined under USCS as SM, SC, ML, CL, and MH. Borderline soils, as defined by USCS, which are a result of the combination of any soils classified as suitable, will be classified as suitable. USCS classification will be determined by geotechnical testing, as outlined in Table 6.

Topsoil will be free from refuse, any material toxic to plant growth, woody vegetation, stumps, roots, clods of clay, stones, or any other object larger than two inches in greatest dimension. Sod and herbaceous growth such as grass and weeds do not have to be removed, but will be mixed thoroughly into the soil during handling operations. The topsoil will have a pH ranging between 5.0 and 7.5 and an organic content between 10 and 20 percent, as determined through laboratory testing of representative samples (Table 7).

The topsoil layer will be placed in one 6-inch-thick lift. Traffic on and compaction of the topsoil layer will be kept to a minimum so that it is properly aerated. If excessive compaction of the topsoil occurs in a given area, the area will be tilled to reduce the in-place density of the topsoil layer.

3.6.3 FINAL GRADING

Figure 12 presents the final grading plan. This plan is design to promote surface water runoff without excessive concentrating flows that would otherwise induce soil erosion.

3.6.4 REVEGETATION

Disturbed areas at the Site will be revegetated with a select grass mixture designed to promote low-term soil stability and minimize erosion.

4.0 IMPLEMENTATION STRATEGY

4.1 PROJECT MANAGEMENT AND ORGANIZATION

Section 9 of the DP describes the management of the Hematite Decommissioning Project, focusing on the organization, qualifications, and training of Westinghouse personnel with primary responsibility for nuclear safety. This section of the RD Work Plan summarizes the information presented in Section 9 of the DP and provides supplementary information and additional detail regarding the roles and responsibilities of Westinghouse personnel and the remediation contractors who will participate in RD and perform the duties defined in the HASP, SAP, and CQAP.

4.1.1 PROJECT PARTICIPANTS

Westinghouse is responsible for completing the Site decommissioning and Operable Unit 1 remediation. For this effort, Westinghouse will act in the traditional role of "Owner" for construction contracting but will also use Westinghouse employees and contractor personnel assembled into an integrated team to achieve decommissioning and Operable Unit 1 RA goals. Regulatory oversight will be provided both by NRC with respect to decommissioning activity and MDNR for implementation of Operable Unit 1.

4.1.2 PROJECT ORGANIZATION, ROLES, AND RESPONSIBILITIES

Figure 13 presents the project organization chart for the Hematite Site decommissioning and Operable Unit 1 remediation. This organization chart shows project contractor and subcontractor categories and corresponding reporting to the Westinghouse project management team.

4.1.2.1 Project Director

The Westinghouse Hematite Decommissioning Project and Operable Unit 1 remediation organization is led by the Project Director and a staff of functional area managers. The Project Director has overall responsibility to ensure safety and compliance during the

decommissioning and remediation of the Hematite Site while complying with applicable laws and regulations. At a minimum, the Project Director will have the following qualifications:

- Bachelor's degree in an appropriate discipline or an equivalent combination of education and experience;
- Previous managerial experience in project management of large complex projects; and
- Training in nuclear safety.

4.1.2.2 Project Oversight Committee

The Project Director is supported by a Project Oversight Committee with representatives of Radiation Protection, Licensing, and Operations functional areas. The goal of the Project Oversight Committee is to improve work place safety for the project. The Project Oversight Committee evaluates the effectiveness of and recommends improvements to safety rules, policies, and procedures. The Project Oversight Committee also reviews first-of-a-kind project activities and changes to the intent of existing programs. The Project Oversight Committee is designed to improve communications between the Project Director and the functional areas and among the functional area managers.

4.1.2.3 Functional Areas

Functional areas manager reporting to the Project Director are following (Figure 13):

- Quality Assurance;
- Security;
- Operations;
- Radiation Protection;
- Licensing;
- Project Controls;
- Project Engineering; and
- Environmental, Health, and Safety

The following sections describe the roles, responsibilities, and qualifications of the functional area managers.

4.1.2.3.1 Quality Assurance

The Quality Assurance (QA) functional area has primary responsibility for implementation of the Hematite Project Quality Plan (PQP) and is responsible for overall quality of the project. This function includes planning, organizing, and managing QA activities; providing overall QA direction to the project; managing activities of assigned personnel to ensure compliance with QA; and developing and managing the non-compliance identification and reporting process. The Quality Assurance Manager reports to the Westinghouse Corporate Quality Assurance Organization, with dotted line responsibilities to the Project Director.

The Hematite PQP is a comprehensive Site program that establishes the QA requirements and management controls for safety involving license materials and quality-related activities (*e.g.*, deeds, actions, processes, tasks, or work) which influence the achievement or verification of quality requirements and objectives associated with decommissioning the Hematite Site.

The PQP provides measures to ensure the following:

- Control of decommissioning activities affecting the quality of work performed by or for the project;
- Project work activities can be performed without undue risk to the environment, and the health and safety of employees and the public;
- Personnel training and qualification;
- Self-assessments and independence of QA personnel; and
- Procedures, instructions, and documents include quantitative and qualitative acceptance criteria for quality activities.

The Hematite PQP and its implementing procedures define the actions to be taken by Hematite management, employees, and contractors during the performance of quality-related activities to ensure QA requirements are consistently met. The QA program is based on line and staff organizations, which are held responsible and accountable for the quality of their

assigned work, and for verifying the achievement of quality-related objective through audits, surveillances, assessments, and reviews.

Contractors performing work are required to comply with the Project PQP and supporting procedures. Contractor developed procedures that are quality-related will be reviewed and audited in accordance with the PQP.

At a minimum, the manager responsible for Quality Assurance will have:

- B.S. in a relevant technical or administrative area, or equivalent experience.
- Minimum of three years experience in related fields as applicable for the specific project element.

4.1.2.3.2 Security

The Security functional area has primary responsibility for implementation of the Hematite Security Plan.

4.1.2.3.3 Operations

Operations is responsible for the safe and efficient execution of work performed by project personnel, identifying the personnel and physical resources required to complete work tasks, and interfacing with Project Engineering and Project Controls on work assigned to contractors. At a minimum, the Operations functional area manager will meet the following qualifications:

- Bachelor's degree in an appropriate discipline or equivalent combination of education and experience;
- Previous managerial experience; and
- Nuclear criticality safety training.

Operations will construct the Water Treatment Plant and provide oversight to contractor operations for procedural compliance.

4.1.2.3.4 Radiation Protection

Radiation Protection is responsible for the establishment and guidance of radiation protection programs. As such, Radiation Protection is responsible for ensuring that activities involving the use of radioactive material are conducted safely and in accordance with applicable regulatory requirements. Radiation Protection also evaluates potential and/or actual radiation exposures, establishes appropriate control measures, approves written procedures, and assures compliance with pertinent procedures and regulations. Under Radiation Protection's direction, health physics personnel collect samples, perform analyses, take measurements, maintain records, and assist in performing the technical aspects of the radiation protection program. Radiation Protection is also responsible for the radiological aspects of waste management and hazardous material transportation. Additional responsibilities of Radiation Protection include the following:

- Reviewing and approving radiological protection procedures;
- Monitoring of areas in which radioactive material is used;
- Oversight of ordering, receipt, surveys, and delivery of licensed material;
- Packaging, labeling, surveys, etc., of shipments of licensed material;
- Radiological effluent control and environmental monitoring programs;
- Radiological training of personnel;
- Inventory and leak testing of sealed sources;
- Responding to and investigating incidents involving radioactive material; and
- Maintaining required radiological records.

At a minimum Radiation Protection functional area manager will meet the following qualifications:

- A Bachelor's degree in the physical sciences, industrial hygiene, or engineering from an accredited college or university, or an equivalent combination of training and relevant experience in radiological protection;

- At least one year of work experience in applied health physics, industrial hygiene, or similar work relevant to radiological hazards associated with site remediation. This experience should involve working with radiation detection and measuring equipment;

- A thorough knowledge of the proper application and use of health physics equipment used for the radionuclides present on-site, analytical procedures used for radiological sampling and monitoring, and the methodologies used to calculate personnel exposure to radionuclides present on site;
- Strong skills in written and oral communication and organizational management; and
- Previous managerial experience.

4.1.2.3.5 Licensing

Licensing responsibilities include those Site activities necessary to ensure compliance with the NRC License SNM-33. Licensing activities include interacting with the NRC and other regulators as assigned, preparing license amendments, and reviewing planned work activities to ensure compliance with License SNM-33. The Licensing functional area also manages Nuclear Criticality Safety and Material Control and Accounting. At a minimum, the Licensing functional area manager will meet the following qualifications:

- Bachelor's degree in an appropriate discipline or equivalent combination of education and experience;
- Previous managerial experience in the environmental and safety discipline;
- Competency in nuclear criticality safety; and
- Strong skills in written and oral communication and organizational management.

4.1.2.3.6 Project Controls

Project Controls responsibilities include financial, accounting, and informational systems; office facilities and systems; the development and maintenance of the project schedule; the establishment and maintenance of financial and managerial controls; administrative support functions, including document control; project contracts; procurement of material and services; coordinating the legal and procurement reviews of all supplier and contractor contracts; and establishment of procurement systems and controls for the purchase of materials and equipment or their sale.

4.1.2.3.7 Project Engineering

The Project Engineering Manager will provide direction, final review, and internal approval of design documents, contractor shop drawing submittals, and similar engineering work product developed throughout the project. A licensed Missouri Professional Engineer and will sign and stamp all final work products developed, as necessary.

Project Engineering will take the lead role in shop drawing approval and review (and approve if acceptable) modifications to work requested by contractors.

4.1.2.3.8 Environmental Health and Safety

Under the direction of the Environmental Health and Safety (EH&S) manager, Westinghouse will complete the engineering design and construct the water treatment system.

EH&S personnel will take lead responsibility for preparing the necessary reports and documents required for implementation and certification of the RA, including preparing applicable permits.

EH&S personnel will also provide confirmatory soil sampling, health and safety support, and ambient air monitoring during implementation of the RA and documentation of remedial activities.

EH&S personnel will also provide health and safety support including health and safety monitoring during implementation of the RA and documentation of remedial activities.

4.1.3 CONTRACTORS AND SUBCONTRACTORS

In accordance with the Consent Decree, Westinghouse will formally notify MDNR of the contractor selected to perform RA prior to contract award. This notification will be accompanied by a demonstration of the contractors' capabilities to conduct the remedy. MDNR will have the right to disapprove of the contractor within 10 days of such notification.

As a result of a competitive procurement process, Westinghouse has selected Environmental Chemical Corporation (ECC) of Lakewood, Colorado as its proposed contractor to provide remedial services to implement the Operable Unit 1 RA at the Site. ECC will serve as the Prime Contractor and will be responsible for providing construction management and implementing construction services related to the decommissioning and remediation.

The ECC Project Manager will maintain overall responsibility for the technical and administrative aspects of ECC's work on the project. The ECC Project Manager will ensure that the proper resources are made available to complete all work associated with the RD on schedule and within budget. The ECC Project Manager will coordinate RA activities with Westinghouse functional area managers and serve as the primary on-site point of contact with Westinghouse functional area managers.

The ECC Health and Safety Officer will report to the ECC Project Manager and be responsible for the technical review and approval of the HASP, as well as ongoing review of project health and safety issues for the duration of the remediation.

The ECC Site Superintendent will be responsible for the ECC's RA implementation. The ECC Site Superintendent will provide direct oversight and direction of construction personnel, ECC sampling personnel, and ECC's subcontractors. The ECC Site Superintendent will provide daily updates to the ECC Project Manager regarding RA progress and will identify any potential issues that require resolution.

One or more commercial analytical laboratories will be contracted to provide off-site analytical services for chemical and radiological analyses of soil, water, and waste samples collected during remediation. Off-site laboratories will also provide analytical support for industrial hygiene and health physics monitoring during remediation. Laboratory requirements and qualifications are detailed in the SAP.

Off-site transportation and disposal facilities are discussed in Section 5.6.

4.2 REMEDIATION SCHEDULE

Figure 14 provides a Gantt chart schedule for implementation of Operable Unit 1 at the Hematite Site. The schedule shows the sequencing and expected duration for each of the major tasks. The schedule is based on a 4-day per week, 10-hour per day work schedule.

4.3 PROJECT PLANS

4.3.1 HEALTH AND SAFETY PLAN

The Hematite HASP describes the overall procedural and equipment requirements for protection of project personnel and the public for Site activities. Additionally, Westinghouse has developed a Project Health and Safety Plan (HASP) specific to the Hematite Decommissioning Project. The Westinghouse HASP provides for task-specific activity hazard analyses to identify industrial, physical, chemical, and biological hazards associated with various decommissioning and remediation activities. The activity hazard analysis will designate engineering, administrative, and personal protective equipment (PPE) control measures in addition to industrial hygiene monitoring requirements. It is envisioned that the majority of the Operable Unit 1 activities will be conducted using Level D protection. Level C protection may be needed for some excavation and waste handling activities. Work area and personnel monitoring data will be used to assess the adequacy of PPE requirements on an ongoing basis.

ECC will prepare a Site-specific HASP for its remediation and decommissioning work in accordance with OSHA requirements at 29 CFR 1910.120. Westinghouse will review ECC's HASP for consistency with the Westinghouse HASP. The Westinghouse HASP is a higher-tier plan, and any conflicts with this document will be resolved through modifications to ECC's HASP.

4.3.2 SAMPLING AND ANALYSIS PLAN

Westinghouse is preparing and will submit to MDNR a SAP that addresses the sample collection and analysis during the Operable Unit 1 remediation. The SAP, which will include

both the FSP and QAPP, will update the corresponding documents previously approved by MDNR as part of the RI. The SAP will be prepared and submitted to MDNR for review and approval prior to initiation of remedial actions. The Sampling and Analysis Plan will describe the sampling frequency, analytical methods, detection limits and data quality objectives to evaluate the effectiveness of the remedial actions. The SAP will also describe the methods for characterizing off-site backfill to be used on-site as well as the waste characterization sampling.

A separate Waste Analysis Plan will be developed by the remedial contractor to describe the procedures used to meet treatment standards, in the even the VOC treatment cell is utilized.

4.3.3 CONSTRUCTION QUALITY ASSURANCE PLAN

This section provides the CQAP for the Operable Unit 1 remedial action at the Hematite Site. The CQAP is complementary to the QAPP and other quality assurance and quality control (QA/QC) documents, procedures, and work plan for the Hematite Site decommissioning and remediation. The CQAP specifically addresses QA/QC related to construction activities.

4.3.3.1 Construction Meetings

Prior to the start of construction activities, readiness reviews will be conducted periodically to assess preparation for construction activities. A formal preconstruction meeting will be held with representatives of Westinghouse, ECC, and MDNR. During this meeting, the following items will be discussed:

- Worker health and safety protection and monitoring;
- Responsibilities of each individual and organization;
- Lines of authority and communication for each organization; and
- Protocols for reviewing contractor submittals related to construction quality *(e.g.*, shop drawings, delivery tickets);
- CQAP requirements and their role relative to the remedial action;

- Protocols for identifying and reporting deficiencies in construction and the repairs and retesting of deficiencies;
- Security; and
- Training requirements and training schedules.

The pre-construction meeting may be held in conjunction with readiness reviews and other planning steps for remediation and decommissioning.

Once construction activities have commenced at the Site, it is anticipated that daily progress meetings will be conducted at the Site. Topics related to construction safety and quality will be addressed as needed during the daily briefings.

4.3.3.2 Engineering Design Drawings and Specifications

Because this project primarily involves removal and off-site disposal of impacted materials and will be performed on a turnkey basis, the requirements for engineering design drawings and technical specifications are streamlined. These drawings and specifications have been incorporated into this RD Work Plan.

4.3.3.3 Construction QA/QC Requirements

4.3.3.3.1 Civil Surveys

Westinghouse retained a land surveyor to perform a baseline civil survey. The baseline civil survey set control points to aid in delineating the initial excavation limits of the Burial Pits and other areas of concern. The civil survey was tied to the Missouri State plane coordinate system for ready coordinate translation and areal identification. The survey used a grid system to lay out the control points and identify the Site-specific property boundaries followed by the collection of X, Y, and Z data.

Using the provided survey control, Westinghouse or its contractors will conduct subsequent construction layout surveys delineating limits of clearing, haul road alignments, initial limits of excavation, and locations of temporary facilities. Westinghouse will also conduct civil surveys at the completion of excavation in each remediation area to define the limits of

removal and provide base mapping for confirmatory soil sampling and Final Status Surveys. Both Westinghouse and ECC may conduct interim surveying of excavation areas to evaluate rates of production, quantities, and other information for construction planning purposes.

4.3.3.3.2 Haul Roads and Materials Management Areas

ECC will provide for Westinghouse review and acceptance delivery ticket and other documentation demonstrating that the materials used in construction of haul roads and on-site materials comply with the design specifications provided in Section 3.3 of this RD Work Plan. ECC will not incorporate any materials into its construction of these temporary facilities until accepted by Westinghouse.

4.3.3.3.3 VOC Treatment System

ECC will implement the engineering design of the VOC as presented in Section 3.4 of this RD Work Plan. For this activity, ECC will provide design details, shop drawings, and project plans to address the materials, equipment, and construction procedures to be employed. ECC may propose alternative designs or design details for review and approval by Westinghouse.

Westinghouse will review and provide any comments on ECC's submittals. Westinghouse's review will focus on compliance with regulatory compliance. ECC will revise its submittals as needed to address Westinghouse comments and resubmit for Westinghouse approval.

4.3.3.3.4 Water Treatment System

Westinghouse has constructed the water treatment system in accordance with the design presented in Section 3.5 of this RD Work Plan. Westinghouse will prepare final as-constructed drawings of the system and maintain documentation of equipment and materials incorporated into the installation. These records will include documentation on the calibration and initial startup of the system.

4.3.3.3.5 Backfilling and Site Restoration

To confirm compliance with the materials specifications provided in Section 3.6, imported general backfill and topsoil will be tested for the geotechnical properties as specified in Table 6. Table 6 also specifies the chemical testing requirements for imported backfill based on the source(s) of this material. Results of geotechnical and chemical testing will be submitted to Westinghouse for approval prior to importing material to the Hematite Site.

In addition to this geotechnical testing, Westinghouse will observe and collect weigh tickets from the truck loads of soil brought to the Site to ensure unsuitable soil materials are not incorporated into the backfill and to track quantities placed. Westinghouse will also observe placement and compaction operations, including periodic lift-depth checks. Westinghouse, or ECC at Westinghouse's direction, will conduct interim construction surveys to monitor backfill placement and confirm pre-final and final grades.

Westinghouse will observe seeding operations and collect delivery tickets and other documentation that the seed mixture and other soil amendments comply with the specifications provided in Section 3.6.4 of this RD Work Plan.

4.3.3.4 Documentation of Construction Activities

Activities affecting quality are documented in accordance with written manuals, procedures, instructions, specifications and drawings that contain appropriate criteria for determining whether prescribed activities have been satisfactorily accomplished. This documentation is established in the three distinct levels that integrate policies, procedures, and working documents.

4.3.3.5 Work Inspections

The Hematite PQP is an essential element of the project, and program requirements will be adhered to in the performance of activities covered by the PQP.

Work performed by or for the project will comply with the PQP and will be implemented using a "graded quality assurance" approach, meaning requirements are applied as necessary,

to achieve the level of quality specified. Using this approach, procedures are used to identify and implement control requirements for materials and services based on the complexity of the work, the function of the material or service, and the importance of materials, services, processes, and activities.

The quality of work performed by or for the HDP will be verified by audits, surveillance, and inspection.

