Final
Remedial Alternatives Evaluation Technical Memorandum

Marion Pressure Treating Company Superfund Site
Union Parish, Louisiana
EPA Identification No. LAD008473142

Remedial Action Contract 2 Full Service
Contract: EP-W-06-004
Task Order: 0062-RICO-067Z

Prepared for

U.S. Environmental Protection Agency
Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

Prepared by

EA Engineering, Science, and Technology, Inc.
405 S. Highway 121
Building C, Suite 100
Lewisville, Texas 75067
(972) 315-3922

December 2011
Revision: 01
EA Project No. 14342.62

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirement
bgs	Below ground surface
B(a)P	Benzo(a)pyrene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COPC	Contaminant of potential concern
DNAPL	Dense non-aqueous phase liquid
EA	EA Engineering, Science, and Technology, Inc.
EC	Engineering control
E&E	Ecology and Environment, Inc.
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
FSR	Feasibility Study Reassessment
GRA	General response action
HHRA	Human Health Risk Assessment
IASD	Inactive and Abandoned Sites Division
IC	Institutional control
ISCO	*In situ* chemical oxidation
LDEQ	Louisiana Department of Environmental Quality
LDR	Land Disposal Restrictions
LTM	Long-term monitoring
MCL	Maximum Contaminant Level
mg/kg	Milligram(s) per kilogram
MNA	Monitored natural attenuation
MPTC	Marion Pressure Treating Company
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	No Further Action
NPL	National Priorities List
OSWER	Office of Solid Waste and Emergency Response
PAH	Polynuclear aromatic hydrocarbon
PRG	Preliminary remediation goal
qPCR	Quantitative polymerase chain reaction
RAO	Remedial action objective
RAETM	Remedial Alternatives Evaluation Technical Memorandum
RATM	Remedial Alternatives Technical Memorandum
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RECAP	Risk Evaluation/Corrective Action Plan
RI	Remedial Investigation
ROD	Record of Decision
RSL	Regional Screening Level
SFI	Supplemental field investigation
SIP	Stable isotope probing
site	Marion Pressure Treating Company Superfund Site

SVOC	Semi-volatile organic compound
TBC	To be considered
TCLP	Toxicity Characteristic Leaching Procedure
TI	Technical Impracticability
TT	Tetra Tech EM, Inc.
µg/L	Microgram(s) per liter
USACE	U.S. Army Corps of Engineers
WBZ	Water-bearing zone

1. INTRODUCTION

This document presents the Remedial Alternatives Evaluation Technical Memorandum (RAETM) produced by EA Engineering, Science, and Technology, Inc. (EA) for the Marion Pressure Treating Company (MPTC) Superfund Site (site) in Union Parish, Louisiana. EA produced this RAETM for the U.S. Environmental Protection Agency (EPA) Region 6 under Remedial Action Contract Number EP-W-06-004 and Task Order 0062-RICO-067Z. The framework and requirements are documented in the EPA Statement of Work Revision 01 (EPA 2010a) and the EA Work Plan and Cost Estimate (EA 2010a).

The Remedial Investigation (RI) Report (Tetra Tech EM, Inc. [TT] 2001c), the Human Health Risk Assessment (HHRA) and Ecological Risk Evaluation (TT 2001a), the Feasibility Study (FS) Remedial Alternatives Memorandum (TT 2001b), the Feasibility Study (TT 2001d), and the Supplemental Field Investigation Report (EA 2011) provide the basis for this RAETM. The regulation and guidance documents that were utilized in this evaluation included, but were not limited to, the following:

- National Oil and Hazardous Substance Pollution Contingency Plan (NCP), Title 40 Code of Federal Regulations (CFR) Part 300

- *Guidance for Conducting Remedial Investigation and Feasibility Studies under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)* (Office of Solid Waste and Emergency Response [OSWER] Directive 9355.3-01) (EPA 1988).

1.1 PURPOSE OF REPORT

This RAETM will support the preparation of the FS Reassessment (FSR) Report and remedy selection to be included as an Amendment to the original Record of Decision (ROD) completed in June 2002. In this document, potential remedial alternatives are evaluated against seven screening criteria to determine which remedial alternatives will be considered in the FSR. EPA will make the determination regarding final selection of the remedial alternatives to be further developed.

The seven criteria to be employed in the evaluation of remedial alternatives in the RAETM and FSR are:

- Overall protection of human health and the environment
- Compliance with Applicable or Relevant and Appropriate Requirements (ARAR)
- Long-term effectiveness and permanence
- Reduction in toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability (technical and administrative)
- Cost.

Prior to the completion of any potential ROD Amendment, two additional criteria will be considered. These include:

- State acceptance; and
- Community acceptance.

Fully developed cost estimates were not prepared for this RAETM, but will be prepared for remedial alternatives that are evaluated in the FSR.

1.2 SITE LOCATION AND DESCRIPTION

The MPTC site covers approximately 22 acres and is located in a rural area northwest of Marion, Union Parish, Louisiana (Figure 1). The site is located about 14 miles northeast of Farmersville and 35 miles north-northwest of Monroe, Louisiana.

The site is located on the east side of State Highway 551 about 0.5 mile north of the intersection of State Highway 551 and State Highway 33. It is located in the northwest quarter of the northeast quarter of the southwest quarter of Section 10, Township 22 North, Range 2 East, Union Parish, Louisiana. The geographical coordinates of the site are latitude 32°54' 29" north and longitude 92°15'14" west.

The property is surrounded by forest to the north, east, and south. Wetlands are located to the east and southeast. Residential properties are located west and south of the site along State Highway 551. Big Creek is located east of the property, and an unnamed tributary to Big Creek is west of the property. The former wood-treating operational area drains (1) to the east towards Big Creek through drainage gullies collectively called the East Drainage Ditch, and (2) to the west towards the gullies collectively called the West Drainage Ditch.

An abandoned building, tanker trailer, and small wastewater treatment sump are the only known structures remaining from past wood-treating operations (Figure 2). During an EPA removal action, polynuclear aromatic hydrocarbon (PAH)-contaminated soil was consolidated in an onsite area (Consolidation Area) and capped. The Consolidation Area measures about 280 feet by 210 feet and is surrounded by a fence (Ecology and Environment, Inc. [E&E] 1999). Additionally, two small PAH-contaminated spoil piles are located 200 to 300 feet south of the original (10-acre) property boundary (Louisiana Department of Environmental Quality [LDEQ] 1999). These features, in addition to a shed located near the spoil piles, are shown on Figure 2, which presents the current site layout. During the RI, a fence was constructed around the perimeter of the site to restrict access to the site.

1.3 SITE OWNERSHIP

The MPTC site originally consisted of a 10-acre tract of land owned by Mr. Bobby L. Green. MPTC was owned and operated by Mr. Bobby L. Green from 1 November 1964 to 8 May 1990. Mr. Green also served as MPTC's president. Between 1964 and 1984, partial ownership of the original 10-acre tract had been divided between H.D. Green, Daniel Green, Bobby L. Green, and

Brooks Jones. The original 10-acre tract was sold to MPTC on 17 August 1984. Through property tax forfeiture and sales, the original 10-acre tract has passed through various owners. The current owners of the property are Otis Riley, Daniel B. Green, Mary Virginia Green-Jones, and Bobby L. Green. The MPTC site has also expanded beyond the original 10-acre tract to currently encompass about 22 acres (Figure 2).

1.4 SITE HISTORY

MPTC began operations on 1 November 1964. MPTC produced pressure-treated wood products, including poles, bridge pilings, fence posts, and other lumber. Creosote was reported to be the only wood preservative used during the wood treatment process (E&E 1995a and 1995b). From 1964 to 1985, a 15,000 square-foot, unlined surface impoundment (the former impoundment) was used to dispose of process wastewater. The former impoundment was regulated under the Resource Conservation and Recovery Act (RCRA) after 1976 and was described as a two-celled, hourglass-shaped unit, approximately 80 feet wide by 240 feet long. The depth of the former impoundment is not known, but is estimated to have been between 2.5 to 10 feet deep. During closure of the unit in 1985, (1) water in the former impoundment was pumped to the onsite wastewater treatment system, (2) sediments were excavated and transported offsite for disposal, and (3) the former impoundment was backfilled with approximately 1,450 cubic yards of loamy sand and graded to conform to the general topography of the area (E&E 1995c). Closure of the impoundment resulted in several unresolved LDEQ enforcement actions against MPTC for lack of post-closure plans, ground water sampling plans, and invalid certification of clean closure.

After MPTC failed to submit a post-closure permit in July 1989, LDEQ conducted a RCRA compliance inspection at MPTC in September 1990 and found that the facility was abandoned with no sign of recent activity. The facility gates were open, the retorts and associated equipment were still in place, and ground surface around the tanks was covered with a "creosote-like material." The LDEQ referred the site to the Inactive and Abandoned Sites Division (IASD), since MPTC had filed for bankruptcy on 10 October 1989. IASD requested a removal action by the EPA Response and Prevention Branch.

Between September 1996 and March 1997, EPA performed a removal action at the MPTC site. These activities included the offsite disposal of fluids and sludge stored in the tanks, decontamination, dismantling and offsite disposal of the tanks and retort vessels at the site, excavation of contaminated soil, and placement of the contaminated soil in a capped Consolidation Area (E&E 1997). Approximately 10,000 cubic yards of contaminated soil were excavated and placed into the Consolidation Area. The contaminated soil was capped with a 2-foot thick clay cover and an 18-inch thick topsoil layer.

The MPTC site was proposed to the National Priorities List (NPL) on 22 October 1999 and added to the NPL on 4 February 2000. An RI and FS were completed at MPTC in 2001. The ROD (EPA 2002), identified two operational units: (1) contaminated onsite soil; and (2) contaminated ground water. The selected remedy included a combination of the following: (1) excavating wastes, (2) onsite thermal desorption, (3) offsite stabilization and disposal of residual wastes, and (4) backfill of excavated areas and re-vegetation. The Remedial Design (RD; TT

2003) was completed in September 2003. An independent technical review of the RD was performed by the U.S. Army Corps of Engineers (USACE) in 2006 (USACE 2006). Implementation of the designed remedy and Remedial Action was prioritized and queued subject to availability of funding. In the meantime, unsuccessful implementation of the selected thermal desorption technology at another Superfund site demonstrated that the technology was more difficult to implement than anticipated. This prompted the current reassessment to evaluate if other technologies would be more appropriate.

1.5 REMEDIAL INVESTIGATION RESULTS

During the RI in 2000, samples were collected from surface soil/sediment, subsurface soil, ground water, surface water, public water supply, and ecological samples at the MPTC site to determine the nature and extent of contamination (TT 2001c). The analytical results for these samples indicated the presence of creosote-related contaminants in concentrations above residential human health risk screening levels and ecological risk levels across a large area of the site.

A field investigation was performed as part of the RD in 2002, where additional soil borings were collected to aid in dense non-aqueous phase liquid (DNAPL) delineation and to determine the physical properties and the extent of the confining unit underlying the Cockfield Aquifer. Additionally, seven monitoring wells were installed and 14 previously existing monitoring wells were sampled (TT 2002).

A supplemental field investigation (SFI) in 2010–2011 employed the use of a cone-penetrometer testing rig in conjunction with the Tar-specific Green Optical Screening Technology® to delineate the extent of creosote at the site. Testing was performed in the Consolidation Area and former impoundment in an attempt to more accurately determine the extent of the DNAPL (Figure 3). Additionally, monitoring wells were purged and sampled using low-flow (micropurge) sampling techniques in accordance with the EPA-approved Field Sampling Plan (EA 2010b) and standard operating procedures. Data collected from the SFI were presented in the Supplemental Field Investigation Report (EA 2011).

The following sections summarize the findings of the three investigative field efforts introduced above. The elements included are: (1) contaminants of potential concern (COPCs); (2) conceptual site model; and (3) risk assessment.

1.5.1 Contaminants of Potential Concern

COPCs detected in soil, sediment, surface water, and ground water include metals, semi-volatile organic compounds (SVOCs), and volatile organic compounds. Creosote DNAPL was observed in measurable quantities in three monitoring wells (MW-2, MW-3, and MW-14) during each of the investigative field events.

1.5.2 Conceptual Site Model

The conceptual site model is comprised of the following components: (1) hydrogeology; (2) nature and extent of contamination; (3) source areas; (4) migration pathways; and (5) exposure pathways.

1.5.2.1 Hydrogeology

The Cockfield Formation (0–100 feet below ground surface [bgs]), the Cook Mountain Formation (100–300 feet bgs), and the Sparta Sand (300–900 feet bgs) are the geologic formations (in descending order) beneath the site. The site monitoring wells are screened in the Cockfield Formation. A 50- to 110-foot thick massive silty clay bed at the base of the Cook Mountain Formation (200–300 feet bgs) creates a confining unit for the Cockfield Aquifer, because it retards movement of water through the Cook Mountain Formation into the Sparta Sand.

The geology of the Cockfield Formation at the MPTC site generally consists of clay with silt and sand stringers (soil unit C1) from the ground surface to a depth varying from approximately 13 feet bgs to 25 feet bgs, underlain by sand and fine sand with silt clay and lignite (soil unit S1) to a depth varying from approximately 40 feet bgs to 50 feet bgs. The C1 clay layer on top reduces infiltration of water to underlying layers. S1 is the shallow water-bearing zone (WBZ) of the Cockfield Aquifer. This sand layer is underlain by another shallow clay and silty clay layer (soil unit C2), followed by a fine sand and sand with silt clay and lignite layer (soil unit S2). S2 is the deeper WBZ. Both S1 and S2 are potential drinking water sources. The deepest layer of the Cockfield Formation is silty clay (soil unit C3), which confines the S2 sand on the bottom. Soil unit C3 is the deepest interval assessed during the RI. Figure 4 identifies the locations of the cross sections detailed in Figures 5 and 6, which provide visual representations of the Cockfield Formation.

Based on a review of the potentiometric data from the SFI, the horizontal hydraulic gradients in both WBZs of the Cockfield Aquifer appear to be relatively low. Shallow ground water flow was to the southwest in December 2010. In March 2011, the shallow ground water flow was to the south and west. The S1 WBZ water elevation ranged from 159.32 to 160.98 feet above mean sea level across the site in December 2010, and from 160.01 to 161.59 feet above mean sea level in March 2011.

The S2 WBZ water elevations ranged from 162.66 to 162.85 feet above mean sea level in December 2010, and from 162.98 to 163.16 feet above mean sea level in March 2011. The S2 ground water flow was to the south and southeast in December 2010 and March 2011. Because of the very flat gradient at the site, ground water is not expected to migrate offsite. The S2 WBZ water elevations are about 2 to 3 feet higher than those in the S1 WBZ, indicating an upward head gradient.

1.5.2.2 Nature and Extent of Contamination

An analysis of the data collected during the RI, FI, and SFI was performed to describe the nature and extent of contamination in sediment, soil, surface water, and ground water. Chemical concentrations were incorporated with physical characteristics, historical information regarding site activities, and other evidence to evaluate the nature and magnitude of contamination. Similar evidence was used to delineate the extent of contamination both horizontally and vertically. Spatial and temporal trends were evaluated as they may be important in the migration pathway analysis. Such delineation of trends contributed to the identification of areas that need to be remediated at MPTC, as further discussed in Section 2.3.

The horizontal limits of the DNAPL plume appear stable. Review of available data suggests that only the three monitoring wells (MW-2, MW-3, and MW-14), where DNAPL was observed in 2000, still contain DNAPL in 2010, or traces thereof. The DNAPL occurrence appears to be limited to the area of the Consolidation Area and former impoundment. There is no evidence that vertical migration of DNAPL has continued. Furthermore, natural vertical migration of DNAPL is hindered by an aquitard (C2). As a result, future significant vertical DNAPL plume migration is unlikely. However, there are minor dissolved-phase ground water impacts to S2, which is below the C2 aquitard (Figures 7 and 8).

Creosote-impregnated soils have been found down to a depth of 45.6 feet bgs, which is an elevation of 123.76 feet above mean sea level underneath and around the Consolidation Area and former impoundment. The vertical extent of the DNAPL-contaminated soils is not defined, as depths reached during investigative activities were limited. The lateral extent of contaminated soil spans the Consolidation Area and the outermost borings where DNAPL-impacted soils were identified in Figure 3 based on observations and calculation, as discussed in the SFI Report (EA 2011).

The water wells for the Marion public supply water system are screened in the Sparta Sand. No other nearby water wells were identified during the RI. Ground water samples were collected from the City of Marion public supply water wells as part of the RI. The laboratory testing results indicate that the drinking water from the Marion public supply water wells meet Maximum Contaminant Levels (MCLs; EPA 2011) and the water quality criteria established for primary drinking water systems by the Louisiana Department of Health and Hospitals, Office of Public Health. No site-related contaminants have been detected in the City of Marion public supply water wells.