4.3.3.6 Remedial Action Completion Report and As-Built Drawings

Completion reports will be prepared by the remedial contractor under the guidance of the Quality Assurance. Sufficient data and information will be provided in the release record to enable an independent re-creation and evaluation at some future time. Quality records are completed documents that furnish evidence of the quality of materials, services, and activities affecting quality and compliance with the CQAP and QAPP. Quality records may also include articles such as materials, samples, or test specimens when required. Additionally, Project Engineering will prepare or have prepared any as-built drawings for project deliverables. As-built drawings will be prepared when completed tasks deviate significantly from the design drawings.

4.3.4 COMMUNITY RELATIONS PLAN

Consistent with the requirements of the NCP, Westinghouse has actively worked to inform the public and to seek public input to the remediation of the Hematite Site throughout the CERCLA process. Westinghouse routinely publishes newsletters providing status reports to the public and has held public meeting at key points in the CERCLA and decommissioning processes.

Westinghouse is currently revising its Community Relations Plan to tailor its programs to better suit the Operable Unit 1 remediation and decommissioning activity. As part of this plan, Westinghouse will maintain the public document repository at the Festus Public Library and distribute updates on project status. In addition to, or in conjunction with, NRC's public

meeting in advance of decommissioning, Westinghouse plans to hold a public information session to keep the local community apprised of project status.

4.3.5 OTHER PROJECT PLANS

As part of the decommissioning process, Westinghouse has prepared several planning documents that pertain to the design and implementation of Operable Unit 1. While this RD Work Plan is intended to be a complete, stand-alone document, these other Westinghouse planning document provide supportive and complementary information regarding project management, security, nuclear safety, and monitoring. These other planning documents are cited in the references provided as Section 6.0 of this RD Work Plan.

5.0 REMEDIAL OPERATIONS

This section describes the Site operations for the Operable Unit 1 remediation at the Hematite Site, focusing on how design components and other requirements will be implemented in the field.

5.1 SITE SETUP AND INFRASTRUCTURE

5.1.1 SECURITY

The requirements for physical security and protection of remediation activities and excavated materials are provided in the Hematite Physical Security Plan (PSP). The Hematite PSP is based on the requirements of 10 CFR 73.67 for fixed site and in-transit protection of SNM of moderate and low strategic significance. The security requirements under NRC regulations for SNM are more stringent and comprehensive than typically associated with chemical waste site remediation.

Security measures to be employed during decommissioning and remediation activities are focused on controlling personnel and materials entering or leaving work areas and other portions of the Site. These measures include, but are not limited to the following:

- Maintenance of chain link-fencing along or beyond the perimeter of remediation work areas;
- Installation of temporary fencing to control access within the Site;
- Positive identification, logging, and inspection of personnel, equipment, and materials entering and leaving work zones.

Full-time security officers will implement these security measures.

5.1.2 OFFICES

Westinghouse will provide office space for project participants in buildings that are slated to remain on-site following completion of Operable Unit 1 and decommissioning. Required offices for certain Westinghouse, MDNR, and NRC personnel will be provided in Building

110. Offices for other Westinghouse and contractor personnel will be provided in Building 230. Ingress and egress to and use of office locations will be in accordance with Site security measures (Section 5.1.1).

5.1.3 TEMPORARY UTILITIES

The Hematite Site is serviced by commercial electrical, water, natural gas, and telephone utilities. As part of building demolition, which will precede the Operable Unit 1 remediation, remaining utility services will be shut off and disconnected from the buildings scheduled for demolition. These services will, however, be maintained to the buildings scheduled to remain at the Site (*i.e.*, Buildings 110, 230, and 231).

During the Operable Unit 1 remediation, electrical power will be needed to power the following:

- Dewatering pumps;
- Blower for the VOC treatment system;
- Air quality monitoring stations;
- Security monitors;
- Temporary lighting (if needed);
- Sewage Treatment Plant;
- Construction trailer(s);
- Waste Evaluation Area/Material Assay Area (Building 115);
- Soil Screening Equipment; and
- Water treatment system.

Temporary electric lines will be run from available on-site locations for the VOC treatment blow, air quality monitoring stations, and security monitors. Temporary electric lines or portable generators will be used as needed to power pumps and temporary lighting. Local electrical power is available within Building 230 to service the water treatment system.

Water for Site use during remediation (*e.g.*, dust suppression, decontamination, potable use, etc.) will be provided by the existing water supply system. Sanitary facilities will be provided by the existing sewage treatment plant, supplemented by portable facilities, up to

the time that the sewage treatment plant is removed, if necessary. If removal of the plan is required, portable facilities will be used throughout the Site.

Except for locations with Buildings 110 (offices) and 230 (offices and water treatment system), where natural gas service is already available, natural gas service will not be required during the Operable Unit 1 remediation.

5.1.4 RAILROAD SPUR

To facilitate waste transportation by rail, a railroad spur has been constructed off the Union Pacific mainline track at the south side of the Hematite Facility (Figure 10). The design of this installation is presented in Appendix B.

5.1.5 TEMPORARY FACILITIES

The temporary materials handling, VOC treatment, and water treatment facilities described in Section 3.3.1 and 3.3.2 will be installed before initiating soil and waste excavation. Construction trailers and other temporary facilities will be mobilized to the Site on an as-needed basis.

Materials handling operations are designed to minimize the potential for spreading contamination by equipment or vehicle traffic. Equipment or vehicles leaving potentially contaminated areas will be surveyed and decontaminated as necessary using "dry" methods (*e.g.*, brushing or wiping). Decontamination using water sprays will be conducted in a manner to contain any impacted wash water and to protect personnel and the public from overspray.

5.1.6 EXISTING UTILITY LOCATION AND PROTECTION

Underground utilities will be located, marked and isolated, as necessary. Prior to any excavation, the Contractor will call 1-800-DIG-RITE to identify all underground utilities.

A natural gas pipeline crosses the impacted portion of the Site adjacent and parallel to the existing Site railroad line (Figure 3). The natural gas pipeline is anticipated to remain in service for the duration of the decommissioning activities. The location and depth of this gas line below the existing ground surface has been clearly defined by excavating at intervals of approximately 40 feet and recording location coordinate data. Prior to performing excavation activities at this location, precautions and control measures for excavation activities in areas affected by the natural gas pipe line will be detailed in the appropriate work control documents. Missouri Natural Gas will be consulted if excavation encroaches within five feet of the natural gas pipeline in order to institute precautions or controls on excavation. Other Site utilities will be identified and protected during excavation.

5.1.7 PROTECTION OF MONITORING WELLS

Figure 15 shows the locations of current wells within and near the remediation areas at the Hematite Site. These wells are listed in Table 7.

5.1.7.1 Monitoring Well Abandonment

Wells within the active remediation areas will be abandoned during the Site preparation tasks for each area. Wells will be abandoned in accordance with Missouri State Well Construction Regulations (10 CSR 23-4.080). Shallow wells within excavation areas will be removed in their entirety as part of the remedial effort. Not less than 20 business days prior to the planned abandonment, Westinghouse will submit a letter to the MDNR Federal Facilities Section requesting approval.

5.1.7.2 Monitoring Well Protection

Monitoring wells near, but not within planned excavation areas, will be protected as needed to minimize the potential for damage during remediation. Wells will either be refinished as flush-mounted wells by a Missouri Licensed Driller and/or protected. Refinished flush-mounted wells will either be fitted with a road box capable of supporting heavy loads or be protected as if it were a well finished above grade. For any well not refinished as a flush-mounted well and considered to be particularly vulnerable to damage during RA activities

(*i.e.*, wells within close proximity to the excavations, traffic routes, or areas involving the use of heavy equipment), bollards fence posts, or other similar barrier painted or marked for visibility will be installed around the well for more permanent and durable protection. Records of well reconstruction will be submitted to the well head protection group of MDNR.

5.2 ENVIRONMENTAL CONTROLS AND MONITORING

The following subsections describe the potential water discharges and air emissions associated with the Operable Unit 1 remediation and how this potential releases will be controlled. Water and air monitoring programs are also summarized; details of these programs are provided in the Hematite EEMP.

5.2.1 STORM WATER MANAGEMENT

The primary goal of storm water management is to provide storm water pollution prevention and maintain compliant discharges the NPDES Permit (MO-0000761) as issued by MDNR. Storm water management must also be conducted in accordance with the Storm Water Pollution Prevention Plan requirements of the Jefferson County Land Disturbance Permit (Section 2.5.1.3).

5.2.1.1 Control of Uncontaminated Water

Managing uncontaminated surface water is primarily focused on diverting such water around work areas and controlling potential soil erosion and sedimentation induced by uncontaminated Site runoff. Best management practices to be used throughout the remediation include grading and berming active excavations and materials handling areas to minimize run-on. Erosion and sedimentation controls are discussed in Section 5.2.1.3.

Specific water management actions may include diverting Northeast Site Creek.

It may also be necessary to manage any sanitary wastewater generated during the remediation of the former Leach Field. It is anticipated that the water will be radiologically

impacted, and will therefore require treatment. The water will be disinfected using a chlorination technique prior to treatment in the water treatment system. After removal of the bacteria from the sanitary wastewater, it will be collected for treatment at the existing wastewater treatment facility with treated wastewater discharged under the NPDES permit.

5.2.1.2 Control of Contaminated Water

The following tasks summarize the process and control measures for the handling of surface water and groundwater from contaminated or potentially contaminated areas:

- Collecting the infiltration that enters the sidewalls and bottoms of water into the excavations from shallow groundwater or perched water sources;
- Grading the bottoms of excavations so that water drains to collection points that then convey the water to sumps;
- Installing pump intakes at the sumps and pumping the water to a staged holding tank (T-1) and then pumping the collected water to the on-site treatment system;
- Containing runoff within outdoor handling areas for potentially contaminated materials;
- Collecting contained run-off from outdoor handling areas for potentially contaminated materials and pumping collected water to the on-site treatment system;
- Processing the collected water through the water treatment system.
- Discharging collected water in accordance with the requirements of the NRC license, the effluent limitations and other requirements of the MDNR-issued NPDES permit.

Solids collected in filtration media or settled in collection tanks will be surveyed and sampled for chemical COPCs and radiological constituents prior to removal and placement in approved containers. These extracted materials and packaged materials will then be managed with other waste materials for off-site disposal.

5.2.1.3 Erosion And Sedimentation Controls

Erosion and sedimentation controls will be installed before the initiation of clearing and grubbing. These controls will include silt fencing to control suspended solids associated with

sheet flow. Silt fencing will be installed in accordance with the requirements of per the Jefferson County Land Disturbance Permit. In addition, the larger of the Evaporation Ponds will be employed as a temporary storm water retention basin. This pond will receive runoff from the load-out pad area and those areas southeast of the process building slabs. The accumulated water will be tested for parameters identified in the NPDES permit and MO-ARAR013 and, if compliant, discharged to surface water downstream of the Hematite Facility. If the collected water contains COPCs above the effluent limits defined in the NPDES permit or MO-ARAR013, the water will be pumped to the on-site water treatment system for processing and discharge.

5.2.1.4 Storm Water Discharge Monitoring

Site discharges, including storm water discharged, are monitored in accordance with the MDNR-issued NPDES permit.

5.2.2 AIR EMISSIONS

Potential air emissions associated with Operable Unit 1 include the following:

- Particulate matter (dust);
- Radiological contaminants;
- VOCs; and
- Emissions from internal combustion engines on demolition equipment and transportation vehicles.

Particulates include nuisance dust, inhalable particulates, and fine particulates, and could, if proper mitigative measures are not taken, include asbestos fibers.

5.2.2.1 Dust Control

Particulates can be generated in excavation, on-site material haulage, and materials handling and load-out.

5.2.2.1.1 Dust Control Techniques

The primary methods to be employed in controlling fugitive dust generation during excavation, haulage, and handling include the spray application of water (with or without surfactants or other additives) or covering of exposed materials to the extent practicable. When airborne dust generation is observed, water sprays will be used to wet haul roads as a means of dust control. If fugitive dusts are observed at excavation or materials handling areas, water will be applied as needed with hoses using high-pressure nozzles that can create a fog or mist that acts to knock down particulates from the air and minimize the volume of water applied. In all cases, the objective is to apply sufficient water to control dust generation by achieving saturation or near-saturation conditions at the surface of porous materials but not in such excess quantities as to create appreciable surface water runoff or free liquids associated with the waste materials.

The rate of water application and the total volume to be used cannot be reliably estimated. Weather conditions (*e.g.*, precipitation, wind speed, solar radiation, and temperature) as well the characteristics of the soils being handled will affect the rate of generation. Water application procedures and effectiveness will heavily rely on the expertise and experience of Site management and the trained work force. If dust generation and water application become a frequent requirement, the use of surfactants or other additive that prolong the effectiveness of a water application will be evaluated.

In addition to water application, other dust control measures will be employed. These measures include the following:

- Covering or closing transportation containers once they are loaded;
- Transporting materials off-site in enclosed or covered containers; and
- Restricting the on-site movement of transportation vehicles to designated haul roads and materials handling areas.

5.2.2.1.2 Airborne Particulate Action Levels

Action levels are established to define the point at which work activities must be adjusted and measures taken to assure that air emissions are not exceeding regulatory requirements. For the Operable Unit 1 remediation, action levels will be both qualitative and quantitative. If either the qualitative or quantitative action level is exceeded, efforts for dust control (e.g., watering) will be intensified, and additional dust control measures enacted (e.g., covering stockpiles).

For fugitive dust, the qualitative action level is designed for compliance with the MDNR regulation regarding fugitive dust from demolition operation (10 CSR 10-6.170). If at any time visible emissions are observed leaving the work area and traveling downwind toward the property boundaries, supervisory personnel will modify or curtail work activities as needed until measures can be taken to ensure that fugitive dust emissions are not migrating beyond the premises of origin in quantities that: 1) the particulate matter may be found on surfaces beyond the property line of origin; or 2) the particulate matter emissions are visible in the ambient air beyond the property line.

The quantitative action level standard for airborne particulates is based on protecting ambient air quality and will be set at 500 micrograms per cubic meter ($\mu g/m^3$) over a 15-minute averaging time, as measured by real-time aerosol monitors located downwind of work areas. These real-time monitors will be used to determine the concentration of airborne particulate matter with an aerodynamic diameter of 10µ (PM_{10}). A concentration of 500 $\mu g/m^3$ over a 15-minute averaging time is a conservative action level for compliance with the National Ambient Air Quality Standard (NAAQS) for PM_{10}, which is set at 150 $\mu g/m^3$ averaged over 24 hours.

5.2.2.1.3 Airborne Particulate Monitoring

Airborne particulate monitoring will be conducted to characterize exposures for the protection of workers. Personal air monitoring readings will be taken to characterize Site activities. Airborne dust/particulate concentrations will be measured using real-time aerosol

monitors, which employ a scattered light photometric sensing cell, when there are visible signs of airborne dust in the work area. Calibration and maintenance of air monitoring equipment will follow manufacture specifications and be properly documented. Recalibration and adjustment of air monitoring equipment will be completed as Site conditions and equipment operation warrant. Air monitoring action levels, as given in Section 5.2.2.1.2, have been developed that stipulate the particulate concentrations in the breathing zone that require an action based on exposure levels.

5.2.2.2 Airborne Radiological Contamination

A measurable amount of airborne radioactivity may be created during decommissioning activities such as building demolition, buried waste excavation, and soil remediation. The concentration of airborne radioactivity for a specific work activity shall be estimated prior to the start of the work. In developing the estimate, personnel may consider results from similar previous work, calculations of what fraction of contamination will become airborne, and conservative assumptions about unknown conditions.

Perimeter Sampling of air effluents shall be performed using low-volume portable sampling pumps when work activities involve the potential to generate, at the perimeter of the work activities, airborne radioactivity concentrations in excess of 20 percent of the annual limits specified in 10 CFR 20, Appendix B, Table 2, Column 1. Note that the air concentrations within the work area will be measured independently of the perimeter sampling; air concentrations within the work area are measured using personal air sampling pumps or additional low-volume portable sampling pumps.

The number and location(s) of perimeter portable air sampler(s) shall be selected near the perimeter of the work area, with consideration for the location and nature of the work activities and environmental conditions such as wind direction. For example, during railcar loading operations typically 2 air sampling location will be selected, and their location will not be fixed to allow placement appropriate for the work.

In addition to portable perimeter samplers, air monitors are positioned at fixed locations near the perimeter of the Central Tract Area. The ALARA goals, investigation levels, and regulatory limits for airborne effluents will also be applied to these fixed monitoring locations. The ALARA goals investigation levels, and regulatory limits are based on percentage of the applicable annual limits specified in 10 CFR 20, Appendix B, Table 2, Column 1. The percentages are 20, 50, and 100 for The ALARA goals investigation levels, and regulatory limits, respectively.

Effluent air samples shall be analyzed for gross alpha radioactivity and gross beta radioactivity. The Minimum Detectable Concentration (MDC) target for gross alpha analysis of air effluents is established at 50 percent of the applicable 10 CFR 20 Appendix B, Table 2, Column 1 limits[1] (with a target goal of 20 percent where practical). The MDC target for gross beta analysis of air effluents is established at 5 percent of the applicable 10 CFR 20 Appendix B, Table 2, Column 1 limits.

5.2.2.3 **Airborne VOC Emissions**

Airborne emissions of VOCs are potentially associated with on-site waste excavation and handling and with emissions from the VOC treatment system.

Fugitive VOC emissions from excavations and material handling may be difficult to control because of the near-immediate release once VOC-containing materials are exposed to the atmosphere. Sustained sources of VOC emissions will be identified by the monitoring with hand-held instruments used to guide excavations. If a potentially significant source of airborne VOCs is identified, the effort will be made to expedite the removal of these materials to the VOC treatment facility, where they will be covered and vented through vapor-phase carbon adsorbers.

[1]The volume of air that can be sampled in a 24-hour period limits the MDC that can be achieved for alpha radioactivity within a reasonable counting time. To achieve an MDC for gross alpha radioactivity at 2.5E-15 µCi/ml would require a 10-hour count time for the sample and 10-hour count time for background radioactivity. Thus, the MDC for samples collected on a daily frequency is set at the ALARA Investigation Limit of 50 percent of the license limit, instead of 5 percent as recommended by Regulatory Guide 4.16.

At the water treatment system, located indoors in Building 230, the equalization/storage tanks (T-2 through T-4) are covered tanks vented through vapor-phase carbon to a roof vent. All other process vessels are closed vessels.

Organic vapor monitoring will be conducted to characterize exposures for the protection of workers. Personal air monitoring readings will be taken to characterize Site activities as well as during activities where contaminated media are present, including normal working operations, excavating, changing filter media, and materials handling. A background reading will be taken before the start up of activities and periodically thereafter. Organic vapor concentrations will be monitored in the field with a photoionization detector (PID). Calibration and maintenance of air monitoring equipment will follow manufacture specifications and will be properly documented. Recalibration and adjustment of air monitoring equipment will be completed as Site conditions and equipment operation warrant. Air monitoring action levels have been developed that stipulate the particulate concentrations in the breathing zone that require an action based on exposure levels:

- When organic vapor readings are 0 to 5 parts per million by volume (ppmv) above background, normal operations may continue. Continue work area and breathing zone monitoring.
- When organic vapor readings more than 5 ppmv above background are sustained for 5 minute or longer, coordinate with EH&S for guidance.
- Whenever organic vapor readings are more than 25 ppmv above background, a stop-work order is required. Leave work area, and contact EH&S for guidance.

Additionally, whenever noticeable odors outside the work zone as determined by project personnel are detected, work ceases until mitigated or approved by EH&S.

5.2.2.4 Vehicle Emissions

Emissions associated with the internal combustion engines on construction equipment and transportation vehicles are considered to be of minor importance. To ensure that construction equipment emissions are controlled, construction equipment will be required to contain the manufacturers' recommended emission control systems.

5.3 CLEARING AND GRUBBING

In areas where clearing and grubbing is necessary, hand tools (e.g., chain saws) and construction equipment will be used to fell trees, remove underbrush, and remove tree stumps in accordance with the design and to the limits set by Westinghouse (Section 3.1.1). Cleared and grubbed material will be sized, shredded, and staged with similar wastes for off-site disposal.

5.4 SOIL AND BURIED WASTE EXCAVATION AND HANDLING

Removing buried waste and contaminated soil will entail excavation, materials handling, and construction dewatering. Excavations rates, methods, and materials handling are primarily controlled by the limitations imposed for compliance with nuclear safety concerns. As a result, excavations will be conducted in a deliberate and methodical manner as described in the following subsections.

5.4.1 PREPARATORY STEPS

In certain remediation areas, preparatory steps are needed before proceeding with excavations.

5.4.1.1 Concrete Foundation Removal

The floor slabs, foundations, and process drains associated with the demolished structures (*i.e.*, Building 240, Building 253, Building 254, Building 255, Building 256, and Building 260) will be removed as described in Chapter 8 of the DP. Depending on the waste acceptance criteria of the disposal facility, concrete foundations, slabs, and paved areas may be decontaminated prior to removal, or simply removed and prepared for off-site disposal without decontamination. Samples of processed concrete and asphalt will be analyzed to determine compliance with appropriate release criteria and/or waste acceptance criteria for candidate waste disposal facilities.

If surfaces are decontaminated to facilitate off-site disposal, decontamination of concrete slabs, foundations, and paved surfaces would be performed using standard methodologies, which may include swabbing, HEPA-vacuuming, mechanical grinding, scabbling, chipping, saw-cutting, chemical stripping, and power-washing surface areas. Contamination surveys of surfaces of concrete slabs would be performed prior to and following decontamination efforts. Surfaces that cannot be decontaminated to levels below the unconditional release criteria would be disposed of as LLRW.

Whether or not decontaminated in advance of removal, breaking and sectioning (sizing) concrete foundations, slabs and paved areas will be performed using an excavator equipped with a hydraulic breaker, or other concrete processing equipment that allows breaking of concrete and asphalt into pieces of manageable size. Steel reinforcing will be removed as necessary, and sections that cannot be readily decontaminated will be segregated. Broken concrete slabs, foundations, and other materials from paved areas will then be processed for off-site disposal.

5.4.1.2 Supernatant Removal

In both the Site Pond and former Evaporation Ponds, standing water (supernatant) will be removed to the maximum extent practicable in advance of soil excavation.

At the Site Pond, a water diversion system will first be installed to manage the water that normally flows into the Site Pond from the spring and Outfall No. 3. Once the inflow-bypass system is operational and diverting the inflow of the Site Spring and Outfall #003, the Site Pond will be drained. Site Pond water will be drawn down in accordance with Site discharge permits, sampled, and processed as necessary for discharge under the Water Management Plan. It is envisioned that most of the water in the pond could be drained by controlled lowering of the dam weir level; the final water removal would be accomplished by pumping.

After water removal, sediments and soils will be allowed to dry naturally before proceeding with excavation.

5.4.2 INITIAL EXCAVATION LIMITS

Westinghouse will conduct the surveying and lay out the initial excavation limits in each remediation area based on characterization data and historical Site operations information. Because of the relatively large areal extent, the excavation limits in the Burial Pit Area will be defined by delineating the areas to be excavated. If practicable, two excavating crews will start at different areas and work the Burial Pit Area simultaneously. This approach will be employed as long as there is sufficient space for heavy equipment to operate safely and without cross-contamination and for the on-site facilities to efficiently handle the materials generated in excavation.

5.4.3 SCREENING AND EXCAVATION OF LIFTS

The excavation and removal of soils and buried waste will be conducted within the defined remediation areas. Beginning at the surface, and following any needed preparatory steps (Section 5.4.1), excavation will proceed in a series of lifts. The depth of the excavation lifts will be determined based on the area being excavated and the criticality safety assessment for that area.

5.4.3.1 General Sequencing

Following is the general order of techniques to be employed in removing soil from contaminated areas and handling these materials with respect to radiological condition.

Soil will be evaluated using in-situ gamma walkover surveys and visual inspection of the exposed surface. This evaluation is repeated for each newly exposed surface following each lift removal.

After the evaluation, the soil will be excavated and removed in thin lifts. Excavated soils will be segregated based on the results of the visual inspection, radiological and chemical survey/screening. Excavated soil will be stockpiled adjacent to the excavation or loaded into a haul truck for transfer to the Waste Consolidation Area.

Soil overburden transferred to the Waste Consolidation Area will be consolidated, inspected, and loaded into a haul truck for evaluation at the High-Resolution Gamma Survey Station. This High-Resolution Gamma Survey Station will be used for all materials originating from the burial pit areas. Material confirmed to be acceptable for re-use will be transferred to the Clean Soil Stockpile. Material exceeding the re-use criteria will be disposed of as radioactive waste.

The excavation process will include sloping and benching, as required. These activities will continue until visual inspections indicate the wastes and impacted soils have been removed, and surveys and screening instrument responses indicate levels below the DCGLs and RGs.

For Operable Unit 1, excavations do not need to be extended below the local groundwater table to remove soils that are solely impacted by VOCs. In the field, a decision to stop excavating prior to achieving RGs would be made, in consultation with MDNR, based on the material being excavated and the degree of groundwater infiltration to the excavation. If principle threat wastes are encountered, efforts will be made to remove them to the maximum extent practicable.

5.4.3.2 **VOC Screening**

In parallel with the in-situ gamma walkover surveys and visual inspection, a PID will be employed to identify VOC-impacted materials. Initially, a positive response of the PID in this screening will be taken as indication of the presence of VOC-impacted materials; as additional experience is gained through the Operable Unit 1 project, Westinghouse may adjust this set point to reduce “false positive” responses and unnecessary soil treatment and handling.

At ten percent of the locations where positive PID readings are indicated, a sample of the material will be collected for a more controlled headspace evaluation. The sampling will be biased to collect samples from the locations exhibiting the highest PID reading. The standard operating procedure for this headspace testing is defined in the SAP. Not less than 10 percent of the samples selected for headspace analysis will be submitted for laboratory

analysis of VOCs. The results of this headspace and laboratory testing will allow for improved identification of VOC-impacted materials and reduce the occurrence of false-positive readings as the project proceeds.

5.4.4 OTHER MATERIALS AND OBJECTS

5.4.4.1 Removal of Discrete Objects

When objects are encountered in the soil, excavation will generally be performed using heavy equipment. More controlled and precise methods and equipment may be used as deemed necessary, and it is anticipated some hand shoveling would be necessary to preclude damage to the object.

Excavated drums or containers will be prepared and placed into over-pack containers for subsequent transfer to the Waste Evaluation Area or the Collared Drum Buffer Storage Area for transport to the Waste Evaluation Area. Smaller containers will be transferred as soon as possible and containerized in accordance with NCS protocols.

5.4.4.2 Asbestos

Historical records for the Burial Pit Area suggest that RACM may be present in the subsurface. Materials at the Red Room Roof Burial Area may also contain RACM. The removal of potentially RACM will be performed by a Missouri certified asbestos abatement contractor in accordance with asbestos requirements under National Emissions Standards for Hazardous Air Pollutants (NESHAPS) requirements (40 CFR 61, Subpart M) and the corresponding Missouri regulations. The procedures used by the contractor will be made available to MDNR prior to the initiation of RACM removal.

5.4.4.3 Non-Aqueous Phase Liquids

Excavations in the Burial Pit Area, Evaporation Ponds, or in soils beneath the process buildings may encounter non-aqueous phase liquid. Such liquid would likely be present in seams or parting of clayey soils. If encountered, these liquids would be placed in drums

using the excavation equipment or, more likely, by hand shoveling. These materials would then be separately characterized and profiled for off-site disposal.

5.4.5 CONFIRMATORY SAMPLING

Once the limits of excavation are achieved based on visual inspections for the removal of buried waste and surveys and screening instrument responses indicate levels below the DCGLs and RGs, sampling will be performed to confirm completeness of removal. Confirmatory sampling for radiological constituents and VOCs will be conducted in parallel.

For radiological constituents, the confirmatory sampling primarily takes the form of Final Status Surveys as described in Section 5.8.

For VOCs, confirmatory soil sampling will be conducted to confirm attainment of RGs. The sampling strategy will be described in the Sampling and Analysis Plan which will be prepared prior to the initiation of remedial actions. The Sampling and Analysis Plan will describe the sampling frequency, analytical methods, detection limits and data quality objectives to evaluate the effectiveness of the remedial actions.

A separate Waste Analysis Plan will be developed by the remedial contractor to describe the procedures used to meet treatment standards, in the event that the VOC Treatment Cell is utilized. The document will be provided by the remedial contractor performing the treatment.

5.5 SORTING AND SEGREGATION

The Site operations procedures rely on the on-site sorting, segregation, and treatment of exhumed materials to minimize the quantities of wastes requiring off-site disposal and to maximize the quantity of material deemed suitable for reuse as on-site backfill. Sorting and segregation procedures are designed to properly classify the exhumed solid wastes and soils according to the material type, degree of radiologic impacts, and the degree of VOC impacts. Table 5 lists the eight potential material classifications and the expectations regarding the on-

site treatment and disposition of these various categories of materials. In addition to these classifications, material exhibiting abnormal radiation levels, intact containers, and similar items will be separately managed on-site prior to off-site disposal.

5.5.1 FISSILE MATERIAL INCLUDING RECOVERABLE MATERIAL

For excavations involving the removal of buried wastes, soils, or subsurface structures (*e.g.*, concrete slabs, buried piping) in areas where it is determined that the presence of fissile materials is a reasonable possibility based on characterization data and historical knowledge, Chapters 8 and 10 of the DP provide screening and handling approaches that have been analyzed from a nuclear criticality safety perspective. Screening for fissile materials during remediation is the initial goal. Such screening typically will involve duplicate performance of radiological surveys, using sodium iodide scintillation detectors, of defined volumes of material to ensure that nuclear criticality safety limits have not been exceeded. The objective of the in situ radiological surveys is to identify any item or region of soil/waste above a conservatively defined threshold fissile concentration. The in-situ radiological surveys are complemented by visual inspection of the survey area with the aim of identifying:

- Items with the potential to contain fissile material (e.g., a process filter);
- Items that resemble intact containers;
- Bulky objects with linear dimensions exceeding the excavation lift thickness; and
- Metallic items.

During fissile material screening, the secondary remedial action objectives of identifying hazardous materials (*e.g.*, VOCs), and verifying radioactivity concentrations of potential backfill soils will also be completed. Excavation will continue in areas of suspected fissile materials to a depth where historical knowledge, and/or visible and radiological evidence indicate that suspect materials have been removed. Once fissile material screening has determined that fissile materials are not present in the remediation area in excess of approved limits, nuclear criticality safety controls are then curtailed. By making this nuclear criticality

safety the initial goal, remaining remediation and Final Status Survey activities can proceed unencumbered by nuclear criticality safety controls.

Identified items that exceed nuclear criticality safety limits will be segregated into designated collared drums, or into field containers, which are placed in Collared Drums. Individual designated containers will he handled and stored in accordance with the specific procedures defined in the DP.

5.5.2 LLRW

For LLRW (*i.e.*, materials that are radiologically impacted but not VOC-impacted), field screening will be performed to establish an initial material classification, followed by sampling and analysis to validate the field screening classification. Excavated LLRW will be loaded directly into haul trucks for transfer to the Waste Consolidation Area (or stockpiled adjacent to the excavation until a sufficient quantity is available for transport to the Waste Consolidation Area) for final visual inspection. Soils and materials excavated from the burial pit area will be assayed at the High-Resolution Gamma Spectrometry Station. Materials confirmed to be radiologically contaminated will then be sent to the Waste Handling Area for stockpiling, loading, verification of compliance with waste acceptance criteria, and subsequent transportation to off-site disposal facilities.

5.5.3 VOC-IMPACTED MATERIALS

Materials identified by field screening to be VOC-impacted (Section 5.4.3.2) will be separately transferred to the Waste Consolidation Area for inspection. If the materials originated from the burial pits, they will be sent to the High-Resolution Gamma Survey Station for further radiological screening. From that point, they will be transferred to the appropriate cell of the VOC treatment system as defined in Section 3.4.3.

5.5.4 DRUM HANDLING

Excavation and subsequent sorting operations during remediation of buried waste areas (*e.g.*, Burial Pit Area, Red Room Roof Burial Area) may identify intact or damaged drums or other containers. Inspection, movement, opening, and other handling of drums and other intact containers will comply with OSHA regulations at 29 CFR 1926.65(j).

Overpacked drums and Field Containers will be transferred to the Waste Evaluation Area or the Material Assay Area for assay and evaluation. Field screening will be used to sort radiological versus non-radiological wastes, and further field screening (e.g., solubility, PID screening, pH determination) will be used to classify containerized waste materials. The results of the evaluation and classification will determine the appropriate handling, storage, and final disposition of drums or containers.

5.6 VOC TREATMENT

If on-site VOC treatment is utilized, a separate Waste Management, Minimization and Treatment Plan and a Waste Analysis Plan will be developed by the remedial contractor to describe the procedures used to meet treatment standards. The documents will be submitted to MDNR for review and approval based on the following understanding:

- Missouri has adopted by reference 40 CFR 260 which regulate the treatment of hazardous wastes;
- The regulation allows generators to treat their own waste in approved accumulation units in accordance with a Waste Analysis Plan; and
- The accumulation units, if used, are described in the Waste Management, Minimization and Treatment Plan.

Westinghouse will submit the Waste Management, Minimization and Treatment Plan and the Waste Analysis Plan for review no less than 30 business days prior to the planned start date

of utilizing the treatment system, and use of the treatment system will not begin until written approval is received from MDNR.

5.7 OTHER HAZARDOUS WASTE HANDLING

In addition to VOC-containing wastes, other potentially hazardous wastes could be encountered during remediation of buried waste areas (*e.g.*, Burial Pit Area, Red Room Roof Burial Area). The handling of corrosive, toxic, flammable, and reactive wastes is discussed in the following sections.

5.7.1 CORROSIVE WASTE

Intact metal containers of corrosive wastes are not expected to exist in a burial environment. Intact plastic or glass containers containing fluids could be encountered, however, and such containers would be evaluated in the field to determine if they contain aqueous-based (versus organic) corrosive wastes. If the corrosive waste is an organic acid or base, this material will be containerized for off-site disposal.

If aqueous-based acidic or basic liquids are identified, the waste will be neutralized with the appropriate reagent to achieve an acceptable pH. After adjusting the pH, the solution will be analyzed for metals and VOCs. If constituent concentrations in the solution are comparable to those in other influent streams, the solution will be added to the equalization tank (T-2) for the water treatment system for treatment and discharge. The precipitate will be analyzed for metals and organics using the TCLP procedure in advance of off-site disposal. Disposition of these solids will depend on TCLP results. Depending on the metals present and concentrations, it may be practicable to stabilize these materials in containers to reduce leachable metals concentrations and render them non-hazardous prior to off-site disposal.

5.7.2 TOXIC WASTE

Containerized liquids and solids could contain concentrations of metals that would render them characteristic hazardous waste. Reliable field methods are not available for this

determination, and encountered containerized inorganic liquids and solids will be analyzed for metals concentrations. Aqueous-based liquids with elevated metals levels could then be treated in small quantities (e.g., containers) to reduce metals levels with the solution and precipitate then handled as described in Section 5.7.1. Depending on the physical characteristics of the solids and types and concentrations of metals present, these materials could either be stabilized in containers to reduce leachable metals concentrations and render them non-hazardous prior to off-site disposal or sent off-site for disposal as hazardous waste.

Concentrated organic liquids may be encountered in intact containers or from pockets of liquid under ruptured containers. Field screening (e.g., solubility, PID readings) can be used to identify organic liquids and generally classify them as non-halogenated versus halogenated and volatile versus semi-volatile.

If concentrated organics are encountered, these materials collected in a suitable container and further tested for flammability, TCLP organics, and polychlorinated biphenyls (PCBs). Such liquids are expected to be packaged for off-site treatment and disposal at an incinerator or solvent recovery facility. If found to exhibit concentrations consistent with other influent streams and not to contain constituents detrimental to system operations (*e.g.*, PCBs), the organic liquids could be added to the equalization tank (T-2) for the water treatment system for treatment and discharge.

5.7.3 FLAMMABLE WASTE

Certain concentrated organic liquids (*e.g.*, non-halogenated volatile organics) could exhibit the characteristics of a flammable hazardous waste (*i.e.*, flashpoint less than 140 degrees Fahrenheit). Flammable wastes would be segregated from other wastes while staged on-site and packaged for off-site treatment and disposal at an incinerator or solvent recovery facility.

5.7.4 REACTIVE WASTE

Reactive wastes would not typically be encountered in a burial environment. If suspicious or unique containers are encountered, these will be handled as possibly containing reactive

wastes. Methods for handling, movement, and opening such containers will comply with OSHA regulations at 29 CFR 1926.65(j). Identified reactive wastes will be segregated from other waste materials for needed specialized handling and off-site disposal.

5.8 OFF-SITE TRANSPORTATION AND DISPOSAL

5.8.1 WASTE CHARACTERIZATION

All waste generated at HDP will be characterized to established the appropriate classification of the waste. The results of the characterization will be used to segregate materials into the appropriate waste stream. Appropriate methodologies will be used to perform characterization and will be included in site waste procedures.

5.8.2 PACKAGING

All waste will be packaged for shipment according to the local, state, and Federal transportation regulations for each of the identified waste streams. In particular, the requirements of 49 CFR 171-179 for the transportation of hazardous materials, including radioactive materials, and 10 CFR 71 will be followed. Waste will be shipped to and disposed at a permitted facility.

5.8.3 OFF-SITE TRANSPORTATION

The primary means of transportation of radioactive waste from the Hematite Site will be by rail service and gondola. Westinghouse has completed construction of a spur off the Union Pacific Railroad mainline to facilitate use of rail transportation. A secondary means of transportation of radioactive waste will be by truck/trailer.

In all cases, transportation of waste materials will be performed using permitted and licensed haulers in accordance with U.S. Department of Transportation (DOT) regulations given in 49 CFR 171 through 179 and other applicable state and local regulations. The Hematite Waste Management and Transportation Plan defines transportation requirements.

5.8.4 OFF-SITE DISPOSAL

Westinghouse has identified waste treatment and disposal facilities can potentially accept and properly manage the applicable waste streams anticipated to be generated at the Hematite Site. LLRW will be shipped for processing and/or disposal to one of the following locations or other appropriate out-of-state facilities:

- Studsvik-RACE, LLC., Memphis, Tennessee;
- Energy Solutions, Inc., Oak Ridge, Tennessee;
- Energy Solutions, Inc., Clive, Utah;
- Perma-Fix Environmental Services, Inc., Oak Ridge, Tennessee; and
- US Ecology, Grandview, Idaho.

If LLMW is encountered, it may be shipped for processing and/or disposal to the following locations or other appropriate out-of-state facilities:

- Permafix of Florida, Inc., Gainesville, Florida;
- Energy Solutions, Inc., Oak Ridge, Tennessee;
- NSSI, Houston, Texas;
- Energy Solutions, Inc. Clive, Utah; and
- US Ecology, Grandview, Idaho.