Concentrations of SVOCs in ground water collected from the monitoring wells appear to be decreasing over time, with the exception of MW-14, where higher concentrations of several phenol compounds were detected. Phenols and creosols are components of creosote, the main wood-preserving compound used at the site. Additionally, the most significant ground water contamination appears to be localized around the Consolidation Area and former surface impoundment, proximal to observed (explicit and implicit) DNAPL in the subsurface. The monitoring wells outside of this localized area did not have SVOC detections during the SFI, providing little evidence of widespread dissolved-phase contamination. Because of the low

ground water seepage rates at the site and general immobility of creosote compounds, ground water contamination is not expected to migrate appreciably. Additionally, monitoring wells screened in the S2 formation had concentrations that were orders of magnitude less than the concentrations found in wells screened in the S1 formation, indicating remedial alternatives should focus on the shallow WBZ (S1).

Wells MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, MW-12, and MW-13 are screened through both WBZs, which may allow for contaminant migration between S1 and S2. Because they may serve as conduits for contamination migration, they fail to provide useful ground water contamination data with respect to each individual WBZ, and render confused water levels for the purpose of calculating seepage velocity.

In addition to SVOCs, metals were detected in several wells during the RI (Figure 8). The arsenic concentration detected in MW-6 was 20.5 micrograms per liter (µg/L) and was the only exceedance of the MCL (10 µg/L). Because copper-chromated-arsenic was not utilized for wood treatment at the site, and the only well with arsenic above the MCL is located over 150 feet upgradient of the source area, arsenic in the ground water is not considered to be attributable to historic site activities.

Lead exceeded the MCL (15 µg/L) in one ground water sample that was collected from monitoring well MW-2 (42 µg/L). This monitoring well also had an exceedance of the zinc secondary MCL of 5,000 µg/L, with a concentration of 9,520 µg/L. Lead and zinc are not likely related to site activities because of their isolated occurrences outside of the source area.

Thallium ground water concentrations exceeded the MCL of 2 µg/L in MW-5, MW-7, and MW-4, with concentrations of 13, 10, and 8 µg/L, respectively. Iron was detected above its secondary MCL of 300 µg/L in all but two wells (MW-1 and MW-2) during the RI. Manganese was detected above its secondary MCL of 50 µg/L in all but two wells (MW-1 and MW-3). The thallium, iron, and manganese concentrations are not likely related to the wood treatment activities at MPTC. However, there exists a possibility that reducing conditions, which could contribute to elevated levels of these metals in the ground water, can be a secondary effect of the contamination emanating from previous site activities. Metals should be monitored as part of any future ground water monitoring programs implemented.

1.5.2.3 Sources Areas

Source material is a media that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration to other media or for direct exposure (EPA 1991). The EPA identifies source material as either a principal threat waste or a low-level threat waste.

- **Principal Threat Wastes** – Source materials that are considered highly toxic or highly mobile and that generally cannot be reliably contained or would present a significant risk to human health or the environment if exposure were to occur.

- **Low-level Threat Wastes** – Source materials that exhibit low toxicity and low mobility and can be reliably contained or would present only a low risk to human health or the environment if exposure were to occur.

The source material identified at MPTC is considered a principal threat waste. The Consolidation Area and Former Impoundment Area (Figure 3) both contain DNAPL-impacted soils. The presence of DNAPL indicates high toxicity.

1.5.2.4 Migration Pathways

The nature and extent of contamination is combined with source identification and physical characteristic information to evaluate migration pathways. Free-phase DNAPL flow is not likely to be a prominent migration pathway because it has been found to be localized to three wells (MW-2, MW-3, and MW-14) that seem to provide a conduit in which it can collect, and DNAPL appears trapped in capillary tension. Percolation of precipitation is a potential migration route for the contaminants present in the surface and subsurface soils. Surface water transport of contaminated sediments and erosion of Consolidation Area waste and Former Impoundment Area are likely routes of migration to nearby surface water.

1.5.2.5 Exposure Pathways

Current and future exposure pathways evaluated in the HHRA (TT, 2001a) include the following:

- Ingestion of surface soil
- Dermal contact with surface soil
- Inhalation of particulates or vapors generated from surface soil
- Ingestion of ground water
- Dermal contact with ground water during showering or bathing
- Inhalation of vapors from ground water during showering or bathing
- Ingestion of surface water/sediment
- Dermal contact with surface water/sediment
- Ingestion of biota.

1.5.3 Risk Assessment

The HHRA Report (TT 2001a) results indicate that the major noncarcinogenic risks (Table 1-1) are due to (1) ingestion of arsenic, barium, and manganese in crayfish tissue and (2) ingestion and dermal absorption of arsenic, thallium, dibenzofuran, and naphthalene in ground water. The majority of the carcinogenic risks (Table 1-2) are due to (1) incidental ingestion and dermal contact with PAHs in Big Creek sediments, and (2) ingestion and dermal absorption of arsenic in ground water.

In addition to the noncarcinogenic and carcinogenic risks associated with direct contact with site-related COPCs in surface sediment (0–0.5 feet bgs), PAHs have been detected at depth in several soil sample locations at MPTC. DNAPL has been detected in only three monitoring wells.

Therefore, the potential for leaching of COPCs from contaminated soils and sediments to ground water was also evaluated in the HHRA in order to determine site-specific preliminary remediation goals (PRGs; identified in 2.3.4).

The Ecological Risk Assessment (TT 2001a) evaluated a comprehensive suite of upland and aquatic receptors to identify adverse impacts from COPCs identified for the site. For terrestrial plants, the residual risk should be evaluated in conjunction with the implementation of PRGs for the site. If topsoil and reseeding are not placed during the Remedial Action, then risk to this community should be reassessed. No further action is needed to protect the soil invertebrate community, mammals, and birds at MPTC.

For aquatic receptors, such as benthic invertebrates, sediments in low-lying areas of Big Creek should be remediated. These areas overlap with the areas identified in the HHRA as posing a significant threat to human health, if exposure were to occur. No further action is needed to protect the fish community and amphibians at MPTC.

2. REMEDIAL ACTION OBJECTIVES

This section discusses remedial action objectives (RAOs), Applicable or Relevant and Appropriate Requirements (ARARs), and identifying areas subject to a remedial alternative evaluation. This last step includes the development of PRGs.

2.1 PRESENTATION OF REMEDIAL ACTION OBJECTIVES

According to the NCP, 40 CFR §300.430(a)(1)(i), the "national goal of the remedy selection process is to select remedies that are protective of human health and the environment, that maintain protection over time, and that minimize untreated waste." Based on information relating to types of contaminants, environmental media of concern, and potential exposure pathways, preliminary RAOs were developed to aid in the development and screening of remedial alternatives. Final RAOs will be documented in the ROD Amendment, if appropriate.

2.1.1 Remedial Action Objectives

The preliminary RAOs for the site are:

- Prevent exposure to COCs associated with the site in soils and sediment above remediation goals.
- Prevent exposure to COCs associated with the site ground water above remediation goals.
- Prevent offsite migration of ground water above remediation goals (based on drinking water standards or health-based levels).

- Return ground water to its expected beneficial uses wherever practicable (aquifer restoration).

2.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ARARs are substantive federal and state environmental laws and regulations that specify clean-up levels or performance standards for CERCLA sites.

Section 121(d) of CERCLA, as amended by Superfund Amendments and Reauthorization Act, states that onsite Remedial Actions must attain ARARs. ARARs may include regulations, standards, criteria, or limitations promulgated under federal or state laws. An ARAR may be either "applicable" or "relevant and appropriate," but not both. The NCP in 40 CFR §300 defines ARARs.

Three categories of ARARs exist: chemical-, location-, and action-specific requirements. Chemical-specific ARARs are health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of numerical clean-up values. These values establish the acceptable amount or concentration of a chemical that may be detected in or discharged to the ambient environment. Location-specific ARARs are restrictions on the concentrations of hazardous substances or on activities conducted at the site that result from site characteristics or its immediate environment. For example, location of the site or proposed RA in a flood plain, wetland, historic place, or sensitive ecosystem may trigger location-specific ARARs. Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken. These requirements are triggered by the specific remedial activities selected. Action-specific ARARs do not in themselves determine the remedial alternative; rather, they indicate how an alternative must be conducted.

In addition to the legally binding requirements established as ARARs, many federal and state programs have developed criteria, advisories, guidelines, or proposed "To Be Considered" (TBC) standards. TBC material may provide useful information or recommend procedures if no ARAR addresses a particular situation or if existing ARARs do not provide protection. In such situations, TBC criteria or guidelines may be used to set remedial action levels. Chemical-, location-, and action-specific ARARs are presented in Table 2-1.

2.3 IDENTIFYING AREAS SUBJECT TO A REMEDIAL ALTERNATIVE EVALUATION

Areas that require remedial alternative evaluation were identified if they met the following criteria:

- Area is identified as a principal threat waste.

- Area exceeds remediation goals for COPCs calculated in the HHRA.

- Area where ground water exceeds MCLs (EPA 2011), Regional Screening Levels (RSLs; EPA 2010b), or LDEQ Risk Evaluation/Corrective Action Plan (RECAP) values (LDEQ 2003).

2.3.1 Identification of Areas Based on Human Health Risk Assessment

The HHRA (TT 2001a) evaluated potential current and future exposures at MPTC within 10 exposure areas. This evaluation was completed using benzo(a)pyrene (B[a]P) equivalent concentrations in surface soil. B(a)P equivalents are calculated values based on the concentrations of seven carcinogenic PAHs (benzo[a]anthracene, B[a]P, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, and indeno[1,2,3-c,d]pyrene) present in each sample. Table 2-2 presents the 10^{-4}, 10^{-5}, and 10^{-6} excess cancer risk direct exposure limits for two exposure scenarios: the current/future trespasser/recreational visitor and the potential future industrial worker that were developed in the HHRA (TT 2001a). While a future hypothetical residential scenario was evaluated in the HHRA, future residential land use is unlikely. Therefore, the future trespasser/recreational visitor and future industrial worker scenarios formed the basis of the remediation level development.

A remediation level of 42 milligrams per kilogram (mg/kg) B(a)P equivalent was calculated for the trespasser/recreational visitor at the $1x10^{-4}$ excess cancer risk level (upper end of the acceptable risk range). The remediation level for an onsite industrial worker would be 26 mg/kg B(a)P equivalent for the upper range of the acceptable risk range. The toxicity equivalent and toxicity values used to determine exposure limits in the 2001 HHRA were verified during the development of this report with the current values for PAHs. Based on the comparison, the PRGs determined in the HHRA are considered appropriate.

Samples in the Big Creek Exposure Area (Figure 9) have locations that exceed the 10^{-4} remediation goals. Therefore, these surface soil and sediment locations were considered for remediation to address direct contact at MPTC. The industrial worker exposure scenario was used for the remedial alternative evaluation to allow potential industrial and/or recreational reuse.

Table 2-3 identifies the five soil and sediment sample locations that exceeded the risk-based B(a)P equivalent industrial worker remediation goal. The length of the area subject to remediation spans the length of Big Creek between the midpoint of O16 and N15 and the midpoint of SD01 and SD25 (see Figure 9). A length of 1,400 feet and an average width of 4 feet for Big Creek were used to calculate volumes subject to remediation (approximately 415 cubic yards).

Although sample location JS04 has surface soil concentrations above the risk-based industrial worker remediation level from the 0 to 0.5 feet bgs, it is an isolated hot-spot and, therefore, is not grouped together with the sample locations along Big Creek. Additionally, the surface soil from 0.5 to 2 feet bgs at this location is less than the B(a)P equivalent industrial worker remediation goal. Because it is an isolated hot-spot, the likelihood of a worker spending 25 years at the exact JS04 location is improbable. Before designating this hot-spot for remediation, additional

sampling and characterization at and around this location should be performed to obtain a current and realistic requirement for remediation.

Additional assessment and characterization should be performed during the Remedial Action for sediment sample locations that comprise the Big Creek Exposure Area to verify the presence of affected media greater than remediation goals, as well as the depth of contamination. This characterization can determine whether the contamination is continuous or comprised of isolated pools of residual DNAPL. The current volume of soil and sediment requiring remediation in the Big Creek Exposure Area may vary significantly from the volume estimated using data from sampling performed in 2000.

Although the Consolidation Area and Former Impoundment Area do not pose a current direct contact risk, erosion of the existing clay and soil cap may lead to future exposure above the remediation goals determined in the HHRA. These areas also contain principal threat wastes, which are considered highly toxic and/or highly mobile. To prevent such a scenario, the Consolidation Area and Former Impoundment Area were considered in the remedial alternatives evaluation.

2.3.2 Identification of Areas Based on Prevention of Future Ground Water Exceedances at the Site Property Boundary

The MCLs (EPA 2011), RSLs (EPA 2010b), and LDEQ RECAP values (LDEQ 2003) that were compared to analytical ground water data for SVOCs in the two WBZs are presented in Table 2-4. The RSLs and LDEQ RECAP screening values are not ARARs, but rather, they are TBCs. Figure 7 presents the locations where specific SVOC concentrations were above screening levels in December 2010. In addition to SVOCs, primary and secondary MCL exceedances were detected for arsenic, thallium, lead, zinc, iron, and manganese during the original RI in 2000 and are presented in Figure 8.

According to the ground water monitoring results of the ground water sampling performed in December 2010 as part of the SFI, the SVOC exceedances in S1 were evident within the extents of the DNAPL-contaminated soil, but not near the site boundary. The MCL exceedances of B(a)P concentrations in the S1 subject this WBZ to a remedial alternatives evaluation. Exceedances in arsenic, lead, and thallium were also present in the S1 WBZ during the 2000 RI. Arsenic and thallium in ground water were determined to be risk drivers for human health risk (Table 1-1 and 1-2). Neither arsenic nor thallium is believed to be related to past site operations. Therefore, these risks may be over predictive of reasonably expected risks at the MPTC site. Nevertheless, these areas where contaminated ground water is present above acceptable levels are subject to a remedial alternatives evaluation.

The S2 WBZ does not have MCL exceedances for SVOCs. The potential risk from the SVOC contamination in the deep S2 WBZ was calculated using the results from the December 2010 sampling event. The calculations of the carcinogenic and non-carcinogenic risk from the maximum concentrations detected are presented in Table 2-5. The cumulative carcinogenic risk of 6.8×10^{-5} is within the risk management range of 1×10^{-4} to 1×10^{-6} and the noncarcinogenic hazard index does not exceed 1.0. The maximum concentration of benzo(a)pyrene at 0.052 ug/L

does not exceed the MCL of 0.2 ug/L. Therefore, the S2 WBZ is not subject to a remedial alternatives evaluation due to SVOC contamination. A thallium concentration exceedance was observed in the S2 WBZ, in well MW-4, during the 2000 RI. Because this exceedance was noted in the parent sample, but not in the duplicate sample, and the analytical data for metals in ground water is over a decade old, WBZ S2 was not subject to a remedial alternatives evaluation. However, this WBZ will need to be monitored to ensure that metal concentrations in the ground water remain protective of human health and contaminants do not migrate offsite.

2.3.3 Summary of Areas Subject to a Remedial Alternatives Evaluation

Based on the results of the HHRA (TT 2001a), the Big Creek Exposure area is subject to a remedial alternative evaluation in order to prevent direct exposure above remediation goals calculated as safe for human health. The Consolidation Area and Former Impoundment Area are subject to a remedial alternatives evaluation because they contain principal threat wastes that may cause direct exposure above remediation goals if eroded. The S1 WBZ exceeds ARARs (i.e., MCLs) and is subject to a remedial alternatives evaluation.

2.3.4 Preliminary Remediation Goals

After considering past operations at MPTC, the analytical results for soil, sediment, and ground water samples collected during the RI, and the results of the HHRA, the following remediation goals were identified:

1) B(a)P equivalent of 26 mg/kg (industrial worker scenario) in surface soils and sediment subject to remediation

2) Prevention of exposure to and offsite migration of ground water that exceeds MCLs, RSLs, or RECAP values.

3. DEVELOPMENT AND SCREENING OF TECHNOLOGIES

Remedial technologies were developed in accordance with EPA Guidance (EPA 1988). The development process starts by identifying general response actions (GRAs) and associated technologies for each medium of interest that will satisfy the RAOs. GRAs are generic, medium-specific remedial actions and may include no action, institutional controls (ICs), containment, removal, treatment, disposal, monitoring, or a combination thereof (EPA 1988). At this site, the media of interest within specific areas are:

- **Surface Soils around Consolidation Area** – Applies to unimpacted areas of surface soils around the Consolidation Area where erosion and lack of vegetation presents a migration pathway for infiltration of runoff and potential damage to the engineered cap (Area A on Figure 10).