In addition to LLRW and LLMW, non-radiologically impacted materials to be transported and disposed of off-site include solid wastes, soils that do not achieve RGs through treatment, and other soils found to be chemically impacted but not amenable to on-site treatment (*e.g.*, elevated PAHs). These materials will be shipped to permitted out-of-state disposal facilities.

Regardless of the sites selected for processing and disposal, wastes will be prepared for transport to the facilities in accordance with the receiving site waste acceptance criteria, disposal site license, and DOT and applicable hazardous and solid waste regulations.

5.9 FINAL STATUS SURVEYS

Upon confirmation the applicable DCGLs and RGs have been met, excavations will be prepared for Final Status Surveys. A Final Status Survey Plan is currently being developed

for the Hematite Site. This plan is a separate deliverable to NRC under the Decommissioning Plan and will be reviewed and approved by NRC.

Open excavations will be maintained throughout the Final Status Survey process until restoration is authorized. Depending on the season and prevailing weather, excavations may be covered with tarps. Upon Westinghouse approval, crusting agents or binders may be applied, to preserve the surface and limit erosion or the potential for generation of dust.

Documentation of the Final Status Survey will occur in a Survey Unit Release Record for each survey unit and will include a historical record of the Final Status Survey process. A Final Status Survey Report will be prepared to include the Survey Unit Release records as appendices and will provide a summary of the survey results and the overall conclusions that demonstrate the Site, or portions of the Site, meets the radiological criteria for unrestricted use.

It is anticipated that the Final Status Survey Report will be provided to the NRC in phases as remediation and Final Status Survey are completed with related portions of the Site. The phased approach for submittal is intended to provide NRC with detailed insight regarding the remediation and Final Status Survey early in the process, to provide opportunities for improvement based on feedback, and to support a logical and efficient approach for technical review and independent verification. An NRC contractor may, at the request of the NRC, perform confirmatory surveys and sampling prior to approval of the Survey Unit Final Status Survey.

5.10 SITE RESTORATION

Excavations will be restored using backfill obtained from on-site soils determined to be suitable for re-use and backfill material from pre-approved sources. The Site restoration design requirements are provided in Section 3.6.

At the Site Pond, remediation of the concrete dam will involve decontamination or removal if needed to meet the appropriate DCGLs and RGs. If, based on the final Site configuration,

surface water retention is needed as part of the long-term surface water management plan, a new dam will be constructed during Site restoration, and prior to removal of the water inflow bypass. If the dam is removed, but surface water retention need not be restored in the Site Pond, the pond area would be restored to reestablish natural drainage.

Excavation areas will be isolated and maintained throughout Final Status Surveys and until restoration is authorized. Accordingly, the timing and sequencing of Site restoration activities will depend on the schedule for the Final Status Surveys. Erosion control devices will be maintained until adequate vegetative cover has developed.

5.11 DEMOBILIZATION AND PROJECT CLOSE-OUT

5.11.1 EQUIPMENT DECONTAMINATION

Temporary fixtures, trailers, generators, fuel tanks, supplies, and equipment will be surveyed, decontaminated as necessary for unconditional release, and removed from the Site.

Techniques for decontamination include dry methods, such as using impregnated fabric wipes or dry wipes; or wet decontamination using a high-pressure wash, with or without surfactant, as appropriate. Surfaces will be allowed to dry before unconditional release surveys are performed on equipment and material decontaminated by wet methods. If wet decontamination methods are used, procedures will be established to collect and treat decontamination liquids; to contain and collect and dispose of mud and debris; and to control overspray.

5.11.2 TEMPORARY FACILITY REMOVAL

Additional tasks that may be performed during demobilization include the following:

- Removing temporary haul roads, staging areas and gravel footing; and
- Grading to pre-remediation contours, to the maximum extent practical; with adjustments made to the grade, to mitigate the potential for surface water to pool over the remediated site.

Once a vegetative cover is reestablished, erosion control devices (*e.g.*, silt fence) will be removed. Temporary facilities will be removed and the perimeter fence secured.

5.11.3 FINAL AS-BUILT SURVEYS

Westinghouse will conduct final as-built surveys and prepare (or have prepared on its behalf) final record drawings showing post-remedial conditions.

6.0 REFERENCES

WESTINGHOUSE AND RA CONTRACTOR PROJECT PLANS

Decommissioning Plan

Effluent and Environmental Monitoring Plan

Final Status Survey Plan

Physical Security Plan

Project Health and Safety Plan

Project Management Plan

Project Quality Plan

Security Plan

Waste Management, Minimization, and Treatment Plan (ECC)

Waste Management and Transportation Plan

Water Management Plan

OPERABLE UNIT 1 PROJECT DOCUMENTS

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U.S. Environmental Protection Agency, 1999. "RCRA/Superfund Hotline Monthly Report, October 1999," EPA 530-R-99-012j, SUB-9224-99-010. See RCRA Online Data Base at http://yosemite.epa.gov/osw/rcra.nsf/ea6e50dc6214725285256bf00063269d/FFFC57D800938AC1852568E300468568/$file/14409.pdf. October.

TABLES

Table 1
Summary of TCE and PCE Uses
Hematite Facility

Site Location	Process Description/Application
Trichloroethylene (TCE)[1]	
Building 255 – Item Plant	Dispersion agent for milling/mixing of dry materials in high-enriched fuel formulation. TCE used for its physical properties and because chlorine is a nuclear poison (absorbs neutrons).
Building 255 - Old Development Office	Removal of floor tiles during building renovations (limited use due to TCE volatility).
Building 250 - Red Room	Medium in column to extract kerosene and tri-butyl phosphate from liquor of water and dissolved uranium.
Building 260 - Oxide Conversion	Component of purchased chemical product ("Cranko") used as binder in fuel pellet manufacturing (agglomeration process). Additional TCE (or TCA) was added to the binder as diluent/thinner.
Plant wide	General cleaning/degreasing agent.
Tetrachloroethylene (PCE)	
Building 255 – Old Development Office; Building 240 - Red Room, and Green Room; possibly other locations	Removal of floor tiles during building renovations.
Building 240 - Red Room	"Direct Green" process for converting high enrichment uranium hexafluoride (UF_6) to uranium tetrafluoride (UF_4) and then to uranium dioxide (UO_2). The PCE was chemically reacted with the UF_6 to remove fluorine atoms and produce UF_4.
Building 240 – Green Room?	Development work for converting UF_6 to low-enrichment UF_4).

Notes:

[1] In some interviews, former plant employees indicated that certain of these uses were actually 1,1,1-trichloroethane (TCA), not TCE. Other interviews suggest only TCE was used. The RI identified TCE as a COPC in both soils and groundwater due to elevated concentrations in numerous samples. TCA was not found in elevated concentrations, leading to the conclusion that, even if TCA was used in operations at some times, only TCE usage is relevant to the evaluation of the proper classification of RCRA hazardous wastes potentially generated in the Operable Unit 1 remediation.

Table 2
Buried Waste and Impacted Soil Quantity Estimates
Hematite Site

Remediation Area	Estimated Volume (ft^3)	
	Total Excavation	VOC-Impacted Material
Burial Pits	601,000	60,100
Evaporation Ponds	42,000	4,200
Building Slabs and Soil Beneath Buildings	183,000	18,300
Red Room Roof Burial Area, Cistern Burn Pit, and Wood Barn Floor	7,000	0
Former Leach Field	2,500	0
Spent Limestone	57,000	0
Site Pond	17,000	0
Total	909,500	82,600

Table 3
Operable Unit 1 ARARs and TBC Guidance

Chemical-Specific ARARs and TBC Guidance

Medium	Authority	Requirement	Status	Requirement Synopsis
Soil	Federal	NRC Standards for Protection Against Radiation, 10 CFR 20, Subpart E Radiological Criteria for License Termination	Applicable	This NRC rule establishes requirements for termination of license and release of a site. Specifically, this NRC rule requires the residual radioactivity levels do not result in a total dose to an individual exceeding the specified standards set forth in this NRC rule.
	State	Missouri Hazardous Waste Management Law (RSMo 260) and Regulation 10 CSR 25-7.268	Applicable	Incorporates 40 CFR Part 263 by reference, and rcontains the land disposal restrictions of hazatrdous substances generated during remediation.
		Missouri Risk-Based Corrective Action (MRBCA)	Applied TBC Guidance	Provides default clenaup standards for chemcial COPCs in soils.
Surface Water	Federal	Clean Water Act, National Pollutant Discharge Elimination System (NPDES) (40 CFR 122 – 125)	Applicable	Discharges to navigable waters are regulated by permit, with effluent limitations and/or monitoring requirements applied to specific constituents. Permitting is required for point-source discharges and for storm water discharges associated with industrial activity, including waste disposal areas.
	State	Missouri Clean Water Law, Storm Water Regulations (10 CSR 20-6)	Applicable	Storm water point sources and land disturbances that would result in a storm water point source discharge are required to receive a permit from MDNR.
		Missouri Clean Water Law, Water Quality Standards (10 CSR 20-7)	Applicable	Defines criteria to protect surface waters of the state and defines the state anti-degradation policy.
Air	Federal	Clean Air Act, National Primary and Secondary Ambient Air Quality Standards (40 CFR 50)	Relevant and Appropriate	These standards are not source-specific, but rather are national limitations on ambient air intended to protect public health and welfare. They define acceptable airborne concentrations of conventional air pollutants.
		Clean Air Act, National Emission Standards for Hazardous Air Pollutants (40 CFR 61 and 63)	Applicable; Relevant and Appropriate	These regulations develop emission standards for source types that emit hazardous air pollutants. Parts of NESHAPS are relevant and appropriate to on-site treatment of VOCs and handling waste materials containing RACM.
	State	Missouri Air Conservation Law (RSMo 643) and Regulations (10 CSR 5.180, 6.080, 6.240, and 6.250)	Relevant and Appropriate	These regulations implement the Federal standards and incorporate Federal NESHAPS requirements.

Table 3
Operable Unit 1 ARARs and TBC Guidance

Location-Specific ARARs

Medium	Authority	Requirement	Status	Requirement Synopsis
Floodplains and Wetlands	Federal	Clean Water Act Section 404 (40 CFR 230.10 and 33 CFR 320)	Applicable	A permit is required for discharging dredged or other fill materials into waters of the United States, including jurisdictional wetlands, navigable streams (including the floodway), and certain lakes. Applicable to the remediation of Site Pond sediments.
	State	Missouri Clean Water Law, Water Quality Certification	Applicable	Missouri requires a water quality certification for any fill activities that require a Clean Water Act Section 404 permit. Applicable for the remediation of Site Pond sediments.
Sensitive Ecosystems and Habitats	Federal	Fish and Wildlife Coordination Act (16 USC 661 *et seq* ., 40 CFR 6.302)	Relevant and Appropriate	Actions that will impact fish and wildlife must include action to protect affected fish and wildlife resources. This law prohibits diversion, channeling, or other activity that modifies a stream or river and affects fish or wildlife. Consultations may be required for remediation of Site Pond.
		Migratory Bird Treaty Act (16 USC 703 *et seq.*)	Relevant and Appropriate	Actions taken or funded by Federal agencies that result in the killing, hunting, taking, or capturing or any migratory birds, part, nest, or egg are unlawful. Consultations may be required for remediation of Site Pond.
Groundwater Protection	State	Missouri Clean Water Law, (644.051)	ARAR	Section 644.051 makes it unlawful for any person to cause pollution of any water of the state (including subsurface waters) or to place or permit to be placed any water contaminant in a location where it is reasonably certain to cause pollution of any water of the state.

Table 3
Operable Unit 1 ARARs and TBC Guidance

Action-Specific ARARs

Authority	Requirement	Requirement Synopsis
Federal	NRC Requirement to Decommission (10 CFR 70)	The basic requirement to decommission an NRC licensed site that contains special nuclear material is given in 10 CFR 70.38(h)(2). This regulation also contains the requirements for contents of a decommissioning plan and references the radiological criteria for decommissioning contained in 10 CFR Part 20, Subpart E.
	NRC Standards for Protection Against Radiation, Subpart I Storage and Control of Licensed Material (10 CFR 20)	Establishes requirements for secured access and surveillance of licensed materials stored within a controlled area.
	NRC Packaging and Transportation of Radioactive Materials (10 CFR 71)	Establishes requirements for packaging, preparation for shipment and transportation of licensed material.
	RCRA Criteria for Municipal Solid Waste Landfills (40 CFR 258)	Establishes minimum national criteria for management of non-hazardous waste. Non-hazardous waste must be hauled and disposed of in accordance with these RCRA regulations.
Federal	RCRA Hazardous Waste Management System - General (40 CFR 260)	Provides definition of terms and general standards applicable to 40 CFR 260 - 265, 268. Applicable to remedial alternatives that involve generation of a hazardous waste. Hazardous waste must be handled and disposed of in accordance with RCRA.
	RCRA - Identification and Listing of Hazardous Waste (40 CFR 261)	Identifies solid wastes that are subject to regulation as hazardous wastes.
	RCRA - Standards Applicable to Generators of Hazardous Waste (40 CFR 262)	These regulations establish requirements for the on-site management of any hazardous wastes that may be generated in the course of the remedial action.
	RCRA - Standards Applicable to Transporters of Hazardous Waste (40 CFR 263)	These regulations establish requirements for the off-site transportation of any hazardous wastes that may be generated in the course of the remedial action.
	RCRA - Standards Applicable to Owners and Operators of Treatment, Storage, and Disposal Facilities (40 CFR 264)	Establishes the minimum national standards that define acceptable management of hazardous waste. Applicable to construction of on-site hazardous waste disposal or treatment facility and to any off-site treatment/disposal of generated hazardous waste.
	RCRA – Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (40 CFR 265)	These regulations establish interim status requirements for operating hazardous waste treatment, storage, and disposal facilities.
	RCRA-Conditional Exemption for Low-Level Mixed Waste Storage and Disposal (40 CFR 266, Subpart N)	This regulation provides an exemption of low level mixed waste from the definition of hazardous waste if the waste meets certain eligibility requirements and the site operator meets certain conditions.

Table 3
Operable Unit 1 ARARs and TBC Guidance

Action-Specific ARARs

Authority	Requirement	Requirement Synopsis
Federal	RCRA Land Disposal Restrictions (40 CFR 268 Subpart C)	These regulations set prohibitions on the land disposal of hazardous wastes and would be relevant and appropriate to remedial alternatives encompassing waste exhumation.
	RCRA Treatment Standards (40 CFR 268 Subpart D)	These regulations set treatment standards for types of hazardous waste that must be met prior to land disposal.
State	Missouri Hazardous Substance Rules (10 CSR 24)	Established state-wide emergency telephone number to notify Missouri if a hazardous substance emergency occurs. Also specifies requirements for emergency notification and follow-up written notices in the event of a hazardous substance emergency.
	Missouri Hazardous Waste Management Law (RSMo.260) and Regulations (10 CSR 25)	Provides regulatory framework for identification, storage, transportation and disposal of hazardous wastes. Missouri requirements generally mirror Federal requirements at 40 CFR 260 through 265 and 268 (with some modifications and enhancements).
	RSMo. 260.200(4)	Contains Missouri Hazardous Waste Management Law definitions, including the definition for clean fill material.
	RSMo. 260.200(34)	Contains Missouri Hazardous Waste Management Law definitions, including the definition for solid waste.
	RSMo. 260.210.1(1)	Missouri Hazardous Waste Management Law that restricts illegal dumping activities. This would govern the disposal method chosen during the remedial activities.
	RSMo. 260.210.9(1)	Missouri Hazardous Waste Management Law that regulates clean fill. This is applicable to alternatives with contain on-site fill operations.
	10 CSR 25-3.260	Contains definitions for terms used throughout this rule.
	10 CSR 25-4-260.475 to 260.479	This regulation sets forth characteristics and lists to be used to determine if a solid wasted is a hazardous waste. This regulation incorporates 40 CFR Part 261 by reference.
	10 CSR 25-4.261	Incorporates 40 CFR Part 261 by reference, and regulates containerized or bulk wastes that are removed for off-site disposal.
	10 CSR 25-5.262	Incorporates 40 CFR Part 262 by reference, and requires that hazardous wastes shipped off-site be handled in accordance with the applicable generator regulations.
	10 CSR 25-6.263	Incorporates 40 CFR Part 263 by reference, and regulates the transportation of hazardous waste for off-site disposal.
	10 CSR 25-7.264(2)(F)	Incorporates 40 CFR Part 264 Subpart F by reference, and governs the monitoring and management of contaminated groundwater that originate for releases from solid waste management units.

Table 3
Operable Unit 1 ARARs and TBC Guidance

Action-Specific ARARs

Authority	Requirement	Requirement Synopsis
State	10 CSR 25-7.264(2)(G)	Incorporates 40 CFR Part 264 Subpart G by reference, and governs the closure and post-closure care of hazardous waste management facilities.
	10 CSR 25-7.264(2)(I)	Incorporates 40 CFR Part 264 Subpart I by reference, and governs the use and management of containers for hazardous waste.
	10 CSR 25-7.264(2)(J)	Incorporates 40 CFR Part 264 Subpart J by reference, and governs tank use management and closure of hazardous waste.
	10 CSR 25-7.264(2)(CC)	Incorporates 40 CFR Part 264 Subpart CC by reference, and contains the air emission standards for tanks and containers that are used to store hazardous waste.
	Missouri Water Well Driller's Law (RSMo 256.600 to 256.670) and Regulations (10 CSR 23)	These regulations govern the well, monitoring well, and pump installation industry.
	10 CSR 23-4	This rule governs the construction, registration and abandonment of monitoring well is Missouri.
	10 CSR 23-6	This rule regulates the installation and abandonment of test holes installed to provide geologic or mineral data.
	Missouri Solid Waste Management Law (RSMo.260.200 to 260.245) and Regulations (10 CSR 80)	These regulations generally mirror Federal requirements at 40 CFR 258. They govern disposal of solid waste and specify the types of solid waste excluded from disposal in a sanitary landfill, including regulated quantities of hazardous waste and certain radioactive wastes.
	10 CSR 80-2.020(9)	This regulation allows for permit exemptions, including those for beneficial use of solid waste.
	10 CSR 80-3.010(3)	The rule regulates sanitary landfill waste streams.
	10 CSR 80-4.010(3)	The rule regulates demolition landfill waste streams.
	Missouri Hazardous Waste Management Law (RSMo.260.350 to 260.552) and Regulations (10 CSR 25-7.264 Subpart N)	These regulations set forth standards for landfill site suitability demonstrations, design and operating requirements. The standards modify or add to those found in RCRA 40 CFR 264.
Federal	Clean Water Act, Section 402, National Pollutant Discharge Elimination System (NPDES) (40 CFR 122 – 125)	Requires a permit for every discharge of pollutants form a point source to waters of the United States. Permit gives right to discharge specified pollutants from specified outfalls, normally for a period of five years.

Table 3
Operable Unit 1 ARARs and TBC Guidance

Action-Specific ARARs

Authority	Requirement	Requirement Synopsis
State	Missouri Clean Water Law (RSMo 644) and Regulations (10 CSR 20)	These regulations provide a regulatory framework for treatment of wastes discharged into waters of the State and sets forth limits for various pollutants which are discharged into waters of the State. Establishes permitting requirements and effluent limitations.
	10 CSR 20-2	Contains the definitions of terms used in regulations pursuant to the Missouri Clean Water Law.
	10 CSR 20-6.010	This regulation contains the permitting requirements for construction and operation of a wastewater treatment facility.
	10 CSR 20-6.060	This regulation contains the permitting requirements for placing fill material in navigable waters of the State.
	10 CSR 20-6.200	This rule contains the storm water management regulations and permit requirements.
State	10 CSR 20-15	This regulation specifies the technical and administrative requirements for above-ground storage tanks.
	10 CSR 20-15.010	This regulation specifies which above-ground storage tanks must comply with the technical requirements of 10 CSR 20-15 and defines the terms used.
Federal	Clean Air Act, National Primary and Secondary Ambient Air Quality Standards (40 CFR 50)	These standards are not source-specific, but rather are national limitations on ambient air intended to protect public health and welfare. They define acceptable airborne concentrations of conventional air pollutants.
	Clean Air Act, National Emission Standards for Hazardous Air Pollutants (40 CFR 61 and 63)	These regulations develop emission standards for source types that emit hazardous air pollutants.
State	Missouri Air Conservation Law (RSMo 643) and Regulations (10 CSR 10)	Places restrictions on particulate matter beyond premises of origin Applicable for reference methods for total suspended particulates and PM10 monitoring, general emissions from remediation activities.
	10 CSR 10-6.080	These regulations incorporate Federal NESHAPS requirements.
	10 CSR 10-6.170	Restricts the emission of particulate matter to the ambient air beyond the premise of origin.
	10 CSR 10-6.180	This regulation provides the conditions for testing of emissions.
	10 CSR 10-6.240	This rule regulates registration, notification and performance requirements for asbestos abatement projects.

Table 3
Operable Unit 1 ARARs and TBC Guidance

Action-Specific ARARs

Authority	Requirement	Requirement Synopsis
State	10 CSR 10-6.250	This rule regulates certification, accreditation, and business exemption requirements for asbestos abatement projects.
Federal	Occupational Safety & Health Administration (29 CFR 1910)	These regulations specify requirements for health and safety protection for workers potentially exposed to contaminants in hazardous waste site remediation. Also includes employee "Right-to-Know" regulations.
	Occupational Safety & Health Administration (29 CFR 1926)	These regulations specify the type of safety equipment and procedures to be followed during construction activities, including earthwork construction.
Federal	Hazardous Materials Transportation Regulations (49 CFR 173, Subpart I)	These regulations set forth the U.S. Department of Transportation (DOT) requirements for packaging and transportation of radioactive material. These requirements are prescribed in addition to, not in place of, NCR regulations under 10 CFR 71.
	Hazardous Materials Transportation Regulations (49 CFR 171-179)	These regulation establish definitions and provisions for transporting hazardous materials; marking, labeling and placarding requirements; as well as general requirements for shipments rand packaging.

Table 4
Chemical Constituents of Potential Concern and Applicable Remediation Goals[2]

CHEMICALS OF CONCERN	REMEDIATION GOALS FOR OU1 (mg/kg)			BASIS OF REMEDIATION GOAL
	Surface soil	**Subsurface Soil**	**Sediment**	**MRBCA Table B-1 Lowest Default target Levels**
Volatile Organic Compounds (VOCs)				
Cis-1,2 dichloroethylene	0.521	0.521	---	Groundwater Protection pathway
Trans-1,2 dichloroethylene	1.10	1.10	---	Groundwater Protection pathway
Trichloroethylene (TCE)	0.141	0.141	---	Groundwater Protection pathway
Perchloroethylene (PCE)	0.141	0.141	---	Groundwater Protection pathway
Vinyl Chloride	0.0192	0.0192	---	Groundwater Protection pathway
Polynuclear Aromatic Hydrocarbons (PAHs)				
Benzo(a)Anthracene	6.12	---	---	Groundwater Protection pathway
Benzo(a)Pyrene	0.62	---	---	Soil Direct Contact pathway
Benzo(b)Fluoranthene	6.19	---	---	Soil Direct Contact pathway
Indeno (1,2,3-cd)Pyrene	3.77	---	---	Soil Direct Contact pathway
Total PAHs[1]	---	---	2.0	
Metals				
Arsenic	9.6	---	---	Calculated from background data.

Notes:
[1] Total PAHs is the sum of the concentrations of 13 specific polynuclear aromatic hydrocarbons.

Table 5
Potential Categories of Excavated Materials

Material Type	Degree of Radiologic Impact	Degree of VOC Impact	On-Site Treatment	Disposition
Solid Waste	Above DCGLs	Elevated VOCs	Yes, to render non-RCRA hazardous	Off-site disposal: LLRW/LLMW[1]
		Not VOC-Impacted	No	Off-site disposal: LLRW
	Below DCGLs	Elevated VOCs	Yes, to render non-RCRA hazardous	Off-site disposal: industrial waste[2]
		Not VOC-Impacted	No	
Impacted Soil	Above DCGLs	Elevated VOCs	Yes, to render non-RCRA hazardous	Off-site disposal: LLRW/LLMW
		Not VOC-Impacted	No	Off-site disposal: LLRW
	Below DCGLs	Elevated VOCs	Yes, to render non-RCRA hazardous and to meet PRGs	On-Site Backfill
		Not VOC-Impacted	No	

Notes:

[1] For the Energy Solutions, Inc. (Energy Solutions) facility in Clive, Utah, Condition 14.B of the Radioactive Material License prohibits Energy Solutions from disposing of characteristic LLMW after treatment in the low-LLRW disposal cell. Energy Solutions has extended this condition to LLMW treated by generators before shipment. Unless Energy Solution elects to modify its internal policy for the Westinghouse Hematite Site, any waste that, at the point of generation, is determined to be a hazardous waste in accordance with 40 CFR 261 and shipped to the Energy Solutions Clive facility for disposal will be disposed of in the LLMW disposal cell. See Energy Solutions Waste Acceptance Criteria at http://www.energysolutions.com/alpha/license/BWF_WAC.pdf. Other potential disposal facilities do not have similar policies.

[2] Although regulatorily acceptable, from a practical perspective, it may be difficult to receive approval for disposal of such materials in out-of-state industrial waste disposal facilities unless radiation levels are shown to be comparable to background.

Table 6
Geotechnical and Chemical Testing Program for Imported Soils

Component	Required Test	Minimum Testing Frequency	Acceptance Criteria
Common Backfill	Laboratory Classification (ASTM D 2487)	1 every 2,000 cubic yards	USCS SM, SC, ML, and CL, plus borderline soils.
	Sieve Analysis with Hydrometer (ASTM D 422)	1 every 2,000 cubic yards	Maximum particle size of 3 inches.
	Atterberg Limits: Liquid Limit, Plastic Limit, Plasticity Index (ASTM D 4318)	1 every 2,000 cubic yards	Consistent with acceptable soil classifications
	Lift Depth Check by Hand-Auger, Boring, or Other Manual Method	1 per 2,000 square feet of remediation area; per lift	< 9 inches compacted depth.
	Chemical Testing[1]: VOCs, SVOCs, PCB, Pesticides, and Metals (EPA SW-846); Full TCL and TAL, plus radionuclides	Commercial Supplier: 1 per source per 5,000 cubic yards	MRBCA default criteria for residential soils, or as otherwise approved by Westinghouse.
		Borrow pit on agricultural land (approved by Westinghouse): 1 per source per 3,000 cubic yards	
		All other sources (approved by Westinghouse): 1 per source per 1,000 cubic yards	

Table 6
Geotechnical and Chemical Testing Program for Imported Soils

Component	Required Test	Minimum Testing Frequency	Acceptance Criteria
Topsoil	Laboratory Classification (ASTM D 2487)	1 every 2,000 cubic yards	USCS SM, SC, ML, CL, and MH, plus borderline soils.
	Sieve Analysis with Hydrometer (ASTM D 422)	1 every 2,000 cubic yards	Less than 5% by volume > 1-inch particle size.
	Atterberg Limits: Liquid Limit, Plastic Limit, Plasticity Index (ASTM D 4318)	1 every 2,000 cubic yards	Consistent with acceptable soil classifications; Maximum of 40% passing No. 10 sieve shall have particle size < 0.002 mm.
	Lift Depth Check by Hand-Auger, Boring, or Other Manual Method	1 per 100 foot centers for each remediation area	> 6 inches/maximum 7 inches in depth (tracked).
	Organic Content (ASTM 2974)	1 every 2,000 cubic yards	1% < Organic Content < 5%.
	pH	1 every 2,000 cubic yards	6.2 < pH < 7.4
	Chemical Testing[1]: VOCs, SVOCs, PCB, Pesticides, and Metals (EPA SW-846); Full TCL and TAL, plus radionuclides	Commercial Supplier: 1 per source per 5,000 cubic yards	MRBCA default criteria for residential soils, or as otherwise approved by Westinghouse.
		Borrow pit on agricultural land (approved by Westinghouse): 1 per source per 3,000 cubic yards	
		All other sources (approved by Westinghouse): 1 per source per 1,000 cubic yards	

Table 7
Monitoring Wells to be Removed or Abandoned

Groundwater Well	Location
BD-06	Building 255 Slab
BD-08	Building 255 Slab
BP-5A	Burial Pits
BP-20D	Burial Pits
BP-22B	Burial Pits
EP-20	Evaporation Ponds
LF-09	Leach Fields
NB-80	Burial Pits
WS-15	Burial Pits
WS-16	Burial Pits
WS-23	Burial Pits
WS-25	Burial Pits
WS-26	Burial Pits
WS-28	Burial Pits