- **Surface Soil Former Impoundment Area** – Applies to the unsaturated surface soil over the Former Impoundment and the area located east of the Consolidation Area (Area B on Figure 10).

- **Surface and Subsurface Soil Source Area** – Applies to an area measuring approximately 130 feet by 80 feet surrounding monitoring well MW-14 to a depth of approximately 45 feet through the first (S1) sand layer (Area C on Figure 10).

- **Sediment and Surface Soil Big Creek Exposure Area** – Applies to the sediment and surface soil hotspots in the Big Creek area near the southern end of the site (Figure 9).

- **S1 Ground Water** – Applies to the ground water in the shallow WBZ (Figure 7).

- **S2 Ground Water** – Applies to the ground water in the deep WBZ (Figure 7).

The GRAs and remedial technologies for each of the media of interest are identified and presented in Section 3.1. The GRAs and remedial technologies are then screened for effectiveness, implementability, and cost in Section 3.2 before being developed into remedial alternatives in Section 4.

3.1 GENERAL RESPONSE ACTION AND REMEDIAL TECHNOLOGIES

3.1.1 All Media Types

The following GRAs will be considered for all media types:

- No further action (NFA)
- Limited action.

As required by the NCP (40 CFR § 300.430 [e][6]), the selected remedial alternatives must include the NFA alternative to be used as the baseline alternative against which the effectiveness of all other remedial alternatives are judged.

The limited action GRA utilizes ICs, engineering controls (ECs), and long-term monitoring (LTM) to achieve RAOs. ICs are non-engineered instruments, such as administrative and legal controls, that help minimize the potential for human exposure to contamination and protect the integrity of a remedy by limiting land or resource use. ECs are measures that involve design and/or construction in order to prevent human exposure to contamination. LTM involves sampling and analysis of contaminated media to verify that the remedy remains protective. ICs and ECs can be used in all stages of the remedial process to accomplish various remedial objectives, and can be implemented in a series to provide overlapping assurances of protection against contamination.

3.1.2 Surface Soils around Consolidation Area – Area A

Surface soils around the consolidation area do not require application of a specific remedial technology and will be discussed further under the general remedial alternatives in Section 4.1.

3.1.3 Surface Soil Former Impoundment Area – Area B

The surface soil alternatives in the Former Impoundment Area apply to the unsaturated clay soil (C1). The depth to water varies from an average of 0.5 to 23 feet bgs. The GRAs evaluated for contaminated surface soil include the following:

- NFA
- Limited action
- Containment
- Removal.

These GRAs and the individual technologies considered for each GRA are presented in Table 3-1.

Containment is an engineered remedy designed to prevent migration of the contaminants and eliminate exposure pathways to potential receptors. Physical removal may include removal of contaminated soil or the removal of contamination from soil. Removing contaminated soil entails excavation using standard construction equipment to remove material for disposal or treatment. The removal of contamination from the soil entails thermally, biologically, physically, or chemically removing contaminants from the soil. Removal may also be supplemented with other response actions (e.g., treatment) to achieve RAOs.

3.1.4 Surface and Subsurface Soil Source Area – Area C

The surface and subsurface soil alternatives apply to an area within the Former Impoundment Area identified as the Source Area and to a depth of 45 feet bgs. This area was identified because DNAPL contamination was observed in the boring from the surface down to 33 feet bgs, and 20.7 feet of DNAPL was present in MW-14. The vertical extent includes the unsaturated clay soil (C1) and the saturated sand layer (S1). The depth to water varies from an average of 0.5 to 23 feet bgs. The GRAs evaluated for contaminated surface and subsurface soil include the following:

- NFA
- Limited action
- Containment
- Removal
- Treatment.

These GRAs and the individual technologies considered for each GRA are presented in Table 3-1.

Containment and removal are as discussed in the previous section. Treatment subjects contaminants to processes that alter their state, transform them to innocuous forms, or immobilize them. This GRA is usually preferred unless site- or contaminant-specific characteristics make it impracticable. Treatment may be physical or chemical and can be performed *in situ*. *In situ* treatment systems treat the contaminated medium in place; consequently, the need for aboveground waste management is minimal.

3.1.5 Sediment and Surface Soil Big Creek Exposure Area

The sediment and surface soil alternatives apply to the sediment 0 to 2 feet bgs along the Big Creek. The surface soil applies to hotspots near the Big Creek. The GRAs evaluated for contaminated sediment and surface soil include the following:

- NFA
- Limited action
- Containment
- Removal.

These GRAs and the individual technologies considered for each GRA are presented in Table 3-1.

3.1.6 S1 Ground Water

The ground water evaluation applies to the shallow WBZ in the Cockfield Aquifer (S1). The GRAs evaluated for contaminated ground water include the following:

- NFA
- Limited action
- Containment
- Treatment
- Removal.

These GRAs and the individual technologies considered for each GRA are presented in detail in Table 3-2.

Containment is an engineered remedy designed to prevent migration of the contaminants and eliminate exposure pathways to potential receptors. Physical removal may include removal of contaminated ground water or the removal of contamination from the ground water. Removing contaminated ground water entails collection via extraction wells. The removal of contamination from the ground water entails vaporizing PAHs and collecting contaminants from the water without having to extract the water. Removal may also be supplemented with other response actions (e.g., treatment) to achieve RAOs.

Treatment subjects contaminants to processes that alter their state, transform them to innocuous forms, or immobilize them. This GRA is usually preferred unless site- or contaminant-specific characteristics make it impracticable. Treatment may be chemical or biological and can be performed *in situ*. *In situ* treatment systems treat the contaminated medium in place; consequently, the need for aboveground waste management is minimal.

3.1.7 S2 Ground Water

As discussed in Section 2.3.2, the S2 WBZ does not require a remedial alternatives evaluation.

3.2 REMEDIAL TECHNOLOGY SCREENING

This section presents and screens the remedial technologies presented in Tables 3-1 and 3-2.

3.2.1 Preliminary Screening Criteria

Three preliminary screening criteria (i.e., effectiveness, implementability, and cost) were used to screen these remedial technologies. Definitions for these criteria are presented below, and the technology screening is presented in Tables 3-3 and 3-4.

3.2.1.1 Effectiveness

This criterion is a measure of the ability of an option to: (1) reduce toxicity, mobility, or volume; (2) minimize residual risks; (3) afford long-term protection; (4) comply with ARARs; (5) minimize short-term impacts; and (6) achieve protectiveness in a limited duration. Technologies that offer significantly less effectiveness than other proposed technologies may be eliminated from the alternative development process. Options that do not provide adequate protection of human health and the environment likewise are eliminated from further consideration.

3.2.1.2 Implementability

Implementability is a measure of the technical feasibility and availability of the option and the administrative feasibility of implementing it (e.g., obtaining permits for offsite activities, rights-of-way, or construction). Options that are technically or administratively infeasible or that would require equipment, specialists, or facilities that are not available within a reasonable period may be eliminated from further consideration.

3.2.1.3 Cost

Qualitative relative costs for implementing the remedy are considered. Costs were obtained from published sources. Technologies that cost more to implement, but that offer no benefit in effectiveness or implementability over other technologies, may be excluded from the alternative development process.

3.2.2 Screening Summary

The results of the technology screening are summarized in the following section, and the screening is presented in greater detail, including the explanation of whether technologies were retained or not, in Tables 3-3 and 3-4. From the list of technologies potentially applicable for remediation of the chemicals and media of concern, the following technologies were retained for development of alternatives, because they were considered effective, implementable, and cost-effective relative to the other alternatives under consideration.

3.2.2.1 Soil and Sediment

Technologies retained for treatment of soil and sediment are:

- No Action
- ECs
- ICs
- Erosion Controls
- Consolidation and Capping
- Excavation and Disposal
- Excavation and Incineration
- *In Situ* Chemical Oxidation (ISCO)
- *In Situ* Solidification/Stabilization.

3.2.2.2 Ground Water

Technologies retained for treatment of ground water are:

- No Action
- ICs
- LTM
- Monitored natural attenuation (MNA)
- ISCO.

4. DEVELOPMENT OF REMEDIAL ALTERNATIVES

This section combines the technologies that were retained after screening to develop alternatives for the different exposure areas. Table 4-1 provides the remedial alternatives for the site. Alternatives were developed generally based on the media they are designed to treat: soil, sediment, and ground water.

The developed alternatives are described below. These alternatives will be further developed during the FSR.

4.1 GENERAL REMEDIAL ALTERNATIVES

4.1.1 Plugging, Abandonment, and Replacement of Monitoring Wells

The free-phase DNAPL found in MW-2, MW-3, and MW-14 provides a continuing source of contamination to ground water. The amount of DNAPL measured in MW-2 and MW-3 has decreased significantly from 2000 to 2010. However, as discussed in the SFI (EA 2011), it appears that DNAPL is draining from the upper formation into MW-14 due to the excessive screen length in this well. MW-14 had 0.4 foot of DNAPL in 2000, 19.5 feet in 2002, and 20.7 feet in 2010. Because these three wells act as a conduit for DNAPL migration, they will be plugged, abandoned, and replaced after DNAPL removal.

All wells screened through both the S1 and S2 WBZs have the potential of acting as conduits for DNAPL migration and therefore, will be plugged and abandoned. These wells include MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, MW-12, and MW-13. Monitoring wells that are screened through both WBZs also fail to provide useful ground water analytical data, and render confused water levels. Only wells needed as part of a monitoring program will be replaced.

4.1.2 General Erosion Control

Unimpacted areas to the west, north, and south of the Consolidation Area, including the perimeter slopes (Area A on Figure 10), are presently devoid of vegetation and showing signs of erosion from runoff originating from the Consolidation Area. Topsoil will be placed in these areas, graded, and covered with vegetation to prevent erosion of surface soils and potential damage to the engineered cap, thereby, possibly exposing consolidated waste materials. The erosion control of the areas around the Consolidation Area will be included for each remedial alternative where contaminated material is left onsite.

4.1.3 S2 Ground Water

As discussed in Section 2.3.2, the S2 WBZ does not require a remedial alternatives evaluation. However, this WBZ will need to be monitored to ensure that metal and SVOC concentrations in the ground water remain protective of human health and contaminants do not migrate offsite.

4.2 SURFACE SOIL FORMER IMPOUNDMENT AREA REMEDIAL ALTERNATIVES

The following remedial alternatives were identified as potential alternatives for the remediation of the Former Impoundment Area (Area B on Figure 10) at the MPTC Site:

- Alternative F-1: NFA
- Alternative F-2: Limited Action
- Alternative F-3: Erosion Control
- Alternative F-4: Capping
- Alternative F-5: Excavation and Offsite Disposal/Offsite Incineration.

Table 4-2 describes how each of the alternatives meets the RAO.

4.2.1 Alternative F-1: No Further Action

As required by the NCP (40 CFR § 300.430 [e][6]), the alternatives must include the NFA alternative. This is to be used as the baseline alternative against which the effectiveness of all other remedial alternatives are judged. Under NFA, no RAs will be conducted at the site. All contaminants will remain in place and will be subject to environmental influences. Furthermore, no action will be taken to prevent unauthorized access or development at the site. No deed notices to inform interested parties regarding the site conditions will be implemented.

4.2.2 Alternative F-2: Limited Action

Limited action utilizes ICs, and ECs to achieve RAOs. IC instruments used include building/construction restriction, excavation restriction, ground water use restriction, or a combination thereof. ECs are instruments such as fencing or signage that are used to minimize access to contaminated areas or areas that may pose a physical hazard.

Because some alternatives may include leaving material above the PRGs, ICs and ECs will need to be included to isolate these materials from contact or completing a pathway. In the FSR, ICs and ECs will be evaluated in greater depth for effectiveness, implementability, and cost.

4.2.3 Alternative F-3: Erosion Control

Erosion control measures of Alternative F-3 over the Former Impoundment Area include placing top soil, grading, and seeding this area. This will prevent the further erosion of soil from the adjacent Consolidation Area cap, which could possibly lead to exposure to contaminated soil above human health risk levels. ECs and ICs will be implemented because contaminated material will remain onsite.

4.2.4 Alternative F-4: Capping

Alternative F-4 addresses the soil media contamination in the Former Impoundment Area by extending the existing cap over the Consolidation Area to the east to resolve erosion issues that may lead to receptor exposure above acceptable risk levels.

In addition to preventing receptor contact to contaminated surface soil, this alternative also reduces infiltration of surface water. Reducing surface water infiltration will limit the ability for water to transport COPCs (i.e., SVOCs) through the vadose zone into the underlying ground water.

The cap may include a clay layer and a layer of top soil, possibly separated by a geosynthetic liner. A vegetative cover will be placed on the soil or clay cap to reduce erosion, degradation of the cover material, and for aesthetics. ECs and ICs will be implemented because contaminated material remains onsite.

4.2.5 Alternative F-5: Excavation and Offsite Disposal/Offsite Incineration

The purpose of Alternative F-5 is to remove the contaminated surface soils. The removed soil can either be transported for offsite disposal or offsite incineration.

Disposal requirements will depend on whether the excavated material is classified as a hazardous waste, in which case, Land Disposal Restrictions (LDRs) may apply. Classification of the excavated material as a hazardous waste will depend on two factors: its toxicity characteristics, as determined by the Toxic Characteristic Leaching Procedure (TCLP) analytical test, and whether it qualifies as a listed waste. Hazardous wastes are land disposal restricted and require treatment prior to disposal.

4.3 SURFACE AND SUBSURFACE SOIL SOURCE AREA REMEDIAL ALTERNATIVES

The following remedial alternatives were identified as potential alternatives for the remediation of the Source Area (Area C on Figure 10):

- Alternative S-1: NFA
- Alternative S-2: Limited Action
- Alternative S-3: Select Capping
- Alternative S-4: ISCO
- Alternative S-5: Deep Soil Mixing with Stabilization and Solidification.

Alternatives S-1 and S-2 are as described previously in Sections 4.2.1 and 4.2.2, respectively. Table 4-2 describes how each of the alternatives meets the RAO.

4.3.1 Alternative S-3: Select Capping

The purpose of Alternative S-3 is to cap the area identified as the Source Area. The cap may include a clay layer and top soil layer, possibly separated by a geosynthetic liner. Additional investigation activities (i.e., soil borings) will be required during the design phase to delineate the Source Area. ECs and ICs will be implemented because contaminated material remains onsite.

4.3.2 Alternative S-4: *In Situ* Chemical Oxidation

Alternative S-4 requires the injection of a chemical oxidant in the areas with DNAPL contamination present to chemically oxidize the contaminants of concern. Pilot study testing will be conducted and the results of the testing will be used to fully develop this alternative.

To implement this alternative at the site, a chemical oxidizer will be injected into and around the Source Area via direct push or injection wells. The depth and location intervals of the injection points will be determined during the pilot test and will focus on areas of dissolved phase and DNAPL contamination. Additional monitoring wells will be installed to monitor potential downgradient migration of the oxidant and to monitor the progress of the remediation.

4.3.3 Alternative S-5: Deep Soil Mixing with Solidification/Stabilization

Alternative S-5 utilizes stabilization/solidification for the surface and subsurface soils in the Source Area (Area C on Figure 10). The stabilization/solidification alternative will be used to bind the DNAPL in the soil/ground water matrix such that it can no longer act as a continuing source of contamination to ground water. Treatability tests (i.e., pilot study tests) will be required to determine the applicability of solidification/stabilization at the site. Common additives may include, but are not limited to, Portland cement, fly ash, and activated carbon.

4.4 SEDIMENT AND SURFACE SOIL BIG CREEK EXPOSURE AREA REMEDIAL ALTERNATIVES

The following remedial alternatives were identified as potential alternatives for the remediation of the Big Creek Exposure Area:

- Alternative B-1: NFA
- Alternative B-2: Limited Action
- Alternative B-3: Consolidation and Capping
- Alternative B-4: Excavation and Offsite Disposal/Offsite Incineration

Alternatives B-1 and B-2 are as described previously in Sections 4.2.1 and 4.2.2, respectively. Table 4-2 describes how each of the alternatives meets the RAO.

4.4.1 Alternative B-3: Consolidation and Capping

Alternative B-3 addresses the soil media contamination in the Big Creek Exposure Area by consolidating the material over the Former Impoundment Area and capping the impacted material, as described previously. Sediment (0 to 2 feet bgs) along the Big Creek and identified hot spots would be included in the material to be moved (Figure 9). ECs and ICs will be implemented because contaminated material remains onsite.