FIGURES

Figure 1. Site Location Map

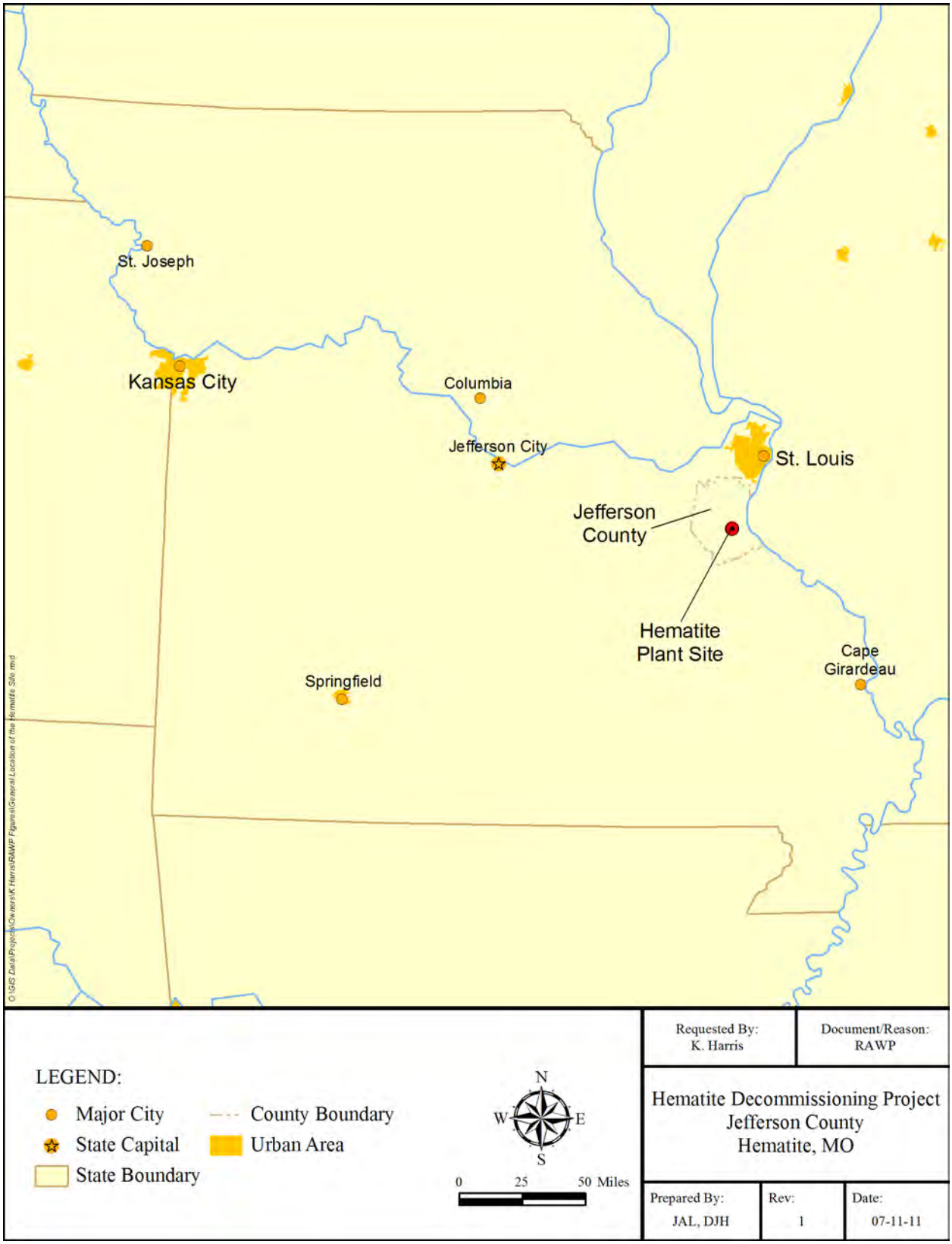


Figure 2. Site Map

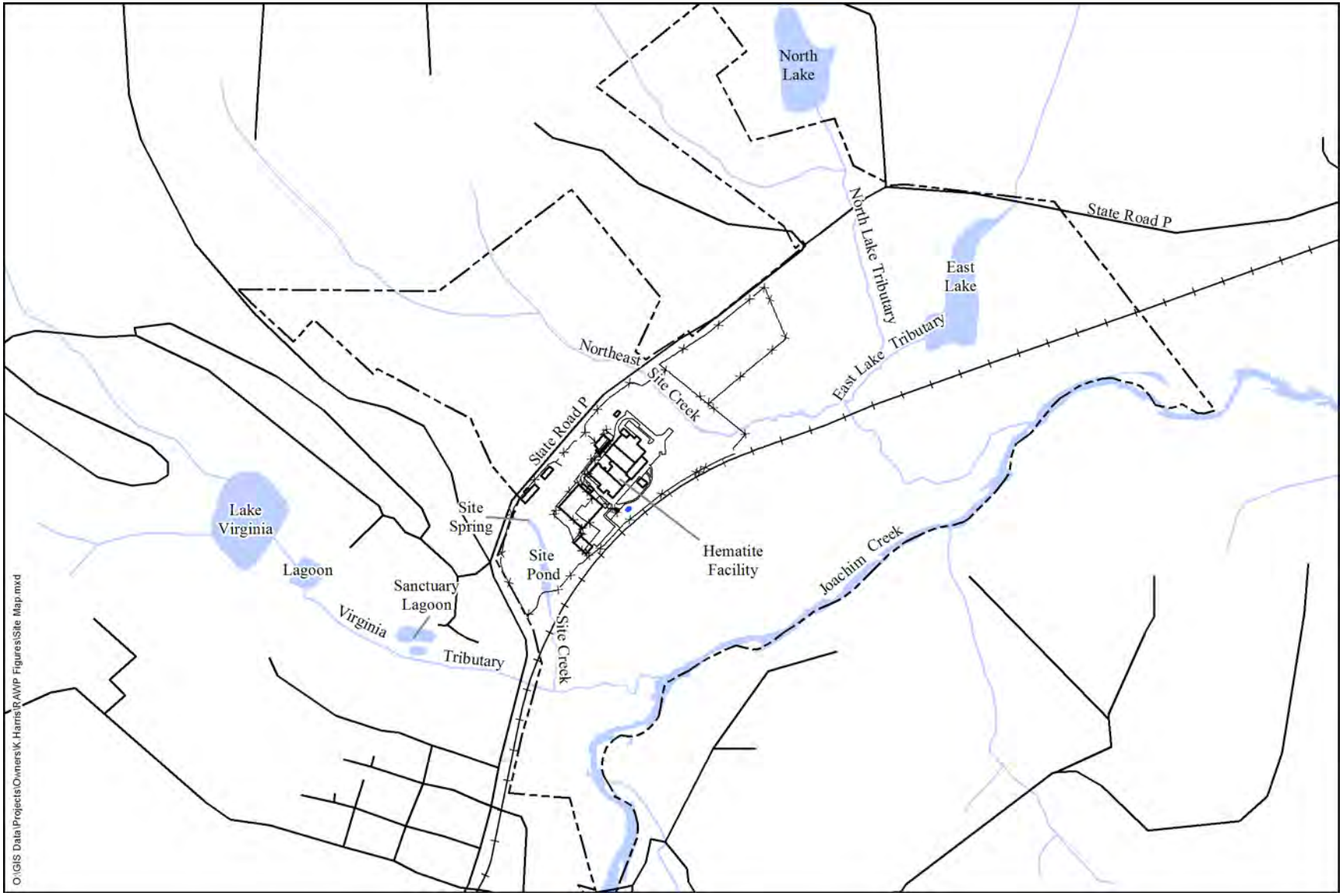


Figure 3. Remediation Areas

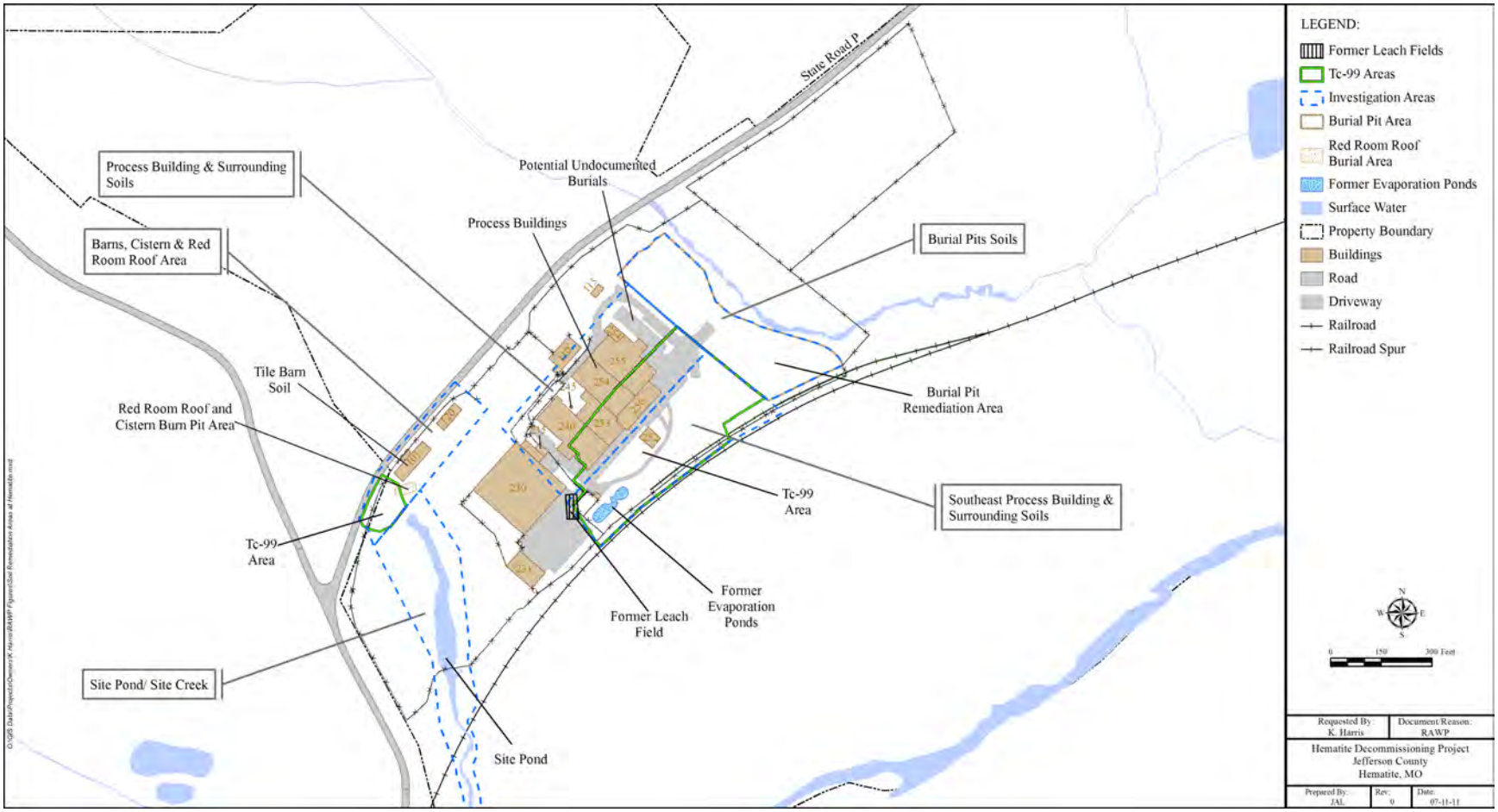


Figure 4. Schematic Cross Section, Overburden Units

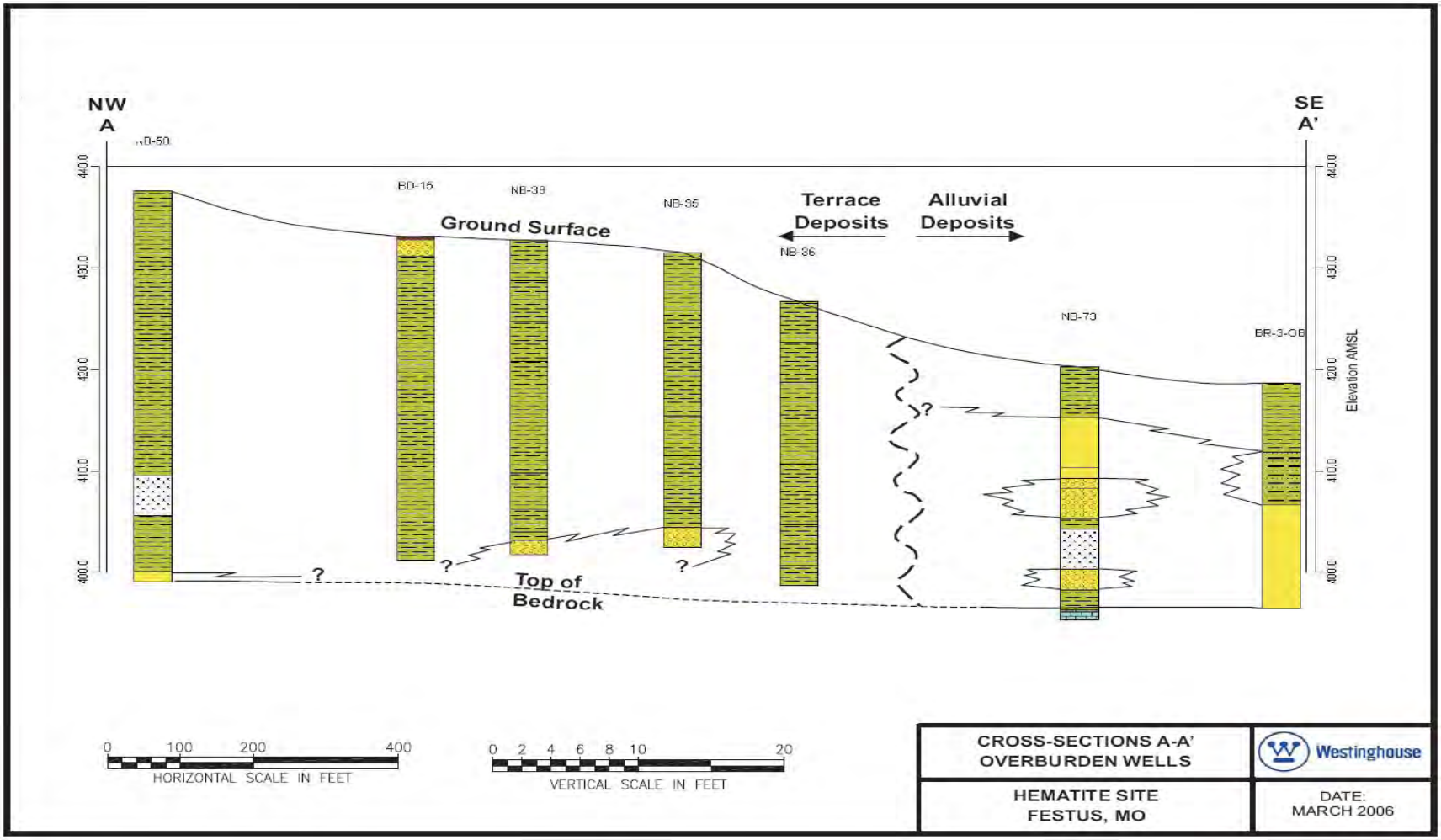


Figure 5. Generalized Overburden Groundwater Surface Map

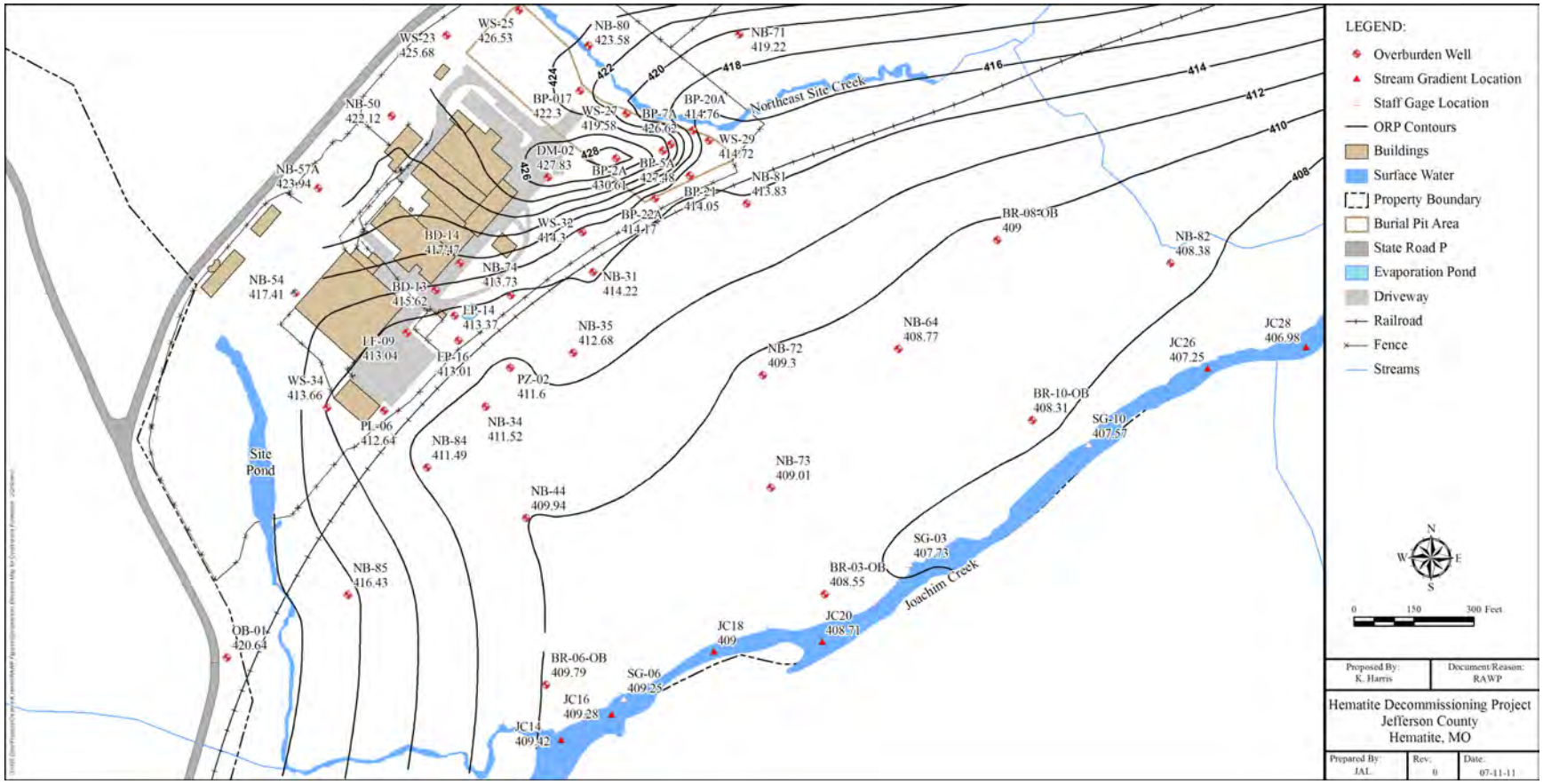


Figure 6. Limits of Clearing

Figure 7. Soil and Buried Waste, Initial Excavation Limits

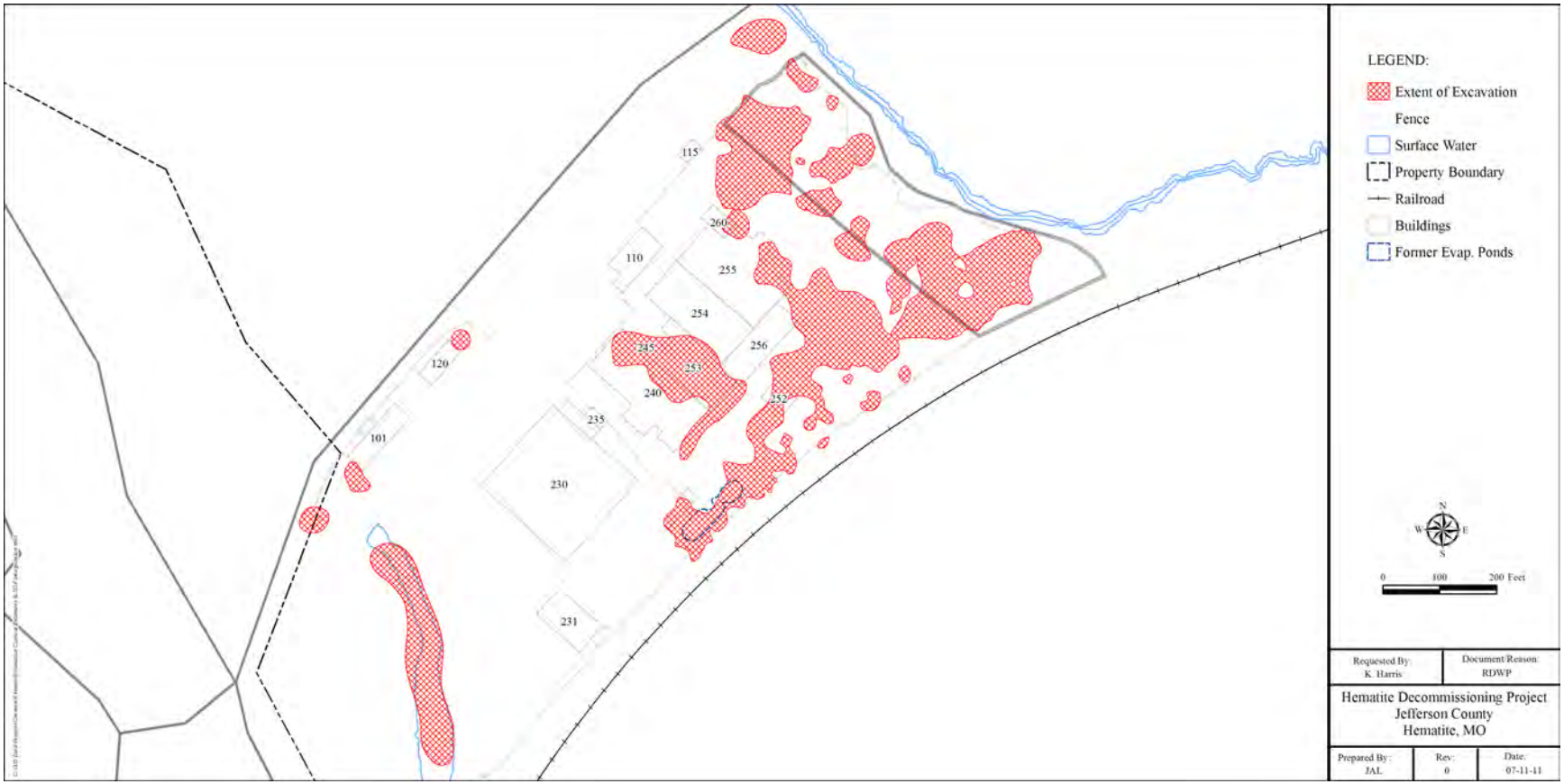


Figure 8. Site Layout, Materials Handling Facilities

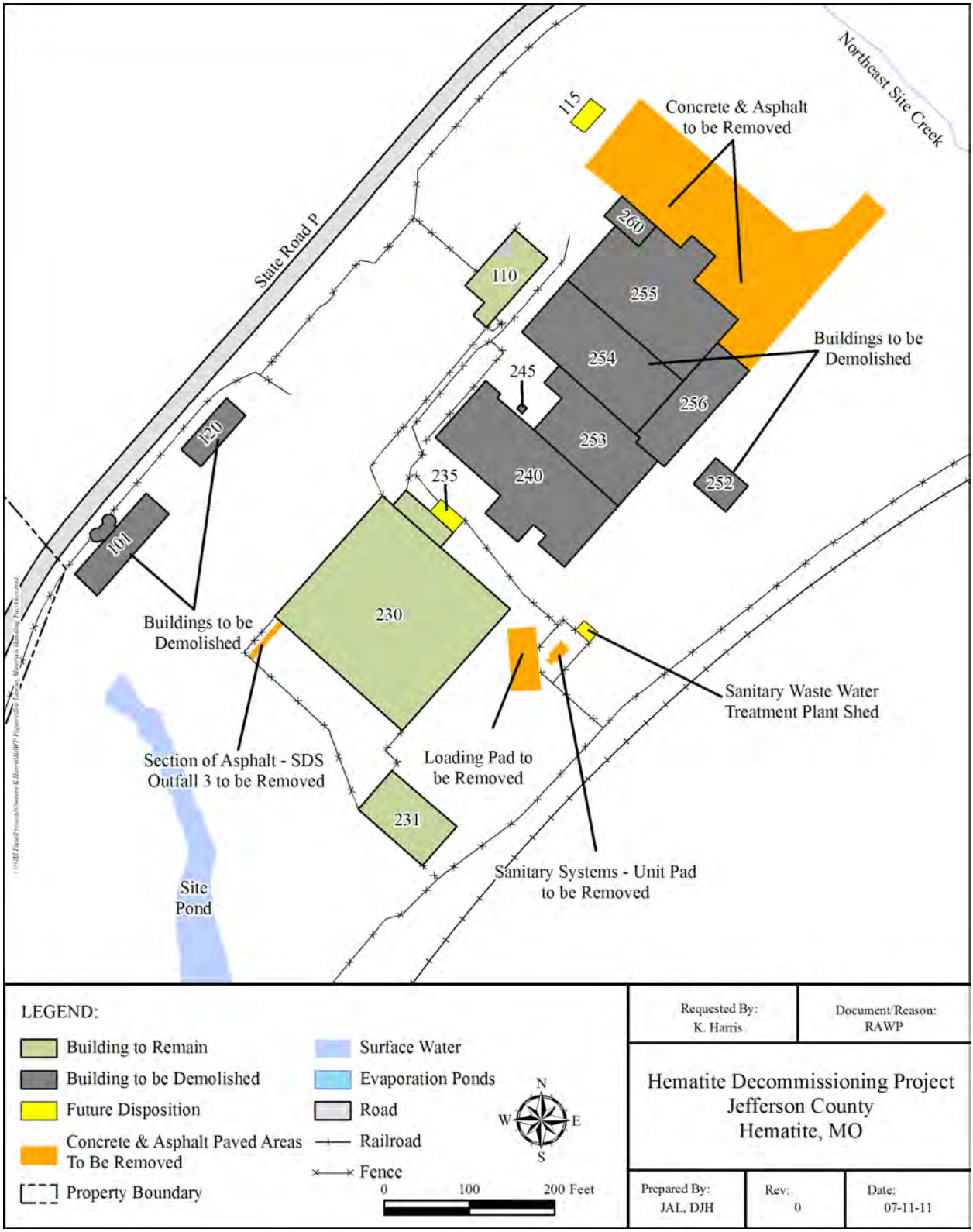


Figure 9. Typical VOC Treatment Cell Layout

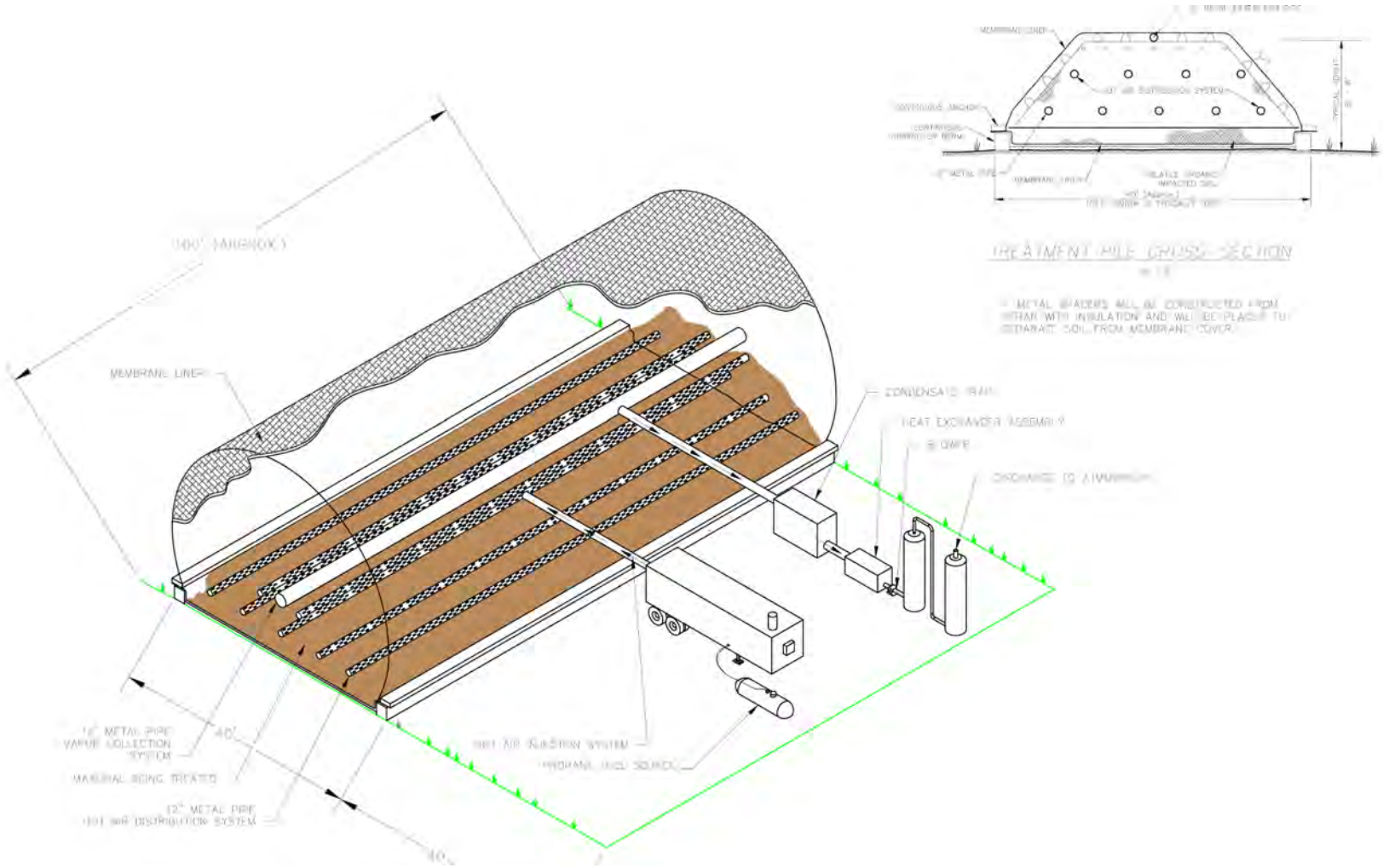


Figure 10. Design Details, Materials Handling and Treatment Areas

Figure 11. Water Treatment System, Process Flow Diagram

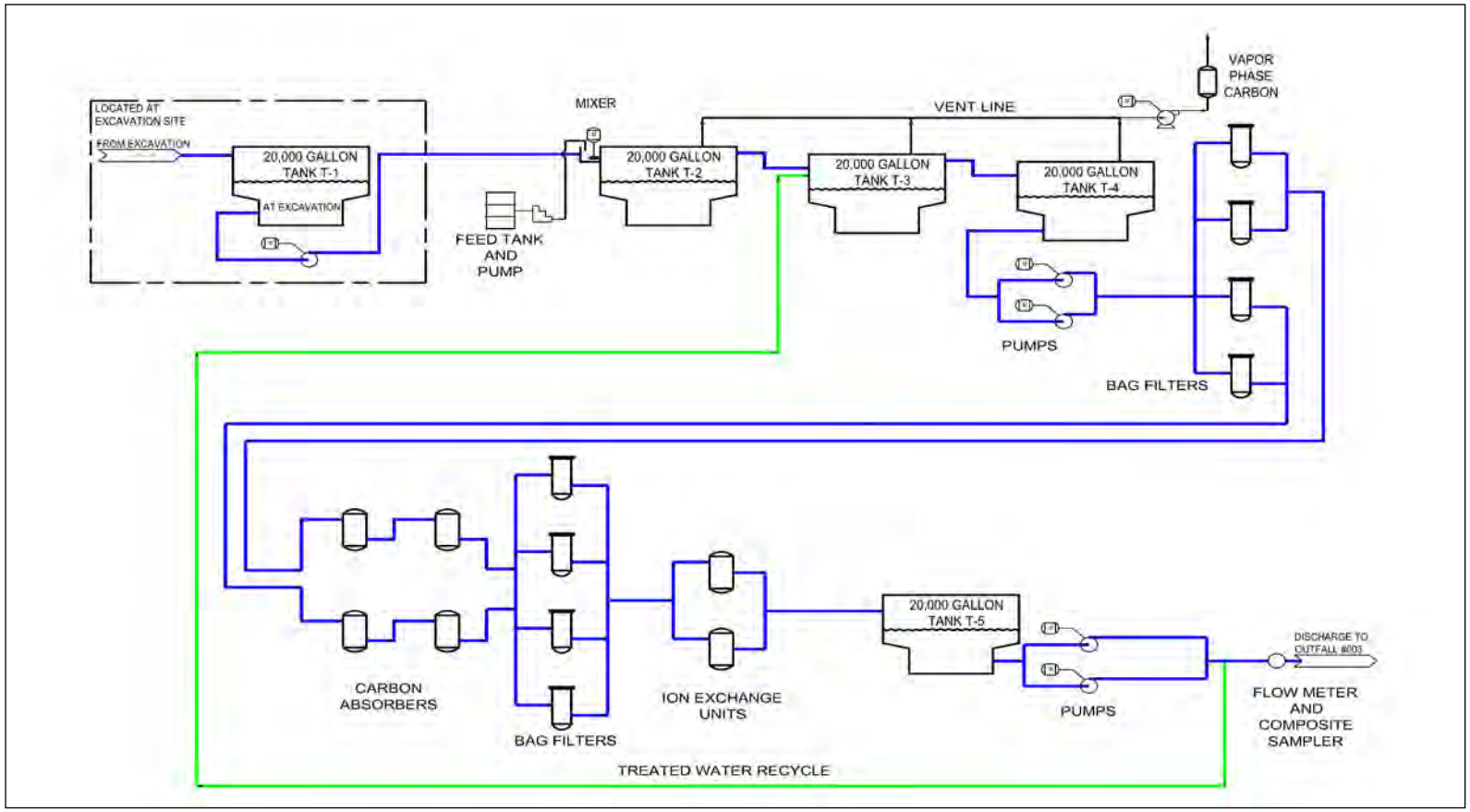


Figure 12. Final Site Grading Plan

Figure 13. Project Organizational Chart

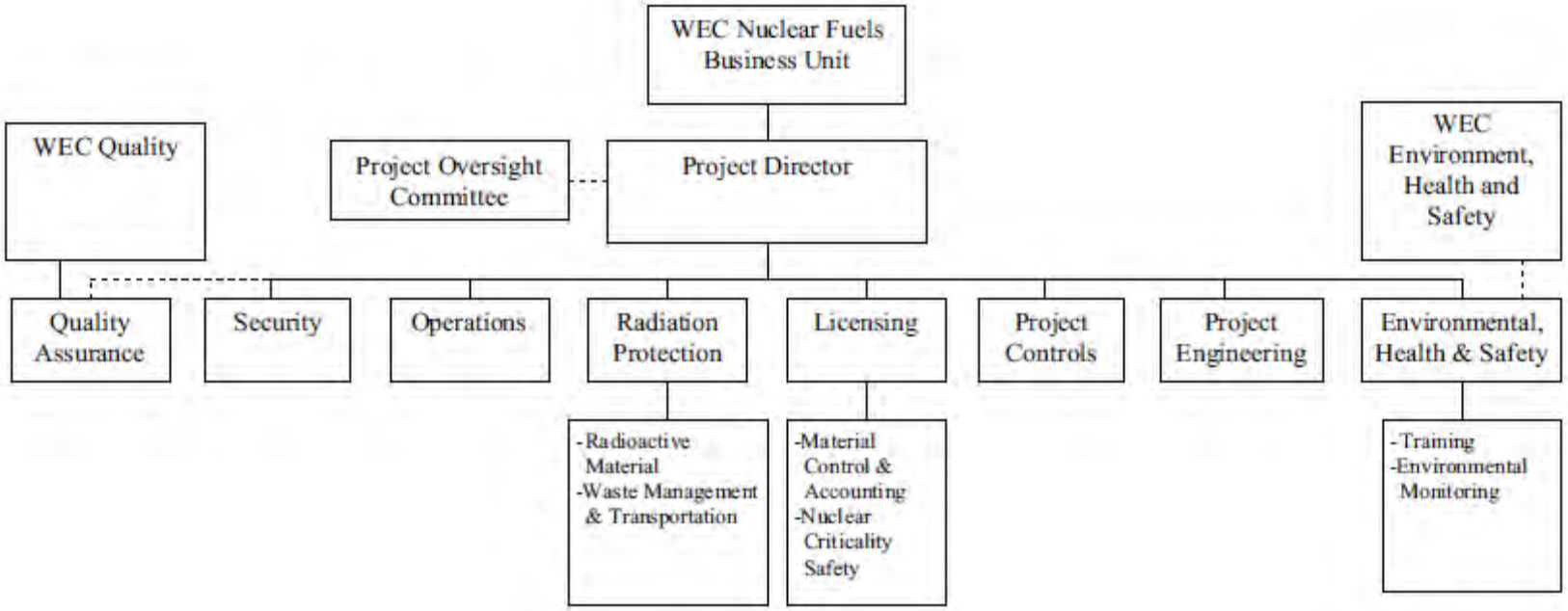


Figure 13a. Project Organizational Chart – Remediation Subcontractor

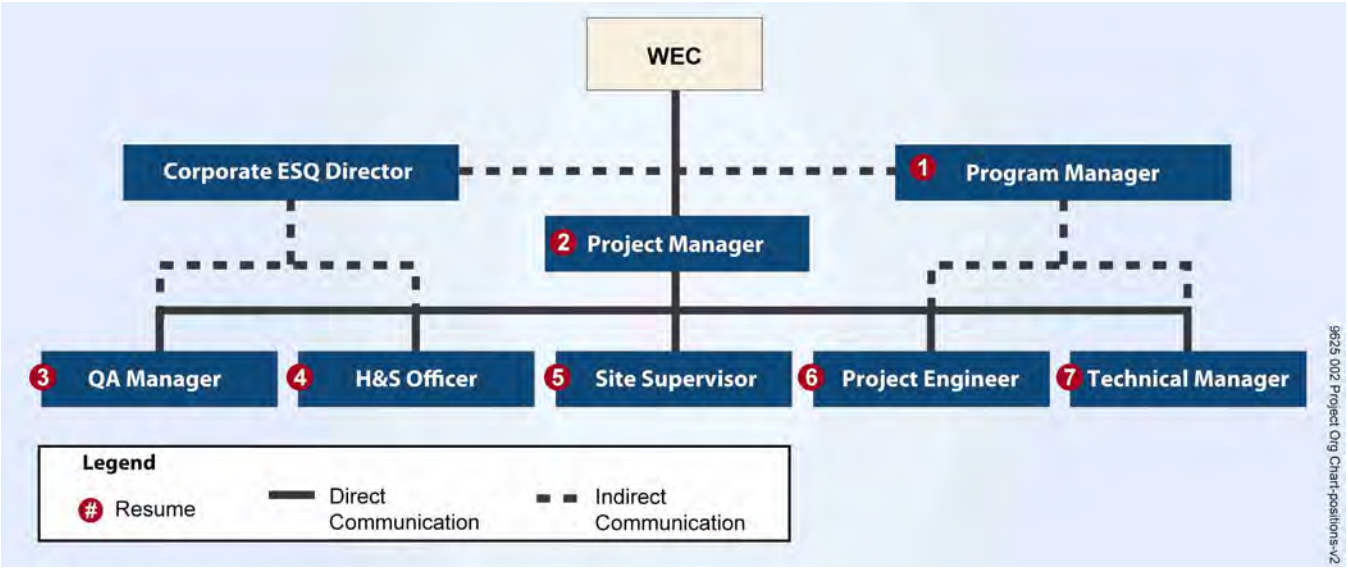
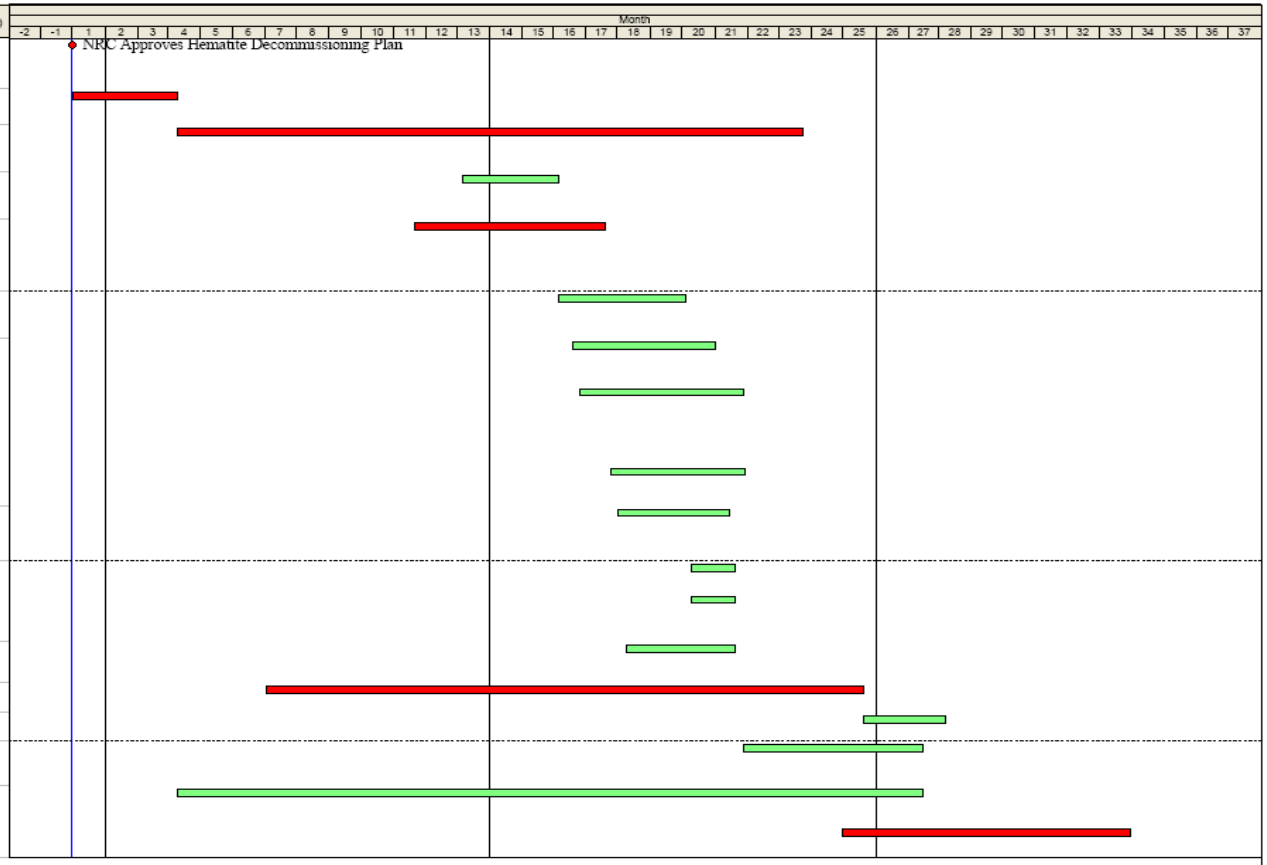


Figure 14. Proposed Schedule for Operable Unit 1 Implementation

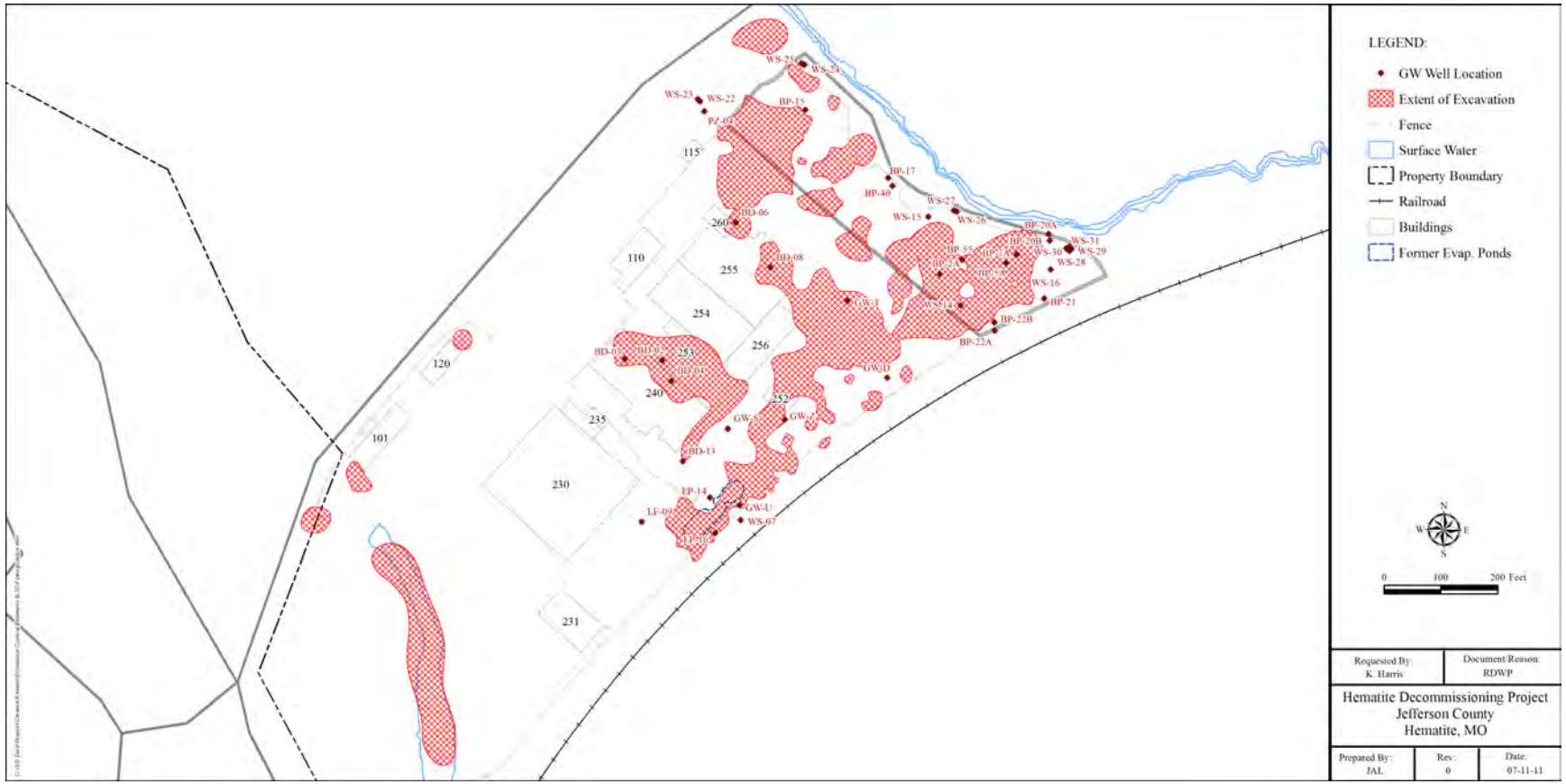
Activity ID	Activity Name	Duration (Work Days)
A1000	NRC Approves Hematite Decommissioning Plan .	0
A1010	Remediation Site Preparation	70
A1020	Burial Pits Remediation & Restoration	423
A1030	Former Leach Field Remediation & Restoration	65
A1040	Red Room Roof, Cistern Burn Pit & Barns Soil Remediation & Restoration	130
A1050	Site Pond Surrounding Areas Remediation & Restoration	87
A1060	Evaporation Ponds Remediation & Restoration	97
A1070	Slabs & Soils Beneath Buildings to be Demolished & Areas Around Building Exteriors, Remediation	110
A1080	Storm Drain System Remediation	92
A1090	Sanitary Wastewater Treatment System Remediation	76
A1100	Soil Remediation Areas	30
A1110	Remediation & Release of Remaining Structures	30
A1120	Demolition of other Structures	74
A1130	Final Status Surveys	405
A1140	Final Site Restoration	55
A1150	Decontamination & Demobilization	123
A1170	Water Treatment System	505
A1180	License Termination	196



Remaining Work
Milestone
Critical Remaining Work

Hematite Decommissioning Project

Figure 15. Monitoring Wells within and Proximal to Remediation Areas



APPENDIX A

GENERATOR'S HAZARDOUS WASTE DETERMINATION

APPENDIX A
GENERATOR'S DETERMINATION OF HAZARDOUS WASTE
OPERABLE UNIT 1
WESTINGHOUSE FORMER FUEL CYCLE FACILITY
HEMATITE, MISSOURI

This appendix provides Westinghouse's determination of the proper classification of hazardous wastes that will potentially be generated during implementation of the Operable Unit 1 remediation of the Westinghouse former fuel cycle facility in Hematite, Missouri. Such wastes contain volatile organic compounds (VOCs), most notably trichloroethylene (TCE) and tetrachloroethylene (PCE), and include solid waste materials and impacted soils that will be excavated from the Burial Pits and other areas of concern at the Hematite site. The purpose of this draft memorandum is to organize pertinent information with respect to the regulatory framework, available agency guidance, and plant site history, but not to make decisions regarding the applicability, relevance, or appropriateness of such regulations or guidance.