4.4.2 Alternative B-4: Excavation and Offsite Disposal/Offsite Incineration

Alternative B-4 addresses the soil media contamination in the Big Creek Exposure Area by excavating and offsite disposal or offsite incineration. Disposal requirements will depend on whether the excavated material is classified as a hazardous waste, in which case LDRs would apply.

4.5 SHALLOW (S1) GROUND WATER REMEDIAL ALTERNATIVES

The following remedial alternatives were identified as potential alternatives for the remediation of the shallow WBZ (S1) ground water:

- Alternative GW-1: NFA

- Alternative GW-2: Limited Action
- Alternative GW-3: ISCO

Alternative GW-1 is as described previously in Section 4.2.1. Table 4-3 describes how each of the alternatives meets the RAOs.

4.5.1 Alternative GW-2: Limited Action

Limited action for ground water consists of implementing a ground water restriction or other ICs to prevent future ground water use at MPTC site that presents an unacceptable risk to human health or may mobilize contaminants hydraulically. The ICs will limit future use of ground water or prevent drilling wells that may cause unacceptable risk from exposure.

LTM would be performed to verify that the plume is not moving and that COC concentrations are not increasing. MNA, allows natural processes to achieve site-specific remedial objectives without enhancement or aggressive treatment. The "natural attenuation processes" that are at work in such a remediation approach include physical, chemical, or biological processes that, under favorable conditions, reduce the mass, toxicity, mobility, volume, or concentration of contaminants in the ground water. Natural processes that occur under MNA may include biodegradation (aerobic or anaerobic), dispersion, or dilution.

It is assumed MNA ground water sampling will be performed semi-annually for the first 2 years to demonstrate the natural attenuation of the ground water, and annually thereafter. Ground water samples will be analyzed for contaminants of concern and indicator parameters measured during well purging, including dissolved oxygen, oxidation-reduction potential, pH, conductivity, and alkalinity.

The effectiveness of MNA will need to be demonstrated using a weight of evidence approach. Primary evidence such as plume stability, reduction in COC concentrations, and favorable geochemical conditions can be obtained through an LTM program. Additional evidence such as biodegradation modeling and/or molecular biological tools (e.g., quantitative polymerase chain reaction [qPCR] and stable isotope probing [SIP]) may be used for additional evidence as needed. Because COCs that exceed acceptable levels will still remain onsite, a Technical Impracticability (TI) waiver may be required for this alternative to be a stand-alone remedy. A contingency measure such as Alternative GW-3 may be evaluated if MNA is not effective.

4.5.2 Alternative GW-3: ISCO

Alternative GW-3, ISCO, utilizes chemical oxidants such as permanganate, persulfate, peroxide, and ozone to oxidize contaminants in the ground water. Oxidants can be injected into WBZs of the Cockfield Aquifer via direct push technology or installation of injection wells. This technology will treat the ground water contamination, precluding any future human exposure in areas of treatment and offsite migration. The ISCO will likely be

applied to the outer boundary of observed ground water contamination. The ground water contamination at the source area will still remain. Therefore, a TI waiver and ICs restricting ground water use could still be required for this alternative to be a stand-alone remedy. Ground water monitoring will be conducted bi-annually to evaluate migration of contaminants offsite that would pose an unacceptable risk.

5. EVALUATION OF REMEDIAL ALTERNATIVES

This section evaluates the remedial alternatives developed in Section 4 following protocols outlined in EPA's RI/FS guidance (EPA 1988). The comparison criteria and evaluation process are discussed below. The evaluation of the remedial alternatives is presented in conjunction with these criteria in Tables 5-1 through 5-4.

5.1 EVALUATION CRITERIA

The assembled alternatives are evaluated in this section based on the nine criteria required by 40 CFR §300.430(e) of the NCP. As stated in EPA guidance (EPA 1988), remedial actions must accomplish the following:

- Be protective of human health and the environment.
- Attain ARARs (or provide grounds for invoking a waiver).
- Be cost effective.
- Use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.
- Evaluate the CERCLA preference for treatment that reduces toxicity, mobility, and volume as a principal element, or explain why it does not.

The nine criteria used to evaluate each alternative are listed below and are discussed in the paragraphs that follow:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction in toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance.

The first two are referred to as the threshold criteria and must be met for an alternative to continue through the ensuing detailed analysis of alternatives. The next five are considered balancing criteria and are addressed in this evaluation. The final two criteria (state and community acceptance) will be evaluated following receipt of feedback from the State and community. These nine criteria are discussed in the following paragraphs.

5.1.1 Overall Protection of Human Health and the Environment

This criterion assesses whether each alternative provides adequate protection of human health and the environment. The overall assessment of protection considers the alternative's long-term effectiveness, permanence, short-term effectiveness, and compliance with ARARs. The evaluation of protectiveness focuses on the reduction or elimination of site risks by the proposed remedial alternative. This criterion is considered a threshold and must be met by the selected alternative.

5.1.2 Compliance with ARARs

This criterion is used to evaluate whether each alternative will meet all of the federal and state ARARs identified or whether there is justification for waiving one or more ARARs. This criterion is also a threshold that must be met by the alternative selected.

5.1.3 Long-term Effectiveness and Permanence

Each alternative is evaluated in terms of risk that remains at the site after the RAO has been met. The primary focus of this evaluation is the extent and effectiveness of controls used to manage the risk posed by treatment residuals or untreated wastes. Long-term effectiveness is one of the balancing criteria. The following factors will be considered in evaluating this criterion:

- Adequacy of remedial controls
- Reliability of remedial controls
- Magnitude of the residual risk.

5.1.4 Reduction in Toxicity, Mobility, or Volume Through Treatment

This evaluation criterion addresses the CERCLA statutory preference for treatment options that permanently and significantly reduce the toxicity, mobility, or volume of the contaminants. The preference is satisfied when treatment reduces the principal threats through the following:

- Destruction of toxic contaminants
- Reduction in contaminant mobility
- Reduction in the total mass of toxic contaminants
- Reduction in the total volume of contaminated media.

5.1.5 Short-term Effectiveness

This evaluation criterion addresses the effects of the alternative during the construction and implementation phase until the RAO is met. Under this criterion, alternatives are evaluated for their effects on human health and the environment during implementation of the remedial action. The following factors will be considered:

- Exposure of the community during implementation
- Exposure of workers during construction
- Environmental impacts
- Time to achieve RAOs
- Sustainability.

The Green Remediation Evaluation Matrix (Department of Toxic Substances Control 2009) is a simple tool used to qualitatively compare the sustainability of treatment alternatives. It evaluates potential impacts associated with environmental stressors with multiple remediation options and provides a means of rating or ranking the asperity or importance of the impacts. Also, it accounts for social, economic, and environmental impacts that occur during the remediation. The Green Remediation Evaluation Matrix is populated with the environmental impacts associated with biological, chemical and/or physical stress factors, and provides a framework for qualitative comparison of multiple remediation options. This simple framework allows for a relative comparison of remedial alternatives to evaluate sustainability and environmental impacts (see Appendix A). Higher scores generally reflect more of an environmentally-friendly and/or sustainable alternative.

5.1.6 Implementability

This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials that may be required during its implementation. The following factors were considered:

- Ability to construct the technology
- Monitoring requirements
- Availability of equipment and specialists
- Ability to obtain approvals from regulatory agencies.

5.1.7 Cost

Generally, the cost for each alternative is calculated from estimates of capital and operation and maintenance (O&M) costs. Capital costs consist of direct and indirect costs. Direct costs include the purchase of equipment, labor, and materials necessary to implement the alternative. Indirect costs include engineering, financial, and other services such as testing and monitoring. Annual O&M costs for each alternative include operating labor, maintenance materials and labor, auxiliary materials, and energy.

A cost estimate in a CERCLA FSR is normally expected to fall within the range of 30 percent below to 50 percent above the actual project cost (accuracy of -30% and +50%) (EPA 2000). The FSR should indicate when it is not realistic to achieve this degree of accuracy based on existing data collected during the RI (EPA 1988). This RAETM does not include developed cost estimates. They will developed in the FSR.

5.1.8 State and Community Acceptance

These two criteria evaluate the issues and concerns of the state and community regarding each alternative. These criteria cannot be evaluated until the state and community have reviewed and commented on the alternatives presented in the FSR.

5.2 ALTERNATIVE EVALUATION

Alternative evaluations are presented for the Former Impoundment Area, Source Area, Big Creek Exposure Area, and Shallow (S1) Ground Water in Tables 5-1 through 5-4. In these tables, potential remedial alternatives are qualitatively assessed in conjunction with seven of the nine evaluation criteria; state and community acceptance are evaluated during the Proposed Plan stage of the project.

5.3 COMPARATIVE ANALYSIS

A comparative evaluation of the remedial alternatives for each media, which contains an evaluation of alternatives in relation to each other, was then conducted for each of the evaluation criteria (see Tables 5-5 through 5-8). The relative ranking of these alternatives is summarized below.

5.3.1 Overall Protection of Human Health and the Environment

Former Impoundment Area

The no further action alternative will not ensure protection of human health or the environment because COC concentrations exceeding human health and ecological risk values will remain onsite. The limited action alternative will contain institutional and engineering controls to limit access to impacted material; therefore, these measures are considered protective. However, ICs (e.g., restricting land use) are easily violated and ECs (e.g., fencing) can be circumvented. The remaining alternatives, including erosion control, capping, and excavation and offsite disposal/offsite incineration, will provide overall protection of human health and the environment because they either cover or remove the contaminated soil, preventing receptor contact to COCs above risk levels.

Source Area

As for the Former Impoundment Area, the no further action alternative will not ensure protection of human health or the environment, but the limited action alternative will be protective for the Source Area. The remaining alternatives, including select capping, ISCO, and deep soil mixing

with stabilization/solidification, will provide overall protection of human health and the environment because they either cover or treat the contaminated soil, preventing receptor contact to COCs above acceptable risk levels.

Big Creek Exposure Area

The no further action alternative in the Big Creek Exposure Area will not ensure protection of human health or the environment, but the limited action alternative will be protective for the Big Creek Exposure Area. The remaining alternatives, including consolidation and capping, and excavation and offsite disposal/offsite incineration, will provide overall protection of human health and the environment because they either cover or remove the contaminated soil, preventing receptor contact to COCs above acceptable risk levels.

Shallow (S1) Ground Water

The no further action alternative will not ensure protection of human health or the environment. The limited action alternative will reduce risk to human health and the environment because it includes implementation of ICs, although this alternative may require a TI waiver to be a stand-alone remedy. The ISCO alternative will reduce the human health and environmental risk by converting the COCs into innocuous substances.

5.3.2 Compliance with ARARs

Former Impoundment Area

There are no chemical-specific ARARs for soil contamination. The no further action, limited action, erosion control, and capping alternatives may not meet the ground water protective subsurface soil concentration requirements set forth by the TBCs (i.e., EPA RSLs and LDEQ RECAP values), but excavation and offsite disposal/offsite incineration will. Control measures will be taken during construction to prevent adverse impacts in the floodplain, loss of wetlands, threats to fish and wildlife resources, or from stormwater runoff. Therefore, all of the alternatives will comply with location-specific ARARs. Control measures implemented during construction will also allow all of the alternatives to comply with action-specific ARARs.

Source Area

There are no chemical-specific ARARs for soil contamination. The no further action, limited action, and select capping alternatives may not meet the ground water protective subsurface soil concentration requirements set forth by the TBCs (i.e., EPA RSLs and LDEQ RECAP values), but ISCO and deep soil mixing will. Control measures will be taken during construction to prevent adverse impacts in the floodplain, loss of wetlands, threats to fish and wildlife resources, or from stormwater runoff. Therefore, all of the alternatives will comply with location-specific ARARs. Control measures implemented during construction will also allow all of the alternatives to comply with action-specific ARARs.

Big Creek Exposure Area

There are no chemical-specific ARARs for soil contamination. The no further action, limited action, and consolidation and capping alternatives may not meet the ground water protective subsurface soil concentration requirements set forth by the TBCs (i.e., EPA RSLs and LDEQ RECAP values), but excavation and offsite disposal/offsite incineration will. Control measures will be taken during construction to prevent adverse impacts in the floodplain, loss of wetlands, threats to fish and wildlife resources, or from stormwater runoff. Therefore, all of the alternatives will comply with location-specific ARARs. Control measures implemented during construction will also allow all of the alternatives to comply with action-specific ARARs.

Shallow (S1) Ground Water

The no further action and limited action alternatives will not comply with the chemical-specific ARARs because B(a)P concentrations in ground water may continue to exceed its MCL. A TI waiver may be required because of this non-compliance. ISCO will comply with ARARs. Control measures implemented during construction will allow all of the alternatives to comply with location- and action-specific ARARs.

5.3.3 Long-term Effectiveness

Former Impoundment Area

The alternative that utilizes excavation and offsite disposal/offsite incineration is the most effective long-term alternative because the impacted material is removed from the site. The erosion control and capping alternatives are not as effective long-term because although they prevent receptor contact with surface and subsurface soils above human health and environmental risk levels, the contaminated material is still present on site. The limited action alternative, which utilizes ICs and ECs to limit exposure, is less effective than the active remedy alternatives, but more effective than the no further action alternative.

Source Area

The ISCO alternative and deep soil mixing with stabilization/solidification alternative are the most effective long-term alternatives because they either chemically or physically treat the COCs in the soil. Select capping is not as effective as the previous two alternatives because contaminated soil remains present on site, although receptor contact is effectively eliminated. Any future erosion or disruption of the cap may reinstate the human health and environmental risks. The limited action alternative, which utilizes ICs and ECs to limit exposure, is more effective than the no action alternative.

Big Creek Exposure Area

The alternative that utilizes excavation and offsite disposal/offsite incineration is the most effective long-term alternative because the impacted material is removed from the site. The consolidation and capping alternative is not as effective long-term because although it prevents

receptor contact with surface and subsurface soils above human health and environmental risk levels, the contaminated material is still present on site. The limited action alternative, which utilizes ICs and ECs to limit exposure, is more effective than the no action alternative.

Shallow (S1) Ground Water

The limited action alternative is more effective than the no further action alternative. The ISCO alternative is more effective than the limited action alternative because it treats the COCs in the water, reducing their ability to pose a threat to receptors in the future.

5.3.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Former Impoundment Area

The excavation and offsite disposal/offsite incineration alternative is ranked highest because it can possibly destroy contaminated material if the incineration option is implemented. This alternative is irreversible and reduces the volume of contaminated material onsite. The erosion control and capping alternatives rank lower than excavation and offsite disposal/offsite incineration because the treatment is not irreversible and contaminated materials remain onsite. The no further action and limited action alternatives are ranked last and equal because both involve contaminated material remaining onsite and both fail to reduce mobility, toxicity, and/or volume.

Source Area

The ISCO alternative is ranked highest because it treats contaminated material, is irreversible, and reduces toxicity by converting COCs into innocuous substances; thereby reducing the volume of the contaminated material onsite. The deep soil mixing with stabilization/ solidification is ranked second because although it is irreversible and reduces mobility, it leaves the contaminated material onsite and fails to reduce toxicity and volume. Select capping is ranked third because although it may reduce mobility of the COCs by limiting rainfall from percolating through the soil, it is not irreversible and does not treat contaminated material. The limited action and no further action alternatives are ranked and last and equal because they not irreversible, do not destroy or treat contaminated material, and fail to reduce toxicity and mobility of contaminated material.

Big Creek Exposure Area

The excavation and offsite disposal/offsite incineration alternative is ranked highest because it can possibly destroy contaminated material if the incineration option is implemented. This alternative is irreversible and reduces toxicity and volume of contaminated material onsite. The consolidation and capping alternative ranks lower than excavation and offsite disposal/offsite incineration because although it reduces mobility of the COCs by limiting rainfall from percolating through the soil, the treatment is not irreversible and contaminated materials remain onsite. The no further action and limited action alternatives are ranked last and equal because

both involve contaminated material remaining onsite and both fail to reduce mobility, toxicity, and/or volume.

Shallow (S1) Ground Water

The ISCO alternative ranks the highest because it treats the contaminated ground water and reduces toxicity by converting the COCs into innocuous substances; thereby reducing the volume of contaminated ground water. This alternative is also irreversible. If natural attenuation is shown to be effective, it is capable of reducing mobility, toxicity, and volume of contaminants in ground water. The no further action alternative is ranked last because it involves contaminated material remaining onsite and fails to reduce mobility, toxicity, and/or volume.