Regulatory Framework[1]

The U.S. Environmental Protection Agency (EPA) regulations at 40 CFR 262.11 require that a generator of solid waste determine whether its waste meets the specific listing or characteristic criteria defined in 40 CFR 261 Subparts D and C, respectively, which would render such material hazardous waste under the Resource Conservation and Recovery Act (RCRA) regulations. In making this determination, the generator must employ due diligence in attempting to establish whether the solid waste originated from a process or application that meets the listing descriptions for either a non-specific source (40 CFR 261.31) or a specific source (40 CFR 261.32) of RCRA hazardous waste or if the waste is a discarded commercial chemical product as defined in 40 CFR 261.33.[2] The generator must employ similar due diligence in determining whether hazardous constituents found in an impacted environmental medium (e.g., soil, sediment) originated from a listed RCRA hazardous waste. In those cases where the source of the hazardous constituents can be reasonably determined and the source is or was reasonably known to be a listed hazardous waste under 40 CFR 261 Subpart D, the soil must be classified and managed as a listed RCRA hazardous waste. In all other cases, the soil must be managed based on the outcome of testing to determine whether the material exhibits the characteristic of a RCRA hazardous waste under 40 CFR 261 Subpart C.

[1] Citations are to Federal regulations. The corresponding state of Missouri regulations need to be reviewed for consistency and any exceptions to the Federal rules.

[2] Under the 40 CFR 261.33 regulations, commercial chemical product refers to a chemical manufactured or formulated for commercial or manufacturing use that consists of the commercially pure grade of the chemical, any technical grades of the chemical that are produced or marketed, and all formulations in which the chemical is the sole active ingredient.

Solid wastes and impacted environmental media containing TCE and PCE could possibly be listed RCRA hazardous waste, depending on the process generating the waste and the source of these constituents in environmental media. 40 CFR 261.31(a) lists two types of hazardous waste from non-specific sources that contain TCE and PCE as follows:

Listed Waste Code	Listing Description
F001	The following spent halogenated solvents used in degreasing: Tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, and chlorinated fluorocarbons; all spent solvent mixtures/blends used in degreasing containing, before use, a total of ten percent or more (by volume) of one or more of the above halogenated solvents or those solvents listed in F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.
F002	The following spent halogenated solvents: Tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, chlorobenzene, 1,1,2-trichloro-1,2,2-trifluoroethane, ortho-dichlorobenzene, trichlorofluoromethane, and 1,1,2-trichloroethane; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above halogenated solvents or those listed in F001, F004, or F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.

Commercially discarded TCE and PCE are also listed RCRA hazardous wastes, carrying the waste codes U228 and U210, respectively.

Even if not a listed waste or a discarded commercial chemical, solid wastes and impacted environmental media containing TCE and PCE, as well as their degradation by-products 1,1-dichloroethylene and vinyl chloride, could be characteristic RCRA hazardous waste depending on the concentration of these constituents in the leachate generated in the toxicity characteristic leaching procedure (TCLP) test. 40 CFR 261.24 provides the following regulatory limits for designation of characteristic toxic hazardous waste based on the results of TCLP testing for these constituents:

Characteristic Waste Code	Constituent	Regulatory Level in TCLP Leachate (micrograms per liter [µg/L])
D029	1,1-Dichloroethylene	700
D039	Tetrachloroethylene	700
D040	Trichloroethylene	500
D043	Vinyl chloride	200

TCE- and PCE-containing materials could also potentially meet the definition of ignitable hazardous waste under 40 CFR 261.21 (Characteristic Waste Code D001).

Guidance

EPA guidance provides that, where a generator makes a good-faith effort to determine if a solid waste or impacted environmental medium is a listed RCRA hazardous waste but cannot make such a determination because the documentation is unavailable or inconclusive, the generator may assume that the materials are not listed hazardous waste.[3] In such cases, the determination of whether or not a waste is hazardous falls solely to the results of waste testing for hazardous waste characteristics.

EPA first articulated this approach in the 1988 preamble to the then-proposed National Oil and Hazardous Substances Contingency Plan (NCP) to implement the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) stating:[4]

> "To determine whether a waste is a listed hazardous waste under RCRA, it is often necessary to know the source. However, at many CERCLA sites no information exits on the source of the waste nor are references available citing the date of disposal. The lead agency should use available site information, manifests, storage records, and vouchers in an effort to ascertain the source of these contaminants. When this documentation is not available or inconclusive, the lead agency may assume that the wastes are not listed RCRA hazardous wastes."

EPA is even more direct in the preamble to the 1990 final NCP:[5]

> "It has been the Agency's longstanding policy that in cases where the origin of the contaminants is unknown, the lead agency may assume that contaminants in media did not originate from listed hazardous wastes."

EPA guidance[6] points out that listing determinations are often particularly difficult in the remedial context because analytical testing "will generally not produce information that will conclusively indicated whether a given waste is a listed hazardous waste."

Plant Site Uses of VOCs

At the Hematite plant, chlorinated VOCs were used in a variety of production and other plant applications. Based on information provided from interviews with former plant employees, these products were purchased in 55-gallon drum quantities, with incoming product drums typically stored outdoors in gravel or paved areas. Following is a summary of the

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[3] EPA, October 1998. "Management of Remediation Waste Under RCRA," EPA530-F-98-026.

[4] Federal Register, December 21, 1988, Volume 53, page 51444.

[5] Federal Register, March 8, 1990, Volume 55, page 8758.

[6] EPA, October 1998. Ibid.

information gleaned from interviews with former plant employees regarding the uses of TCE and PCE at the Hematite plant.

Summary of TCE and PCE Uses
Westinghouse Hematite Former Fuel Cycle Facility

Site Location	Process Description/Application
Trichloroethylene (TCE)[7]	
Building 255 – Item Plant	Dispersion agent for milling/mixing of dry materials in high-enriched fuel formulation. TCE used for its physical properties and because chlorine is a nuclear poison (absorbs neutrons).
Building 255 - Old Development Office	Removal of floor tiles during building renovations (limited because TCE volatility limited usefulness).
Building 250 - Red Room	Medium in column to extract kerosene and tri-butyl phosphate from liquor of water and dissolved uranium.
Building 260 - Oxide Conversion	Component of purchased chemical product ("Cranko") used as binder in fuel pellet manufacturing (agglomeration process). Additional TCE was added to the binder as diluent/thinner.
Plant wide	General cleaning/degreasing agent.
Tetrachloroethylene (PCE)	
Building 255 – Old Development Office; Building 240 - Red Room, and Green Room; possibly other locations	Removal of floor tiles during building renovations.
Building 240 - Red Room	"Direct Green" process for converting high enrichment uranium hexafluoride (UF_6) to uranium tetrafluoride (UF_4) and then to uranium dixodixe (UO_2). The PCE was chemically reacted with the UF_6 to remove fluorine atoms and produce UF_4.
Building 240 – Green Room?	Development work for converting UF_6 to low-enrichment UF_4.

[7] In some interviews, former plant employees indicated that certain of these uses were actually 1,1,1-trichloroethane (TCA), not TCE. Other interviews suggest only TCE was used. The Remedial Investigation identified TCE as a constituent of potential concern in both soils and groundwater due to elevated concentrations in numerous samples. TCA was not found in elevated concentrations, leading to the conclusion that, even if TCA were used in operations at some times, only TCE usage is relevant to the evaluation of the proper classification of RCRA hazardous wastes potentially generated in the Operable Unit 1 remediation.

No vapor degreasing operations or on-site distillation or recovery of spent TCE or PCE was reported.

In addition to the above plant uses, TCE is a degradation by-product of PCE. Accordingly, the source of TCE found in environmental media could be previously disposed materials containing or other spills or releases of PCE.

Plant Site Disposal of VOCs

According to former plant personnel, little TCE or PCE waste was generated.[8] Most of the VOCs used in fuel manufacturing processes were evaporated in subsequent oven drying steps, although incidental spillage, pump leakage, and other releases were reported. Such leakage would have entered the environment through cracks and joints in concrete floors, especially those associated with the Red Room and Green Room. Former plant employees also reported that, when used in cleaning and degreasing, the TCE would very quickly evaporate.

The liquid process wastes that were produced, including those containing TCE and PCE, were typically disposed of in the evaporation ponds (aka "retention ponds"). Such liquid wastes included filtrates from wet recovery operations associated with both the Red Room and Green Room. Some PCE and TCE liquids were also likely released when waste storage drums leaked or spilled.

Solid wastes containing TCE and PCE may have been disposed of in the Burial Pits, and the Burial Pit logs reportedly contain entries describing "TCE rags" and similar wastes. Some liquid TCE and PCE wastes may also have been disposed of in the Burial Pits.

Discussion

The sources of TCE and PCE in buried waste and impacted soils at the Hematite Site include a variety of process materials. Possible sources of TCE found in the Burial Pits, Evaporation Ponds, soils beneath building, and other site area include the following:

- Unused or spent commercial products that contained TCE (i.e., Cranko);
- Liquid and solid wastes from use of TCE as an extraction medium or diluent;
- Solid wastes from use as a solvent for dissolving mastic in removing floor tiles;[9]

[8] While this viewpoint is understood from a manufacturing/production perspective, it is recognized that seemingly small quantities of these VOCs can accounted for the concentrations found in soils and groundwater associated with the Hematite site.

[9] The use of TCE for this purpose was reported to be quite limited because the TCE would evaporate too quickly to be effective. PCE was subsequently employed.

- Liquid and solid wastes from use as a general degreaser or cleaner;
- Anaerobic decomposition of PCE.

Possible sources of PCE found in the Burial Pits, Evaporation Ponds, soils beneath building, and other site area include the following:

- Liquid and solid wastes from processes in which PCE was used in a chemical conversion of UF_6; and

- Liquid and solid wastes from use as a solvent for dissolving mastic in removing floor tiles.

Wastes from using TCE as a degreaser and general solvent cleaner would meet the listing definition of F001 waste, and waste from the use of TCE and PCE as a solvent for dissolving mastic in removing floor tiles would be F002 listed hazardous waste. However, the other uses of TCE and PCE at the Hematite site would not produce wastes that meet the listing descriptions of F001 and F002 waste, and such wastes would be RCRA hazardous only if the concentrations of VOCs in TCLP leachate exceed the regulatory limits designating this material as a characteristic hazardous waste. Aside from the former employee interviews and entries in the logs for the Burial Pits, no other information is available that could be reasonably used to ascribe the source of TCE or PCE found at the site.

From the descriptions of the types and locations of waste disposal gleaned from former employee interviews, the sources of TCE and PCE present in buried waste or impacted environmental media cannot be discerned and wastes from all of the above-listed site operations appear to be co-located. Similarly, although former site employees report that spillage of commercial (incoming) TCE and PCE undoubtedly occurred, the locations and amounts of any such spillage are unknown and again indistinguishable both chemically and geographically from other sources of TCE and PCE.

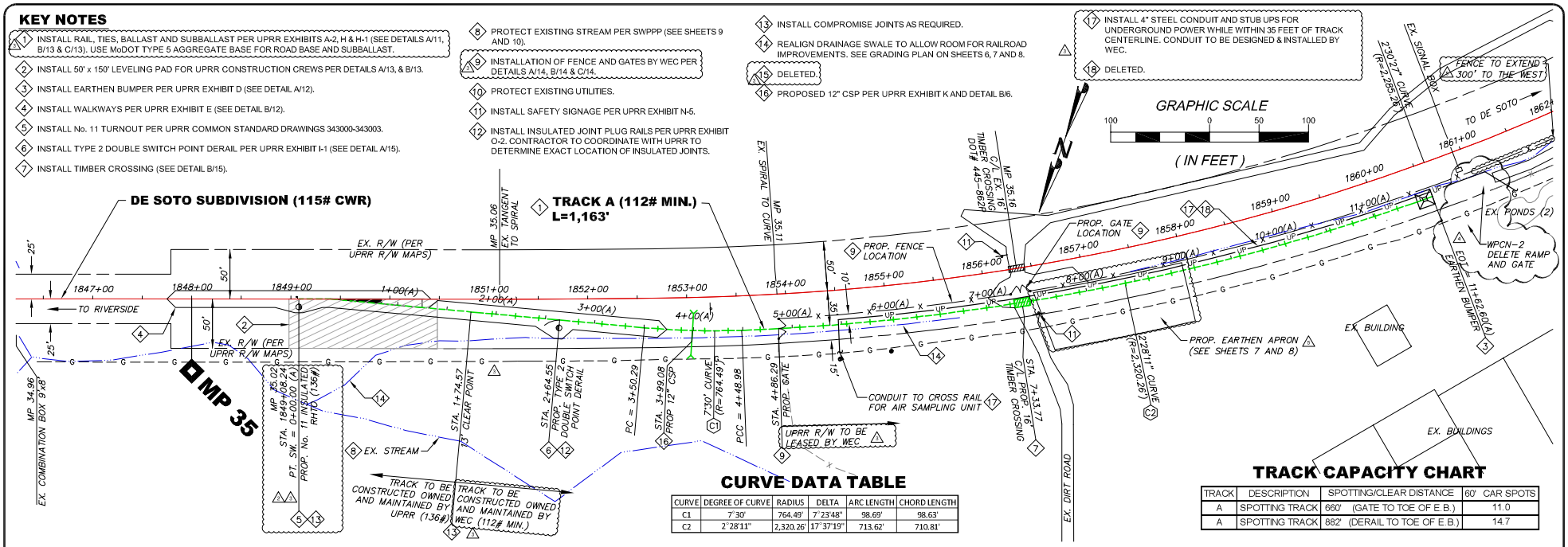
The circumstances of the Burial Pits, Evaporation Ponds, soils under buildings, and other areas of concern at the Hematite Site appear to be those addressed by EPA guidance in which the origin of the constituent is unknown and for which it may be assumed that the constituents in the buried wastes and impacted soils did not originate from listed hazardous waste. TCLP testing will be conducted to identify those wastes and impacted soils exhibiting concentrations of VOCs in the TCLP leachate at concentrations that would render these material RCRA characteristic hazardous waste.

APPENDIX B

DESIGN OF RAILROAD SPUR

KEY NOTES

1. INSTALL RAIL, TIES, BALLAST AND SUBBALLAST PER UPRR EXHIBITS A-2, H & H-1 (SEE DETAILS A/11, B/13 & C/13). USE MoDOT TYPE 5 AGGREGATE BASE FOR ROAD BASE AND SUBBALLAST.
2. INSTALL 50' x 150' LEVELING PAD FOR UPRR CONSTRUCTION CREWS PER DETAILS A/13, & B/13.
3. INSTALL EARTHEN BUMPER PER UPRR EXHIBIT D (SEE DETAIL A/12).
4. INSTALL WALKWAYS PER UPRR EXHIBIT E (SEE DETAIL B/12).
5. INSTALL No. 11 TURNOUT PER UPRR COMMON STANDARD DRAWINGS 343000-343003.
6. INSTALL TYPE 2 DOUBLE SWITCH POINT DERAIL PER UPRR EXHIBIT I-1 (SEE DETAIL A/15).
7. INSTALL TIMBER CROSSING (SEE DETAIL B/15).
8. PROTECT EXISTING STREAM PER SWPPP (SEE SHEETS 9 AND 10).
9. INSTALLATION OF FENCE AND GATES BY WEC PER DETAILS A/14, B/14 & C/14.
10. PROTECT EXISTING UTILITIES.
11. INSTALL SAFETY SIGNAGE PER UPRR EXHIBIT N-5.
12. INSTALL INSULATED JOINT PLUG RAILS PER UPRR EXHIBIT O-2. CONTRACTOR TO COORDINATE WITH UPRR TO DETERMINE EXACT LOCATION OF INSULATED JOINTS.
13. INSTALL COMPROMISE JOINTS AS REQUIRED.
14. REALIGN DRAINAGE SWALE TO ALLOW ROOM FOR RAILROAD IMPROVEMENTS. SEE GRADING PLAN ON SHEETS 6, 7 AND 8.
15. DELETED.
16. PROPOSED 12" CSP PER UPRR EXHIBIT K AND DETAIL B/6.
17. INSTALL 4" STEEL CONDUIT AND STUB UPS FOR UNDERGROUND POWER WHILE WITHIN 35 FEET OF TRACK CENTERLINE. CONDUIT TO BE DESIGNED & INSTALLED BY WEC.
18. DELETED.

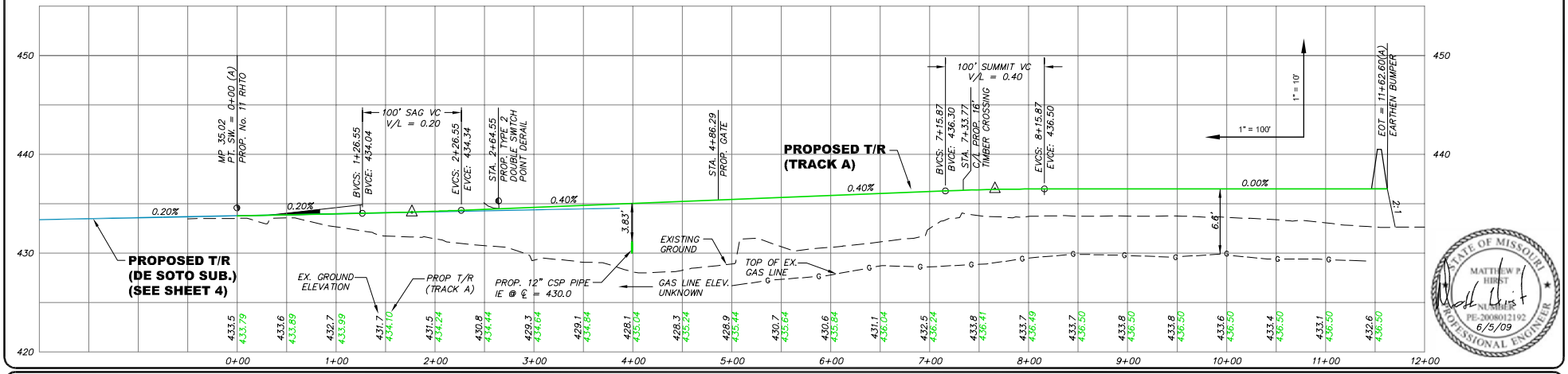


CURVE DATA TABLE

CURVE	DEGREE OF CURVE	RADIUS	DELTA	ARC LENGTH	CHORD LENGTH
C1	7°30'	764.49'	7°23'48"	98.69'	98.63'
C2	2°28'11"	2,320.26'	17°37'19"	713.62'	710.81'

TRACK CAPACITY CHART

TRACK	DESCRIPTION	SPOTTING/CLEAR DISTANCE	60' CAR SPOTS
A	SPOTTING TRACK	660' (GATE TO TOE OF E.B.)	11.0
A	SPOTTING TRACK	882' (DERAIL TO TOE OF E.B.)	14.7



STATE OF MISSOURI MATTHEW P. HIRST NUMBER PE-2008012192 PROFESSIONAL ENGINEER 6/5/09

REV.	BY	DATE	DESCRIPTION
3	SM	9/30/09	MODIFIED NOTES, FENCE, & LOADING PAD
2	CP	9/10/09	REMOVED RAMP AND GATE, MODIFIED APRON CROSS SECTION
1	SM	6/5/09	MODIFIED CONSTRUCTION NOTES & UTILITIES
0	SM	3/26/09	MODIFIED TURNOUT NOTE

	INITIAL/DATE
PRINCIPAL: P. HIRST	
PROJECT MANAGER: D. EYRE	
CHECKER: M. HIRST	
DRAWN BY: D. WELLISCH	
SCALE: AS SHOWN	DATE ISSUED: 11/4/08

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SHEET 5 OF 18

08060F PROJECT NUMBER