5.3.5 Short-term Effectiveness

Former Impoundment Area

The limited action alternative is ranked the highest because it has the least adverse impact on the community, workers, and environment, and takes the least amount of time to achieve the RAO. This alternative is followed by erosion control, capping, and excavation and offsite disposal/offsite incineration, respectively. Capping requires more construction than erosion control, leading to more potential for adverse community, worker, and environmental impacts. Excavation will require movement of larger volumes and handling of contaminated soil more so than capping, increasing the potential risk of harmful exposure for workers and the community, as well as the environment. The no further action alternative is ranked last because although it does not have any adverse impacts, it does not achieve the RAO.

Source Area

The limited action alternative is ranked the highest because it has the least adverse impact on the community, workers, and environment, and takes the least amount of time to achieve the RAO. This alternative is followed by deep soil mixing with stabilization/solidification and select capping, which are ranked equally. Capping and deep soil mixing with stabilization/ solidification will require heavy construction equipment and will disrupt soil which will increase the potential risk of harmful exposure for workers and the community, as well as the environment. ISCO is ranked next because it involves use of hazardous chemicals, leading to more potential for adverse community, worker, and environmental impacts. The no further action alternative is ranked last because although it does not have any adverse impacts, it does not achieve the RAO.

Big Creek Exposure Area

The limited action alternative is ranked the highest because it has the least adverse impact on the community, workers, and environment, and takes the least amount of time to achieve the RAO. This alternative is followed by consolidation and capping, and excavation and offsite disposal/offsite incineration, which are ranked equally. Excavation and offsite disposal/offsite incineration, and consolidation and capping will require heavy construction equipment and will

disrupt soil, increasing the potential risk of harmful exposure for workers and the community, as well as the environment. The no further action alternative is ranked last because although it does not have any adverse impacts, it does not achieve the RAO.

Shallow (S1) Ground Water

The limited action alternative is ranked the highest because it has the least adverse impact on the community, workers, and environment. ISCO will require use of more heavy equipment and disrupt the soil structure more than limited action will, increasing the potential risk of harmful exposure for workers and the community, as well as the environment. The no further action alternative is ranked last because although it does not have any adverse impacts, it does not achieve the RAOs.

5.3.6 Implementability

Former Impoundment Area

The no action alternative will be the easiest to implement. The limited action alternative will follow because it relies on ICs and ECs, which are easier to implement than an intrusive remedy. Erosion control will be easier to implement than capping because of the large volume of clay material that will need to be acquired for the cap. Excavation and offsite disposal/offsite incineration will be the most difficult to implement.

Source Area

The no action alternative would be the easiest to implement. The limited action alternative would follow because it relies on ICs and ECs, which are easier to implement than an intrusive remedy. ISCO will be easier to implement than capping because of the large volume of clay that will need to be procured for the cap. Deep soil mixing with stabilization/solidification will be the most difficult to implement because of the 45-foot depth to which the mixing auger must extend.

Big Creek Exposure Area

The no action alternative would be the easiest to implement. The limited action alternative would follow because it relies on ICs and ECs, which are easier to implement than an intrusive remedy. The consolidation and capping, and excavation and offsite disposal/offsite incineration are ranked equally because both are technical feasible, although the Big Creek Exposure Area terrain will prove difficult to access.

Shallow (S1) Ground Water

The no action alternative would be the easiest to implement. The limited action alternative would follow because it relies on ICs, which are easier to implement than an intrusive remedy. ISCO will be the most difficult to implement although it is technically feasible, it will require more resources and more extensive monitoring than the other ground water alternatives.

5.3.7 Cost

Qualitative cost comparisons are provided in the comparative analysis of the remedial alternatives (see Tables 5-5 through 5-8). This information is not represented here for brevity. Detailed cost estimates will be developed in the FSR.

6. REFERENCES

EA Engineering, Science, and Technology, Inc. (EA). 2010a. Remedial Investigation/ Feasibility Study Reassessment Work Plan for Marion Pressure Treating Company Site, Union Parish, Louisiana. 23 August.

EA. 2010b. Field Sampling Plan, Remedial Investigation/Feasibility Study Reassessment, Marion Pressure Treating Company Superfund Site, Union Parish, Louisiana, EPA Identification No. LAD008473142. 4 November.

EA. 2011. Supplemental Field Investigation Report, Marion Pressure Treating Company Superfund Site, Union Parish, Louisiana. 27 May.

Ecology and Environment, Inc. (E&E). 1995a. Site Assessment Report for Marion Pressure Treating. 20 January.

E&E. 1995b. Preliminary Assessment Report for Marion Pressure Treating Company. 28 April.

E&E. 1995c. Site Assessment Report for Marion Pressure Treating Company. 20 October.

E&E. 1997. Removal Assessment Report for the Marion Pressure Treating Company. January.

E&E. 1999. HRS Documentation and References 1-29 for the Marion Pressure Treating Company Site. October.

Louisiana Department of Environmental Quality (LDEQ). 1999. Expanded Site Investigation Report for Marion Pressure Treating Company. September.

LDEQ. 2003. Risk Evaluation/Corrective Action Program Table 1. Accessed: 1 April 2011. Website: http://www.deq.state.la.us/portal/Portals/0/technology/recap/2003/RECAP%202003%20Text%20Table%201.pdf.

Tetra Tech EM Inc. (TT). 2001a. Marion Pressure Treating Company Human Health Risk Assessment. Prepared for EPA Region 6. 25 May.

TT. 2001b. Marion Pressure Treating Company Superfund Site Feasibility Study Remedial Alternatives Memorandum. Prepared for EPA Region 6. 27 June.

TT. 2001c. Remedial Investigation Report, Marion Pressure Treating Company, Marion, Union Parish, Louisiana. Prepared for EPA Region 6. 18 July.

TT. 2001d. Marion Pressure Treating Company Superfund Site Feasibility Study. Prepared for EPA Region 6. 31 July.

TT. 2002. Marion Pressure Treating Company Field Investigation Report. 10 September.

TT. 2003. Final Design Report for Marion Pressure Treating Company, Marion, Union Parish, Louisiana. 24 September.

U.S. Army Corps of Engineers (USACE). 2006. Independent Technical Review Report for Marion Pressure Treating Company, Marion, Union Parish, Louisiana. December.

U.S. Environmental Protection Agency (EPA). 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final. OSWER Directive 9355.3-01. October.

EPA. 1991. A Guide to Principal Threat and Low-level Threat Wastes. OSWER Directive 9380.3-06FS. November.

EPA. 2002. Record of Decision, Marion Pressure Treating Company, Marion, Union Parish, Louisiana. June.

EPA. 2010a. RAC II Statement of Work for Remedial Investigation/Feasibility Study Reassessment. 20 July.

EPA. 2010b. EPA Region 6 Regional Screening Levels. November. Website: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_run_MAY2011.pdf

EPA. 2011. National Primary Drinking Water Regulations, Maximum Contaminant Levels. Accessed: 1 April 2011. Website: http://water.epa.gov/drink/contaminants/index.cfm.

Appendix A

Green Remediation Evaluation Matrix (GREM)				
Alternative S-5: Deep Soil Mixing with Stabilization/Solidification				
Stressors	**Affected Media**	**Mechanism/ Effect**	**Y/N**	**Score***
Substance Release/Production				
Airborne NOx & SOx	Air	Acid rain & photochemical smog	No	10
Chloro-fluorocarbon vapors	Air	Ozone depletion	No	10
Greenhouse gas emissions	Air	Atmospheric warming	Yes	7
Airborne particulates/toxic vapors/gases/ water vapor	Air	General air pollution/toxic air/humidity increase	Yes	8
Liquid waste production	Water	Water toxicity/sediment toxicity/sediment	Yes	7
Solid waste production	Land	Land use/toxicity	Yes	7
Thermal Releases				
Warm water	Water	Habitat warming	No	10
Warm vapor	Air	Atmospheric humidity	No	10
Physical Disturbances/Disruptions				
Soil structure disruption	Land	Habitat destruction/soil infertility	Yes	6
Noise/Odor/Vibration/Aesthetics	General Environment	Nuisance & safety	Yes	9
Traffic	Land; general environment	Nuisance & safety	No	10
Land Stagnation	Land; general environment	Remediation time; cleanup efficiency; re-development	No	10
Resource Depletion/Gain (Recycling)				
Petroleum (energy)	Subsurface	Consumption	Yes	7
Mineral	Subsurface	Consumption	No	10
Construction Materials (soil/concrete/plastic)	Land	Consumption/reuse	Yes	8
Land & space	Land	Impoundment/reuse	Yes	9
Surface water & groundwater	Water, land (subsidence)	Impoundment/sequester/ reuse	Yes	7
Biology resources (plants/trees/animals/microorganisms)	Air, water, land/forest, subsurface	Species disappearance/ diversity redution/ regenerative ability reduction	No	10
Notes:			**Total**	155

* On a scale of 1-10, with 10 representing the least impact

Scores are intended to provide a qualitative comparison between alternatives for a single media type and are not meant to be compared between different media.

Tables

TABLE 1-1
NON-CANCER HAZARD INDEX SUMMARY
MARION PRESSURE TREATING COMPANY SITE

Receptor	Media	Noncancer HQ[1]	Risk Driver(s)[2] (media)
Trespasser/Recreational Visitor (Adolescent)	Surface water (Big Creek)	0.036	
	Surface water (Unnamed Tributary)	0.031	
	Surface soil (grid system)	0.0043	
	Surface soil (Consolidation Area)	0.000056	
	Airborne particulate and vapors	0.00032	Arsenic (crayfish)
	Sediment (Big Creek)	0.005	Barium (crayfish)
	Sediment (Unnamed Tributary)	0.0033	Manganese (crayfish)
	Crayfish	10	
	Total (all media, all routes)	**10**	
	Sediment (Big Creek hot spots)	3.7	
	Total (all media, all routes, hot spot scenario)	**13.7**	
Offsite Resident (Adult)	Airborne particulates and vapors	0.0011	N/A
	Total	**0.0011**	
Offsite Resident (Child)	Airborne particulates and vapors	0.0017	N/A
	Total	**0.0017**	
Industrial Worker	Surface soil (grid system)	0.0075	
	Surface soil (Consolidation Area)	0.0001	
	Airborne particulates and vapors	0.001	
	Ground water	3.2	Thallium (ground water)
	Total (all media, all routes)	**3.2**	
Onsite Resident (Adult)	Surface soil (grid system)	0.02	Arsenic (ground water)
	Surface soil (Consolidation Area)	0.00017	Dibenzofuran (ground water)
	Airborne particulates and vapors	0.0011	Naphthalene (ground water)
	Ground water	11	Thallium (ground water)
	Total (all media, all routes)	**11**	
Onsite Resident (Child)	Surface soil (grid system)	0.14	Arsenic (ground water)
	Surface soil (Consolidation Area)	0.0014	Dibenzofuran (ground water)
	Airborne particulates and vapors	0.0017	Naphthalene (ground water)
	Ground water	24	Thallium (ground water)
	Total (all media, all routes)	**24**	

Notes:

[1] A hazard index (HI) greater than 1.0 is considered an excess risk for non-carcinogenic health effects.

[2] Constituents with a combined exposure route HI greater than 1.0.

N/A - As the HI for this receptor was less than 1.0, no constituents were identified as risk drivers.

Source: Tetra Tech EM Inc. 2001. Marion Pressure Treating Company Human Health Risk Assessment. 25 May.

TABLE 1-2
CARCINOGENIC RISK SUMMARY
MARION PRESSURE TREATING COMPANY SITE

Receptor	Media	Carcinogenic Risk[1]	Risk Driver(s)[2] (media)
Trespasser/ Recreational Visitor (Adolescent)	Surface water (Big Creek) Surface water (Unnamed Tributary) Surface soil (grid system) Surface soil (Consolidation Area) Air Sediment (Big Creek) Sediment (Unnamed Tributary) Crayfish **Total (all media, all routes)** Sediment (Big Creek hot spots) **Total (all media, all routes, hot spot scenario)**	2.9E-08 --- 5.4E-07 4.2E-07 4.0E-10 3.9E-04 2.5E-06 8.2E-05 **4.7E-04** 5.1E-04 **6.0E-04**	Benzo(a)pyrene (Big Creek sediment)
Offsite Resident (Adult)	Airborne particulates and vapors **Total**	4.0E-09 **4.0E-09**	N/A
Offsite Resident (Child)	Airborne particulates and vapors **Total**	1.2E-09 **1.2E-09**	N/A
Industrial Worker	Surface soil (grid system) Surface soil (Consolidation Area) Airborne particulates and vapors Ground water **Total (all media, all routes)**	2.5E-06 2.0E-06 2.5E-09 1.1E-04 **1.1E-04**	Arsenic (ground water)
Onsite Resident (Adult)	Surface soil (grid system) Surface soil (Consolidation Area) Airborne particulates and vapors Ground water **Total (all media, all routes)**	5.3E-06 3.7E-06 4.0E-09 3.7E-04 **3.8E-04**	Arsenic (ground water)
Onsite Resident (Child)	Surface soil (grid system) Surface soil (Consolidation Area) Airborne particulates and vapors Ground water **Total (all media, all routes)**	9.1E-06 6.3E-06 1.2E-09 1.7E-04 **1.9E-04**	Arsenic (ground water)

Notes:

[1] Cancer risks above $1E10^{-4}$ are generally considered unacceptable.

[2] Constituents with a combined exposure route cancer risk greater than $1E10^{-4}$.

--- = Carcinogenic risk not reported in Human Health Risk Assessment

N/A - As the carcinogenic risk for this receptor was less than 10^{-6}, no constituents were identified as risk drivers.

Source: Tetra Tech EM Inc. 2001. Marion Pressure Treating Company Human Health Risk Assessment. 25 May.

TABLE 2-1
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)
MARION PRESSURE TREATING COMPANY SITE

ARAR	Citation (If Available)	Description	Applicability
Chemical-Specific			
Federal Safe Drinking Water Act, Primary Drinking Water Standard (MCLs)	40 CFR 141,143	Establishes health-based standards for public water systems. It is applicable where contaminated ground water is or may be used for drinking water.	CERCLA requires that MCL for inorganics and organics be considered "relevant and appropriate" for ground water remediation.
Clean Water Act	40 CFR 131	Water Quality Criteria. These criteria set in-stream contaminant concentration levels for the protection of human health and wildlife.	ARAR applies because the ground water at the site is contaminated above levels that pose a threat to human health and wildlife.
EPA's Regional Screening Levels (RSLs)	"Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites" (EPA 2011)	Establishes screening levels for chemical contaminants in soil, water, and air.	TBC applies because many of the COPCs found at MPTC have RSLs (even if they do not have MCLs).
LDEQ RECAP Screening Values	"Risk Evaluation/Corrective Action Program" (RECAP; LDEQ 2003)	Establishes screening standards for chemical contaminants in soil and water.	TBC applies because many of the COPCs found at MPTC have RECAP screening values (even if they do not have MCLs).
Location-Specific			
Floodplain Management	Executive Order 11988; 40 CFR 6 and Appendix A	Requires federal agencies to evaluate the potential affects of actions they may take in a floodplain to avoid adverse impacts in a floodplain.	ARAR may apply if parts of the site are within a 100-year floodplain. A flood zone location map is not available for MPTC.
Protection of Wetlands Order	Executive Order 11990; 40 CFR 6 and Appendix A	Mandates that federal agencies and potentially responsible parties avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and avoid support of new construction on wetlands if a practicable alternative exists.	ARAR applies because parts of the site may be considered wetlands.
Fish and Wildlife Coordination Act	16 USC § 661 et seq., 16 USC § 742 a, 16 USC § 2901	Requires adequate provisions for protection of fish and wildlife resources	ARAR applies because treatment or construction activities will be performed near a creek and wildlife refuge.
Action-Specific			
Air			
NAAQS	40 CFR 50.4, 50.6, 50.8, 50.9, 50.11, 50.12	NAAQS define levels of air quality to protect the public health or the public welfare from any known or anticipated adverse effects of a federally regulated pollutant. NAAQS for sulfur dioxide, nitrogen dioxide, and carbon monoxide apply to incineration.	ARAR may apply if desorption is used during remedial action.
National Emission Standards for Hazardous Air Pollutants (NESHAPs)	40 CFR 61	Establishes specific emissions levels allowed for toxic air pollutants	ARAR may apply because even though activities at MPTC are not expected to constitute a major stationary source of any federally regulated air pollutant, remediation activities
Action-Specific (continued)			
Emission Standards For Particulate Matter	LAC 33: III Chapter 13	Remedial cleanup actions resulting in the generation of airborne particulate matter from the excavation of contaminated soils, earth moving, and regrading must be evaluated.	ARAR may apply because excavation of contaminated soils, earth moving, and regrading are activities that are a part of the excavation and disposal/treatment remedial alternative.
General Regulations on Control of Emissions and Emission Standards	LAC 33: III Section 905	States air pollution control facilities should be installed whenever practically, economically, and technically feasible even though the ambient air quality standards in the affected area are not exceeded.	ARAR may apply for the excavation and desorption or *in situ* thermal treatment remedial alternatives, where air pollutants may be emitted.
Air Emission Standards for Tanks, Surface Impoundments, and Containers	LAC 33: III Chapter 17 Subchapter C	Regulates waste determination procedures, inspection and monitoring requirements, and recording and reporting requirements with respect to air emissions from tanks, surface impoundments, and containers.	ARAR may apply if the excavation and desorption remedial alternative require use of tanks, containers, or surface impoundments.
Waste			
Criteria for Identifying the Characteristics of Hazardous Waste and for Listing Hazardous Waste	40 CFR 261; LAC 33: V Chapter 11	Provides the criteria for identifying a characteristic or listed waste. Solid waste is a hazardous waste if it exhibits any of the characteristics of ignitability, corrosivity, reactivity, and toxicity or if it is a listed waste. Applicable to off site waste disposal.	ARAR applies for excavated soil or waste produced during treatment or construction activities.
Standards Applicable to Generators of Hazardous Waste	40 CFR 262; LAC 33: V Chapter 11	Provides requirements for preparation of waste manifests, waste packaging, labeling and handling.	ARAR applies for possible offsite disposal of excavated soil or waste produced during treatment or construction activities.
Standards Applicable to Transporters of Hazardous Waste	40 CFR Part 263	These regulations establish standards which apply to persons transporting hazardous waste within the United States if the transportation requires a manifest under 40 CFR part 262.	ARAR applies for possible offsite disposal of excavated soil or waste produced during treatment or construction activities.
Land Disposal Restrictions	40 CFR 268; LAC 33: V Chapter 22	Restricts the land disposal of most hazardous wastes, and specified specific treatment standards that must be met before these wastes can be land disposed.	ARAR applies for possible offsite disposal of excavated soil or waste produced during treatment or construction activities.
Monitoring well construction	LAC 56: I Chapter 3	Provides construction standards for monitoring well installation	ARAR applies for alternatives where additional monitoring wells may be required.
Monitoring well abandonment	LAC 56: I Chapter 5	Provides standards for the proper plugging and abandonment of existing wells.	ARAR applies to alternatives where monitoring well abandonment is proposed.
Transportation of Hazardous Materials	49 CFR Part 171	Hazardous materials that may be transported cannot be transported in interstate and intrastate commerce, except in accordance with the requirements of 49 CFR Part 171, Subpart C.	ARAR applies because hazardous materials may be transported during treatment or construction.

TABLE 2-1
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)
MARION PRESSURE TREATING COMPANY SITE

ARAR	Citation (If Available)	Description	Applicability
Action-Specific (continued)			
Solid Waste Regulation	LAC 33: VII Subpart 1	Establishes standards that govern the storage, collection, processing, recovery and reuse, and disposal of solid waste. It also implements a management program that will protect the air, ground water, surface water, and the environment from pollution from solid wastes and, thus, eliminate the potential threat to human health from such pollution.	ARAR applies because treatment or construction activity at the MPTC site may produce solid waste.
Waste Piles	LAC 33: V Chapter 23	Apply to owners and operators of facilities that store or treat hazardous waste in piles. Regulations include design and operating requirement, action leakage rates, inspection of synthetic liners, and monitoring and inspection.	ARAR applies if treatment or removal of contaminated soils requires formation of waste piles.
Remediation Activities			
RAPs	LAC 33: V Chapter 5 Subchapter G	This is a special form of a RCRA permit that an owner or operator may obtain instead of a permit issued under LAC 33: V Section 303-329 and 501-537, to authorize him/her to treat, store, and dispose of hazardous waste at a remediation waste management site.	ARAR applies if remediation activities require treatment, storage, or disposal of hazardous waste at a remediation waste management site.
Inactive and Abandoned Hazardous Waste Substance Site Remediation	LAC 33: IV Chapter 5	Regulates remedial actions, role of PRP in remedial actions, minimum remediation standards and risk evaluation, corrective action, selection of final remedy, and inspections by the department.	ARAR applies because remediation activities will be performed at an inactive and abandoned hazardous waste site.
Water Discharge			
National Pollutant Discharge Elimination System	40 CFR 122-125	Provides conditions that must be incorporated into NPDES permits. Applicable to discharge of storm water from the Site.	ARAR applies because water may be discharged from the site during remedial activities.
Underground Injection Control Program	40 CFR 144	Provides minimum requirements for Class 5 injection wells. Applicable to alternative where reagents will be injected below the water table.	ARAR would apply to the remedial alternatives which includes injecting amendments.
Erosion and Sediment Control	33:IX.2511	Establishes requirements for stormwater discharges from construction activities.	An ARAR would apply if remedial actions result in soil disturbances over threshold criteria. Compliance is associated with substantive requirements of this regulation.
LPDES	LAC 33: IX Subpart 2	Regulates permit applications, permitting conditions, criteria and standards for technology-based treatment requirement, toxic pollutant effluent standards and prohibitions, and sampling procedures.	ARAR applies because water may be discharged from the site during remedial activities.

Notes:

ARAR - Applicable or relevant and appropriate requirements
BIF - Boiler and industrial furnaces
CERCLA - Comprehensive Environmental Response, Compensation & Liabilities Act
CFR - Code of Federal Regulations
COPC - Contaminant of potential concern
LAC - Louisiana Administrative Code
LDEQ - Louisiana Department of Environmental Quality
LPDES - Louisiana Pollutant Discharge Elimination System
MCL - Maximum Contaminant Level
MPTC - Marion Pressure Treating Company
NAAQS - National Primary and Secondary Ambient Air Quality Standards
NPDES - National Pollutant Discharge Elimination System
RAP - Remedial action plan
RCRA - Resource Conservation and Recovery Act
RECAP - Risk Evaluation/Corrective Action Program
RSL - Regional Screening Level
TBC - To be considered
USC - United States Code

TABLE 2-2
DIRECT EXPOSURE LIMITS
MARION PRESSURE TREATING COMPANY SITE

Exposure Scenario	Excess Cancer Risk B(a)P Equivalent Concentrations		
	1 X 10^{-6}	**1 X 10^{-5}**	**1 X 10^{-4}**
Current Trespasser/Recreational Visitor Future Trespasser/Recreational Visitor	0.42 mg/kg	4.2 mg/kg	42 mg/kg
Future Industrial Worker	0.26 mg/kg	2.6 mg/kg	26 mg/kg

Notes:
B(a)P = Benzo(a)pyrene
mg/kg = Milligram(s) per kilogram

TABLE 2-3
AREAS EXCEEDING HUMAN HEALTH RISK EXPOSURE LIMITS - BIG CREEK EXPOSURE AREA
MARION PRESSURE TREATING COMPANY SITE

Sample Location	B(a)P Equivalent (mg/kg)	Remedial Depth (feet bgs)	Notes
JS04	171.72	0.5	Soil hotspot is located near waste pile. Further analysis is required to determine if JS04 is still above exposure limits before designating it as subject to remediation. Additionally, surrounding areas should be further characterized to determine the localization of the contamination exceeding exposure limits.
O16	115.68	0.5	Soil hotspot is located near Big Creek. Further analysis is required to determine if O16 is still above exposure limits before designating it as subject to remediation.
	103.46	2	
SD03	669.4	0.5	Sediment contamination is located in Big Creek. Analysis of this location is required before designating area as subject to remediation due to the transient nature of sediment contamination.
SD02	347.21	0.5	
SD01	148.61	0.5	

Notes:

B(a)P = Benzo(a)pyrene
bgs = Below ground surface
mg/kg = Milligram(s) per kilogram

TABLE 2-4
SUMMARY OF ANALYTICAL DETECTIONS - 2000, 2002, 2010
MARION PRESSURE TREATING COMPANY SITE

Well ID	Analyte	MCL Standards (µg/L)	RSL November 2010 Tap Water (µg/L)		LDEQ RECAP Screening Standards 2003 (µg/L)	August 2000 Concentration (µg/L)	Qualifiers	July 2002 Concentration (µg/L)	Qualifiers	December 2010 Concentration (µg/L)	Qualifiers
			Non-carcinogenic	Carcinogenic							
MW-1	Bis(2-ethylhexyl)phthalate	6	730	4.80	6.00	1	LJ	NS		<4.5	U
MW-2	2,4-Dimethylphenol		730	NA	73	**3,450**		NS		<240	U
	2-Methylnaphthalene		150	NA	0.62	<5.0	U	NS		**420**	
	Acenaphthene		2200	NA	37	1,880		NS		550	
	Acetophenone		3700	NA		57		NS		<240	U
	Benzo(a)anthracene		NA	0.020	7.80	**114**		NS		<240	U
	Benzo(a)pyrene	0.2	NA	0.0029	0.20	**47.5**		NS		<240	U
	Benzo(b)fluoranthene		NA	0.0290	4.80	**47.8**		NS		<240	U
	Benzo(k)fluoranthene		NA	0.29	2.50	**49.1**		NS		<240	U
	Biphenyl		0.83	1800	30	299		NS		77	LJ
	Carbazole		1500[1]	NA		382		NS		320	
	Chrysene		NA	2.90	1.60	**132**		NS		<240	U
	Dibenzo(a,h)anthracene		NA	0.0029	2.50	**5.6**		NS		<240	U
	Dibenzofuran		37.00	NA	10	**1,150**		NS		**290**	
	Fluoranthene		1500	NA	150	1,220		NS		<240	U
	Fluorene		1500	NA	24	1,100		NS		210	LJ
	Indeno(1,2,3-cd)pyrene		NA	0.029	3.70	**14.5**		NS		<240	U
	Naphthalene		6.20	0.14	10	**15,600**		NS		**7,700**	
	Phenanthrene		NA	11000[2]	180	<5.0	U	NS		220	LJ
	Phenol		11000	NA	180	<5.0	U	NS		92	LJ
	Pyrene		1100	NA	18	764		NS		<240	U
MW-3	2-Methylnaphthalene		150	150	0.62	<5.0	U	NS		2.7	LJ
	Acenaphthene		2200	NA	37	238		NS		8.4	
	Biphenyl		0.83	1800	30	50.1		NS		<5.1	U
	Dibenzofuran		37.00	NA	10	**149**		NS		<5.1	U
	Fluorene		1500	NA	24	152		NS		4.5	LJ
	Naphthalene		6.20	0.14	10	**258**		NS		**18**	
	Phenanthrene		NA	11000[2]	180	<5.0	U	NS		5.6	
	Pyrene		1100	NA	18	39.9		NS		<5.0	U
MW-3D	2-Methylnaphthalene		150	150	0.62	NS		NS		3.2	LJ
	Acenaphthene		2200	NA	37	NS		NS		9.2	
	Bis(2-ethylhexyl)phthalate	6	730	4.80	6.00	NS		NS		**5.4**	
	Dibenzofuran		37.00	NA	10	NS		NS		5.6	
	Fluoranthene		1500	NA	150	NS		NS		1.3	LJ
	Fluorene		1500	NA	24	NS		NS		5.0	LJ
	Naphthalene		6.20	0.14	10	NS		NS		**20**	
	Phenanthrene		NA	11000[2]	180	NS		NS		6.0	
MW-4	Bis(2-ethylhexyl)phthalate	6	730	4.80	6.00	2	LJ	NS		<4.5	U
	Diethylphthalate		29000	NA	2900	1	LJ	NS		<4.5	U
MW-4D	Bis(2-ethylhexyl)phthalate	6	730	4.80	6.00	2	LJ	NS		NS	
	Diethylphthalate		29000	NA	2900	1	LJ	NS		NS	

TABLE 2-4
SUMMARY OF ANALYTICAL DETECTIONS - 2000, 2002, 2010
MARION PRESSURE TREATING COMPANY SITE

Well ID	Analyte	MCL Standards (µg/L)	RSL November 2010 Tap Water (µg/L)		LDEQ RECAP Screening Standards 2003 (µg/L)	August 2000 Concentration (µg/L)	Qualifiers	July 2002 Concentration (µg/L)	Qualifiers	December 2010 Concentration (µg/L)	Qualifiers
			Non-carcinogenic	Carcinogenic							
MW-5	Bis(2-ethylhexyl)phthalate	6	730	4.80	6.00	1	LJ	NS		<4.8	U
MW-7	Bis(2-ethylhexyl)phthalate	6	730	4.80	6.00	**7**		NS		<4.5	U
MW-14	2,4-Dimethylphenol		730	730	73	<180	U	NS		**9,200**	LJ
	2-Methylnaphthalene		150	150	0.62	110	LJ	NS		**590**	
	2-Methylphenol		1800	NA		<180	U	NS		**34,000**	
	4-Methylphenol		180	NA		<180	U	NS		**90,000**	
	Acenaphthene		2200	NA	37	140		NS		540	
	Biphenyl		0.83	1800	30	21	LJ	NS		54	LJ
	Dibenzofuran		37.00	NA	10	**84**	LJ	NS		**270**	
	Fluorene		1500	NA	24	78	LJ	NS		200	LJ
	Naphthalene		6.20	0.14	10	**570**		NS		**6,500**	LJ
	Phenanthrene		NA	11000[2]	180	150	LJ	NS		210	LJ
	Phenol		11000	NA	180	<180	U	NS		**120,000**	
MW-15	2,4-Dimethylphenol		730	730	73	NS		2.8	J	<4.5	U
	2-Methylnaphthalene		150	150	0.62	NS		17		4.7	
	2-Methylphenol		1800	NA		NS		3.1	J	<240	U
	3 and 4-Methylphenol		180	NA		NS		5.6	J	<4.5	U
	Acenaphthene		2200	NA	37	NS		19		8.5	
	Acetophenone		3700	NA		NS		11		<4.5	U
	Anthracene		11000	NA	43	NS		2.01		<4.5	U
	Biphenyl		0.83	1800	30	NS		<10	U	1.1	LJ
	Bis(2-ethylhexyl)phthalate	6	730	4.80	6.00	NS		**118**		<4.5	U
	Caprolactam		18000	NA		NS		18		<4.5	U
	Carbazole		1500[1]	NA		NS		7.3	J	6.3	
	Chrysene		NA	2.90	1.60	NS		<10	U	0.070	LJ
	Dibenzofuran		37.00	NA	10	NS		6.6	J	5.6	
	Fluoranthene		1500	NA	150	NS		1.53		2.8	LJ
	Fluorene		1500	NA	24	NS		7.5	J	6.8	
	Naphthalene		6.20	0.14	10	NS		**112**		**6.2**	
	Phenanthrene		NA	11000[2]	180	NS		11.1		15	
	Phenol		11000	NA	180	NS		4.3	J	<4.5	U
	Pyrene		1100	NA	18	NS		1.84		2.2	LJ
MW-16	2-Methylnaphthalene		150	150	0.62	NS		<10	U	0.087	LJ
	Acetophenone		3700	NA		NS		23		<4.8	U
	Naphthalene		6.20	0.14	10	NS		**2.65**		<4.8	U

TABLE 2-4
SUMMARY OF ANALYTICAL DETECTIONS - 2000, 2002, 2010
MARION PRESSURE TREATING COMPANY SITE

Well ID	Analyte	MCL Standards (µg/L)	RSL November 2010 Tap Water (µg/L)		LDEQ RECAP Screening Standards 2003 (µg/L)	August 2000 Concentration (µg/L)	Qualifiers	July 2002 Concentration (µg/L)	Qualifiers	December 2010 Concentration (µg/L)	Qualifiers
			Non-carcinogenic	Carcinogenic							
MW-17	2,4-Dimethylphenol		730	730	73	NS		8.9	J	<4.8	U
	2-Methylnaphthalene		150	150	0.62	NS		7.7	J	0.26	
	2-Methylphenol		1800	NA		NS		8.5	J	<4.8	U
	3 and 4-Methylphenol		180	NA		NS		8.6	J	<4.8	U
	Acenaphthene		2200	NA	37	NS		14.7		10	
	Acetophenone		3700	NA		NS		21		<4.8	U
	Anthracene		11000	NA	43	NS		8.85		8.2	
	Benzo(a)anthracene		NA	0.020	7.80	NS		**3.3**		<4.8	U
	Benzo(a)pyrene	0.2	NA	0.0029	0.20	NS		**1**		**0.042**	LJ
	Benzo(b)fluoranthene		NA	0.029	4.80	NS		1.15		<4.8	U
	Benzo(k)fluoranthene		NA	0.29	2.50	NS		<10	U	0.092	LJ
	Biphenyl		0.83	1800	30	NS		2.1	J	1.5	LJ
	Bis(2-ethylhexyl)phthalate	6	730	4.80	6.00	NS		**250**		<4.8	U
	Caprolactam		18000	NA		NS		188		<4.8	U
	Carbazole		1500[1]	NA		NS		4.9	J	<4.8	U
	Chrysene		NA	2.90	1.60	NS		**3.55**		0.37	
	Dibenzofuran		37.00	NA	10	NS		6.3	J	16	
	Fluoranthene		1500	NA	150	NS		24.2		27	
	Fluorene		1500	NA	24	NS		10.7		23	
	Naphthalene		6.20	0.14	10	NS		**90.5**		<4.8	U
	Phenanthrene		NA	11000[2]	180	NS		36.6		96	
	Phenol		11000	NA	180	NS		3.4	J	<4.8	U
	Pyrene		1100	NA	180	NS		19.7		14	
MW-18	2-Methylnaphthalene		150	150	0.62	NS		70		2.2	
	Acenaphthene		2200	NA	37	NS		111		4.9	LJ
	Benzo(a)anthracene		NA	0.020	7.80	NS		**1.84**		<5.0	U
	Benzo(a)pyrene	0.2	NA	0.0029	0.20	NS		**0.41**		**0.052**	LJ
	Benzo(b)fluoranthene		NA	0.029	4.80	NS		**0.43**		**0.14**	
	Benzo(k)fluoranthene		NA	0.29	2.50	NS		0.24		0.21	
	Biphenyl		0.83	1800	30	NS		22.9		<5.0	U
	Bis(2-ethylhexyl)phthalate	6	730	4.80	6.00	NS		**229**		<5.0	U
	Carbazole		1500[1]	NA		NS		31.4		<5.0	U
	Chrysene		NA	2.90	1.60	NS		2.12		0.46	
	Dibenzofuran		37.00	NA	10	NS		**60**		<5.0	U
	Fluoranthene		1500	NA	150	NS		31.4		21	
	Fluorene		1500	NA	24	NS		61.4		4.6	LJ
	Indeno(1,2,3-cd)pyrene		NA	0.029	3.70	NS		<14.3	U	**0.031**	LJ
	Naphthalene		6.20	0.14	10	NS		**299**		**4.6**	LJ
	Phenanthrene		NA	11000[2]	180	NS		113		29	
	Pyrene		1100	NA	18	NS		18.6		12	

TABLE 2-4
SUMMARY OF ANALYTICAL DETECTIONS - 2000, 2002, 2010
MARION PRESSURE TREATING COMPANY SITE

Well ID	Analyte	MCL Standards (µg/L)	RSL November 2010 Tap Water (µg/L)		LDEQ RECAP Screening Standards 2003 (µg/L)	August 2000 Concentration (µg/L)	Qualifiers	July 2002 Concentration (µg/L)	Qualifiers	December 2010 Concentration (µg/L)	Qualifiers
			Non-carcinogenic	Carcinogenic							
MW-19	Bis(2-ethylhexyl)phthalate	6	730	4.80	6.00	NS		**169**		<4.5	U
MW-19DUP	Bis(2-ethylhexyl)phthalate	6	730	4.80	6.00	NS		**205**		NS	
MW-20	Acenaphthene		2200	NA	37	NS		6.7		<5.0	U
	Anthracene		11000	NA	43	NS		1.51		<5.0	U
	Benzo(a)anthracene		NA	0.020	7.80	NS		**0.59**		<5.0	U
	Benzo(a)pyrene	0.2	NA	0.0029	0.20	NS		**0.15**		<0.10	U
	Benzo(b)fluoranthene		NA	0.0290	4.80	NS		**0.16**		<9.5	U
	Bis(2-ethylhexyl)phthalate	6	730	4.80	6.00	NS		**22.9**		<5.0	U
	Chrysene		NA	2.90	1.60	NS		0.62		0.073	LJ
	Fluoranthene		1500	NA	150	NS		8.81		<5.0	U
	Fluorene		1500	NA	24	NS		4.38		<5.0	U
	Naphthalene		6.20	0.14	10	NS		**12.1**		<5.0	U
	Phenanthrene		NA	11000[2]	180	NS		18.6		<5.0	U
	Pyrene		1100	NA	18	NS		5.73		<5.0	U
MW-21	Acenaphthene		2200	NA	37	NS		8.69		<5.0	U
	Anthracene		11000	NA	43	NS		1.02		<5.0	U
	Benzo(a)anthracene		NA	0.02	7.80	NS		**0.26**		<5.0	U
	Chrysene		NA	2.90	1.60	NS		0.28		0.053	LJ
	Fluoranthene		1500	NA	150	NS		3.44		<5.0	U
	Fluorene		1500	NA	24	NS		4.7		<5.0	U
	Naphthalene		6.20	0.14	10	NS		**17.8**		<5.0	U
	Phenanthrene		NA	11000[2]	180	NS		11.7		<5.0	U
	Pyrene		1100	NA	18	NS		2.79		<5.0	U

Notes:

[1] Carbazole does not have an MCL, RSL, or LDEQ RECAP screening value. The RSL for fluorene was used for carbazole because of structural similarities.

[2] Phenanthrene does not have an MCL or RSL. The RSL for anthracene was used for phenanthrene because of structural similarities.

Values in bold exceed MCLs and/or RSLs.
Values in a colored cell exceed LDEQ RECAP Screening Values.
µg/L = Microgram(s) per liter
D or DUP = Duplicate
J = Estimated value
L = Reported concentration is below the Contract-required Quantitation Limit.
LDEQ = Louisiana Department of Environmental Quality
MCL = Maximum Contaminant Level
NS = Not sampled
RECAP = Risk Evaluation/Corrective Action Program
RSL = EPA Regional Screening Levels
U = Not detected above reporting limit.

TABLE 2-5
S2 GROUND WATER SCREENING LEVEL COMPARISON FOR DECEMBER 2010
MARION PRESSURE TREATING COMPANY SITE

Contaminant	CAS No.	S2 Ground Water Concentrations (ug/L)	Carcinogenic Screening Level (ug/L)	Non-carcinogenic Screening Level (ug/L)	Carcinogenic Risks	Non-carcinogenic Hazard
Naphthalene	91-20-3	6.2	1.4E-01	6.2E+00	4.4E-05	1.0E+00
2-Methylnaphthalene	91-57-6	4.7	--	1.5E+02	--	3.1E-02
Benzo(a)pyrene	50-32-8	0.052	2.9E-03	--	1.8E-05	--
Benzo(b)fluoranthene	205-99-2	0.14	2.9E-02	--	4.8E-06	--
Indeno(1,2,3-cd)pyrene	193-39-5	0.031	2.9E-02	--	1.1E-06	--
Total Carcinogenic Risk or Hazard Index					**6.8E-05**	**1.0E+00**

Notes:

Carcinogenic risk values were based on a 1E-06 risk level. Non-carcinogenic hazard quotient values were based on a hazard quotient of 1.
The EPA Regional Screening Levels are provided on-line at: www.epa.gov/region09/superfund/prg/index.html. September 2008
CAS No. = Chemical Abstracts Services Registry Number
-- = Not applicable or not available
ug/L = Micrograms per liter

TABLE 3-1
DESCRIPTION OF TECHNOLOGIES POTENTIALLY APPLICABLE FOR SOIL/SEDIMENT
MARION PRESSURE TREATING COMPANY SITE

General Response Action	Technology	Process Option	Description
No Further Action	No Action	None	No action.
Limited Action	Engineering Controls	Fencing/Signs	Fencing and signs around the site will be used to keep trespassers out.
	Institutional Controls	Building/Construction Restriction and/or Excavation Restriction	Locations or buildings are restricted to prevent exposures or type/method of construction is limited to prevent exposures, or construction worker notification is required. Digging in areas where exposures might occur is prohibited or guidelines for how and where to perform excavations are used.
Containment	Capping	Consolidation Under a Clay Cap	A clay cap and top soil are placed over contaminated soil to prevent exposure above human health risk levels.
Removal	Excavation and Disposal	Landfill (Offsite)	Contaminated material is collected and transported to an approved offsite disposal facility. May be subject to Land Disposal Restrictions.
	Excavation and Treatment	Incineration (Onsite)	Contaminants are thermally decomposed via oxidation at temperatures usually greater than 900°C to destroy the organic fraction of the excavated soil. The contaminated soil would be incinerated onsite.
		Incineration (Offsite)	Contaminants are thermally decomposed via oxidation at temperatures usually greater than 900°C to destroy the organic fraction of the excavated soil. The contaminated soil would be incinerated offsite.
		Desorption	Contaminants are removed from excavated soil and sediment via direct or indirect heat exchange that vaporizes the semi-volatile organic compounds. The vapors are then condensed, collected, or oxidized.
		Soil Washing	Contaminants sorbed onto fine soil and sediment particles are separated from bulk soil in aqueous solution by particle size.
		Chemical Extraction	Contaminated soil and extractant are mixed in an extractor, thereby dissolving the contaminants. The extracted solution is placed in a separator, where the contaminants and extractant are then separated for treatment and further use.
	In Situ Thermal	*In Situ* Thermal Remediation	Contaminants are removed from soil in place via direct or indirect heat exchange that vaporizes the semi-volatile organic compounds. The vapors are then condensed or otherwise collected for further treatment.
	In Situ Biological	Phytoremediation	Contaminants are removed by plants/trees that are planted in the contaminated soil.

TABLE 3-1
DESCRIPTION OF TECHNOLOGIES POTENTIALLY APPLICABLE FOR SOIL/SEDIMENT
MARION PRESSURE TREATING COMPANY SITE

General Response Action	Technology	Process Option	Description
Removal (continued)	*In Situ* Physical	Soil Vapor Extraction	Contaminants are removed from soil using air extracted via soil vapor extraction wells. Volatile compounds in air are treated in a centralized unit. The air flow is induced by a vacuum. This alternative may be enhanced by executing pneumatic or hydraulic fracturing to expedite contaminant collection.
		Soil Flushing	A fluid, having properties specific to the DNAPL and geosystem under consideration, is injected into the vadose zone and thoroughly swept through the DNAPL zone. The injected solution reacts with the contaminants by lowering interfacial tension between the DNAPL and aqueous phase, and alters other physical properties that enhance DNAPL solubility and mobility before being extracted for treatment.
Treatment	*In Situ* Chemical	Chemical Oxidation	Contaminants are oxidized into innocuous compounds by injecting oxidants such as permanganate, persulfate, peroxide, or ozone into the formation.
	In Situ Biological	Bioremediation	Contaminants are converted into innocuous end products by indigenous or inoculated micro-organisms.
	Solidification/Stabilization	Cement	Portland cement, often augmented with other materials, such as fly ash, lime kiln dust, cement kiln dust, and lime, is used as a binding reagent in solidification/stabilization because of its ability to both solidify (change the physical properties) and stabilize (change the chemical properties).

Note:

DNAPL = Dense non-aqueous phase liquid

TABLE 3-2
DESCRIPTION OF TECHNOLOGIES POTENTIALLY APPLICABLE FOR GROUND WATER
MARION PRESSURE TREATING COMPANY SITE

General Response Action	Technology	Process Option	Description
No Further Action	No Action	None	No action
Limited Action	Institutional Controls	Ground Water Use Restriction	Use of ground water is prohibited or its use (i.e., nonpotable uses) is limited to applications that would not cause exposure to humans.
	Long Term Monitoring	Sampling and Analysis	Periodic sampling and analysis of the ground water will determine plume migration offsite, which could pose a human exposure risk since access to ground water is not restricted offsite.
Containment	Vertical Barriers	Slurry Wall	Walls of bentonite and clay mixed with native soil are built in areas of soft earth via trenching, blocking off lateral ground water migration.
		Grout Curtain	A row of vertical holes are drilled and filled with grout under pressure, so that each pillar of grout overlaps, forming a continuous wall or curtain that blocks off lateral ground water migration.
		Sheet Piling	Sheet piling consists of thin interlocking sheets of steel driven into the ground with impact or vibratory hammers to obtain a continuous barrier in the ground, blocking off lateral ground water migration.
Treatment	*In Situ* Chemical	Chemical Oxidation	Contaminants are oxidized into innocuous compounds by injecting oxidants such as permanganate, persulfate, peroxide, or ozone into the aquifer.
	In Situ Biological	Bioremediation	Contaminants are converted into innocuous end products by indigenous or inoculated micro-organisms.
		Phytoremediation	Contaminant are removed by plants/trees that are planted in soil overlying contaminated ground water.
Removal	*In Situ* Thermal	*In Situ* Thermal Remediation	Contaminants are removed from ground water in place via direct or indirect heat exchange that vaporizes the semi-volatile organic compounds. The vapors are then condensed or otherwise collected for further treatment or burned.
	Ex Situ Physical	Pump and Treat	A series of extraction wells are placed to remove contaminated ground water before it reaches residences. Extracted water is then treated and may be reinjected, released, or discharged.

TABLE 3-3
TECHNOLOGY SCREENING: SOIL/SEDIMENT
MARION PRESSURE TREATING COMPANY SITE

General Response Action	Technology	Process Option	Effectiveness	Implementability	Cost	Status
No Further Action	No Action	None	Will not address relevant RAO	Implementable as no remedial action will be conducted.	Low	**Retained as required under the National Oil and Hazardous Substances Pollution Contingency Plan**
Limited Action	Engineering Controls	Fencing/Signs	Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil.	Implementable	Low	**Retained**
	Institutional Controls	Building/Construction Restriction and/or Excavation Restriction	Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil.	Implementable	Low	**Retained**
	Erosion Controls	Consolidation Under Vegetative Cover	Will address relevant RAO because engineering and institutional controls will be used to prevent receptor contact with contaminated surface soil.	Implementable	Low	**Retained**
Containment	Consolidation and Capping	Consolidation Under a Clay or Soil Cap	Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil.	Implementable	Low	**Retained**
Removal	Excavation and Disposal	Landfill (Offsite)	Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil.	Implementable for surface soils	High	**Retained**
		Disposal Cell (Onsite)	Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil. However, the protective lining underneath the disposal cell will provide little additional protection than capping because contaminated soil will still exist below the lining.	Implementable for surface soils	Medium	Not retained because of effectiveness.
	Excavation and Treatment	Incineration (Onsite)	Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil.	Difficult to implement due to site location and terrain and insufficient utilities (i.e., limited water and energy resources). Incineration can be hazardous and will require control of noxious emissions.	High	Not retained because of implementability.
		Incineration (Offsite)	Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil.	Difficult to implement due remote site location. Travel distance to incineration facility that would accept contaminated waste would drive up costs significantly.	High	**Retained**

TABLE 3-3
TECHNOLOGY SCREENING: SOIL/SEDIMENT
MARION PRESSURE TREATING COMPANY SITE

General Response Action	Technology	Process Option	Effectiveness	Implementability	Cost	Status
Removal (continued)	Excavation and Treatment	Desorption	Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil.	Difficult to implement due to site location and terrain and insufficient utilities (i.e., limited water and energy resources).	High	Not retained because of implementability.
		Soil Washing	Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil.	Difficult to implement - produces a large quantity of waste that requires treatment or disposal. C1 is largely fine soil. Removing organics that are adsorbed onto fine clay particles is difficult.	Medium	Not retained because of implementability.
		Chemical Extraction	Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil.	Difficult to implement - produces a large quantity of waste that requires treatment or proper disposal. Hard to distribute in fine soils.	Medium	Not retained because of implementability.
	In Situ Thermal	*In Situ* Thermal Remediation	Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil by removing contaminants from the soil matrix.	Difficult to implement because of limited energy and water resources.	High	Not retained because of implementability.
	In Situ Biological	Phytoremediation	Will not address relevant RAO because phytoremediation relies on contaminants solubilizing to be metabolized during water uptake. Semi-volatile organic compounds have limited solubility.	Implementable	Low	Not retained because of effectiveness.
	In Situ Physical	SVE	Can be used to prevent receptor contact with contaminated surface soil by removing contaminants from the soil matrix. However, SVE of SVOCs from clay soil is difficult.	Not implementable - SVE is generally not appropriate for sites with ground water located less than 3 feet bgs and difficult for sites with ground water located less than 10 feet bgs. The ground water table at the site is as shallow as 0.5 foot bgs at some locations.	Medium	Not retained because of effectiveness and implementability.
		Soil Flushing	Can be used to prevent receptor contact with contaminated surface soil by removing contaminants from the soil matrix. However, removing organics adsorbed onto fine clay particles is difficult.	Not implementable - distribution in fine soils is difficult.	Medium	Not retained because of implementability.

TABLE 3-3
TECHNOLOGY SCREENING: SOIL/SEDIMENT
MARION PRESSURE TREATING COMPANY SITE

General Response Action	Technology	Process Option	Effectiveness	Implementability	Cost	Status
Treatment	*In Situ* Chemical	Chemical Oxidation	Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil by treating contaminants in the soil matrix.	Implementable via *in situ* mixing	High	**Retained**
	In Situ Biological	Bioremediation	Will not address relevant RAO because high SVOC concentrations (high toxicity) may hinder microbial degradation.	Implementable	Medium	Not retained because of effectiveness.
	In Situ Solidification/ Stabilization	Cement	Will address relevant RAO because it can be used to prevent receptor contact with contaminated surface soil by trapping contaminants in the soil matrix in place.	Implementable	Medium	**Retained**

Notes:

Cost estimates are relative within each General Response Action
bgs = Below ground surface
RAO = Remedial action objectives
SVE = Soil vapor extraction
SVOC = Semi-volatile organic compound

TABLE 3-4
TECHNOLOGY SCREENING: GROUND WATER
MARION PRESSURE TREATING COMPANY SITE

General	Technology	Process Option	Effectiveness	Implementability	Cost	Status
No Further Action	No Action	None	Will not address relevant RAOs	Implementable as no remedial action will be conducted.	Low	**Retained as required under the National Oil and Hazardous Substances Pollution Contingency Plan**
Limited Action	Institutional Controls	Ground Water Use Restriction	Can prevent human exposure to contaminated ground water onsite. May be coupled with another technology to address prevention of offsite migration and aquifer restoration.	Implementable	Low	**Retained**
	Long-term Monitoring	Sampling and Analysis	Will be able to indicate offsite migration.	Implementable	Low	**Retained**
	Monitored Natural Attenuation (MNA)	Sampling and Analysis Including MNA Parameters	Will be able to determine if natural attenuation and aquifer restoration is occurring.	Implementable	Low	**Retained**
Containment	Vertical Barriers	Slurry Wall	Will not address relevant RAOs because the ground water flow direction varies, preventing effective placement of the barrier.	Implementable	Medium	Not retained because of effectiveness.
		Grout Curtain	Will not address relevant RAOs because the ground water flow direction varies, preventing effective placement of the barrier.	Implementable	Medium	Not retained because of effectiveness.
		Sheet Piling	Will not address relevant RAOs because the ground water flow direction varies, preventing effective placement of the barrier.	Implementable	Medium	Not retained because of effectiveness.
Treatment	*In Situ* Chemical	Chemical Oxidation	Will address relevant RAOs because chemical oxidation can convert the SVOCs detected in the ground water into innocuous substances.	Implementable	Medium	**Retained**
	In Situ Biological	Bioremediation	Will not address relevant RAOs because microbial biodegradation of SVOCs is limited.	Implementable	Medium	Not retained because of effectiveness.
		Phytoremediation	Will not address relevant RAOs because phytoremediation relies on contaminants solubilizing to be metabolized during water uptake. SVOCs have limited solubility.	Implementable	Low	Not retained because of effectiveness.
Removal	*In Situ* Thermal	*In Situ* Thermal Remediation	Will address relevant RAOs by removing contaminants from ground water, eliminating human exposure risks. Will address soil matrix contamination as well.	Difficult to implement because of limited water and energy resources	High	Not retained because of implementability.
	Ex situ physical	Pump and Treat	Will not address relevant RAOs. SVOCs are largely insoluble. Pumping ground water is an ineffective means of removing them.	Implementable	High	Not retained because of effectiveness.

Notes:

Cost estimates are relative within each General Response Action
RAO = Remedial action objectives
SVOC = Semi-volatile organic compound

TABLE 4-1
REMEDIAL ALTERNATIVES
MARION PRESSURE TREATING COMPANY SITE

SOIL ALTERNATIVES				
Former Impoundment Area				
Alternative F-1: NFA No Further Action	**Alternative F-2: Limited Action** General Remedial Alternatives, Engineering Controls (ECs) and Institutional Controls (ICs)	**Alternative F-3: Erosion Control** General Remedial Alternatives, Erosion Control (Former Impoundment Area), ECs, and ICs	**Alternative F-4: Capping** General Remedial Alternatives, Capping, ECs, and ICs	**Alternative F-5: Excavation and Offsite Disposal/Offsite Incineration** General Remedial Alternatives, Excavation and Offsite Disposal/Offsite Incineration, ECs, and ICs
Source Area				
Alternative S-1: NFA No Further Action	**Alternative S-2: Limited Action** General Remedial Alternatives, ECs, and ICs	**Alternative S-3: Select Capping** General Remedial Alternatives, Select Capping, ECs, and ICs	**Alternative S-4: ISCO** General Remedial Alternatives, and *In Situ* Chemical Oxidation (ISCO)	**Alternative S-5: Deep Soil Mixing with Stabilization/Solidification** General Remedial Alternatives, and Deep Soil Mixing with Stabilization/Solidification
Big Creek Exposure Area				
Alternative B-1: NFA No Further Action	**Alternative B-2: Limited Action** General Remedial Alternatives, ECs, and ICs	**Alternative B-3: Consolidation and Capping** General Remedial Alternatives, Consolidation and Capping, ECs, and ICs	**Alternative B-4: Excavation and Offsite Disposal/Offsite Incineration** General Remedial Alternatives and Excavation and Offsite Disposal/Offsite Incineration	---
GROUND WATER ALTERNATIVES				
Shallow (S1) Ground Water				
Alternative GW-1: NFA No Further Action	**Alternative GW-2: Limited Action** General Remedial Alternatives, ICs, LTM, MNA and/or Technical Impracticability (TI) Waiver	**Alternative GW-3: ISCO** General Remedial Alternatives, ISCO, ICs, Monitoring, and TI Waiver	---	---

Notes:

*Capping - capping may consist of placing an impervious geosynthetic liner, clay, and top soil over area.
EC - Engineering Control
IC - Institutional Control
ISCO - *In Situ* Chemical Oxidation
LTM - Long-term Monitoring
NFA - No Further Action
WBZ - Water-bearing Zone

Former Impoundment Area (F alternatives) - includes former impoundments and surrounding area, located to the east of the Consolidation Area.
Source Area (S alternatives) - are within the Former Impoundment Area of approximately 130 feet by 80 feet and surrounding MW-14, to a depth of 45 feet through the first (S1) sand layer.
Big Creek Exposure Area (B alternatives) - the sediment and surface soil hotspots in Big Creek, near the southern end of the site.
Shallow Ground Water (GW alternatives) - the contaminated ground water in the (S1) shallow water-bearing zone

General Remedial Alternatives
Plugging, Abandonment, and Replacement of Monitoring Wells - plugging and abandoning wells with dense non-aqueous phase liquid in them (MW-2, MW-3, and MW-14) and wells that are screened through both the S1 and S2 water-bearing zones (MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, MW-12, and MW-13).
General Erosion Control - erosion control measures will be implemented around the slope/perimeter of the Consolidation Area with the majority of the area subject to such measures being located to the west and south. General erosion control measures will consist of, but are not limited to, placement of top soil, grading, and seeding.
S2 Ground Water- the S2 WBZ will be monitored annually to ensure that the concentrations do not increase.

TABLE 4-2
SOIL REMEDIAL ALTERNATIVES EVALUATED AGAINST REMEDIAL ACTION OBJECTIVE
MARION PRESSURE TREATING COMPANY SITE

Alternatives	Remedial Action Objective **Prevent exposure to COCs associated with the site in soils and sediment above remediation goals.**
Alternatives F-1, S-1, and B-1: No Further Action	Does not address remedial action objective.
Alternatives F-2, S-2, and B-2: Limited Action	Institutional and engineering controls will prevent human exposure to contaminated soil.
Alternative F-3: Erosion Control	Erosion control will prevent receptor exposure to contaminated soils.
Alternatives F-4, S-3, and B-3: Capping	Capping will prevent receptor exposure to contaminated soils.
Alternatives F-5 and B-4: Excavation and Offsite Disposal/Offsite Incineration	Removing contaminated soil will prevent receptor exposure to contaminated soil.
Alternative S-4 : *In Situ* Chemical Oxidation (ISCO)	Treatment of the contaminated soils with ISCO will prevent receptor exposure to contaminated soil.
Alternative S-5: Solidification/Stabilization	In place solidification/stabilization of soils in the source area will prevent receptor exposure to contaminated soils.

Notes:

ISCO = *In situ* chemical oxidation
RAO = Remedial action objective

Former Impoundment Area (F alternatives) - includes former impoundments and surrounding area, located to the east of the Consolidation Area.
Source Area (S alternatives) - are within the Former Impoundment Area of approximately 130-feet by 80-feet and surrounding MW-14, to a depth of 45 feet through the first (S1) sand layer.
Big Creek Exposure Area (B alternatives) - the sediment and surface soil hotspots in Big Creek, near the southern end of the site.

TABLE 4-3
GROUND WATER REMEDIAL ALTERNATIVES EVALUATED AGAINST REMEDIAL ACTION OBJECTIVES
MARION PRESSURE TREATING COMPANY SITE

Alternatives	Remedial Action Objectives		
	Prevent exposure to COCs associated with the site ground water above remediation goals.	**Prevent offsite migration of ground water above remediation goals.**	**Return ground water to its expected beneficial uses wherever practicable.**
Alternatives GW-1: No Further Action	Does not address RAO.	Does not address RAO.	Does not address RAO. Will require demonstration of monitored natural attenuation (MNA) or Technical Impracticability Waiver.
Alternatives GW-2: Limited Action	Institutional and engineering controls will prevent human exposure to contaminated ground water.	Will detect offsite migration of ground water.	MNA may demonstrate a return of ground water to its expected beneficial use. Aquifer restoration through natural attenuation may occur downgradient of Source Area but Technical Impracticability Waiver or other alternative may be required for the area with dense non-aqueous phase liquid (Source Area).
Alternative GW-3: *In Situ* Chemical Oxidation (ISCO)	Treatment of the contaminants at the outer boundary of the ground water contamination with ISCO will prevent exposure in those areas.	Treatment of the contaminants at the outer boundary of the ground water contamination with ISCO will prevent offsite migration of contaminated ground water.	Treatment of the contaminants in the ground water with ISCO will restore the aquifer.

Notes:

ISCO = *In situ* chemical oxidation
MNA = Monitored natural attenuation
RAO = Remedial action objective

Shallow Ground Water (GW alternatives) - the contaminated ground water in the (S1) shallow water bearing zone

TABLE 5-1
FORMER IMPOUNDMENT AREA ALTERNATIVE EVALUATION SUMMARY
MARION PRESSURE TREATING COMPANY SITE

	Alternative F-1: No Further Action	**Alternative F-2: Limited Action**	**Alternative F-3: Erosion Control**	**Alternative F-4: Capping**	**Alternative F-5: Excavation and Offsite Disposal/Offsite Incineration**
	No Further Action	General Remedial Alternatives, Engineering Controls (ECs), and Institutional Controls (ICs)	General Remedial Alternatives, Erosion Control (Former Impoundment Area), ECs, and ICs	General Remedial Alternatives, Capping, ECs, and ICs	General Remedial Alternatives, Excavation and Offsite Disposal/Offsite Incineration, ECs, and ICs
(1) Overall Protection of Human Health and the Environment					
	There is no reduction of risk with this alternative. In the event of continued erosions, the contaminated surface and subsurface soils in the Former Impoundment Area can pose unacceptable risk to receptors.	There is some reduction of risk with this alternative by limiting exposure to surface soils in the Former Impoundment Area with the implementation of engineering and institutional controls.	There will be no unacceptable risk to human health or the environment once erosion control measures are implemented in the Former Impoundment Area. Receptors will not contact contaminated surface soils once the area is covered with graded top soil and vegetation.	There will be no unacceptable risk to human health or the environment once a cap is placed over the Former Impoundment Area. Receptors will not contact contaminated surface soils once the area is covered with clay (possibly a geosynthetic liner), top soil and vegetation.	There will be no unacceptable risk to human health or the environment once the contaminated surface soils are removed from the Site.
(2) Compliance with Applicable Relevant or Appropriate Requirements (ARARs)					
	This alternative will comply with ARARs.	See Alternative F-1	See Alternative F-1	See Alternative F-1	See Alternative F-1
(3) Long-Term Effectiveness and Permanence					
	This alternative will not provide long-term effectiveness or permanence. This alternative offers no controls. The contaminated surface and subsurface soils in the Former Impoundment Area will still continue to pose a risk.	Institutional and engineering controls rely on humans following access restrictions into perpetuity.	This alternative is effective and permanent for the RAO pertaining to direct exposure to contaminated surface and subsurface soils that may be a result of erosion.	See Alternative F-3	See Alternative F-3
(4) Reduction of Toxicity, Mobility, or Volume through Treatment					
Amount of Hazardous Materials Destroyed or Treated	None	None	None	None	If the removed soils are incinerated, then contamination in the surface and subsurface of the Former Impoundment Area will be destroyed. However, if the removed soils are transported to a landfill for disposal, the contaminated material may not be destroyed or treated.
Degree of Expected Reductions in Toxicity, Mobility, or Volume	None	None	None	None	Excavation of the contaminated soils from the Former Impoundment Area will reduce the volume of the contamination present.
Irreversible Treatment?	No	No	No	No	Yes
Residuals Remaining After Treatment	Yes	Yes	Yes	Yes	No
(5) Short-Term Effectiveness					
Community Protection	There are no additional risks.	There is very little additional risk to the community, because the only action is implementing institutional and engineering controls to limit exposure. Additionally, the Site is situated in a remote location, with limited residential or industrial activity.	Increased short-term risks to the community during construction activities and transport of equipment and materials. Dust will be produced during construction activities. These can be mitigated through standard construction practices. Additionally, the Site is situated in a remote location, with limited residential or industrial activity.	See Alternative F-3	Increased short-term risks to the community during excavation and transportation of contaminated to soil to disposal or incineration facility. Dust will be produced during construction activities. These can be mitigated through standard construction practices. Additionally, the Site is situated in a remote location, with limited residential or industrial activity.
Worker Protection	There are no additional risks.	There is very little additional risk to the community, because the only action is implementing institutional and engineering controls to limit exposure. Additionally, the Site is situated in a remote location, with limited residential or industrial activity.	Workers can potentially be exposed to contaminated media during construction activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing controls.	See Alternative F-3	Workers can potentially be exposed to contaminated media during excavation and transportation to a disposal or incineration facility. Work around heavy equipment and deep excavated pits carries potential risk to workers. Risks can be minimized by implementing controls.

TABLE 5-1
FORMER IMPOUNDMENT AREA ALTERNATIVE EVALUATION SUMMARY
MARION PRESSURE TREATING COMPANY SITE

	Alternative F-1: No Further Action	**Alternative F-2: Limited Action**	**Alternative F-3: Erosion Control**	**Alternative F-4: Capping**	**Alternative F-5: Excavation and Offsite Disposal/Offsite Incineration**
	No Further Action	General Remedial Alternatives, Engineering Controls (ECs), and Institutional Controls (ICs)	General Remedial Alternatives, Erosion Control (Former Impoundment Area), ECs, and ICs	General Remedial Alternatives, Capping, ECs, and ICs	General Remedial Alternatives, Excavation and Offsite Disposal/Offsite Incineration, ECs, and ICs
Environmental Impacts	There is no additional impact	There is no additional impact.	Environmental impacts associated with implementation and air emissions.	See Alternative F-3	See Alternative F-3
Sustainability GREM Score[1]	N/A	N/A	163	156	144
Time Until RAO(s) Achieved	N/A	1 month	3 months	4 months	6 months
(6) Implementability					
Ability to Construct and Operate	N/A	This alternative is technically feasible.	Erosion control for the Former Impoundment Area is technically feasible.	Capping the Former Impoundment Area is technically feasible, but procuring the large amount of clay required may be costly due to lack of local availability.	Excavation is technically feasible, but may be difficult in the existing terrain.
Monitoring Requirements	N/A	None	Visual inspection of the Former Impoundment Area.	See Alternative F-3	See Alternative F-3
Availability of Equipment and Specialists	N/A	Equipment and specialists are available for the implementation of all of these technologies.			
Ability to Obtain Approvals and Coordinate with Other Agencies	N/A	Ability to obtain approvals and coordinate with other agencies assumed to be possible.			
(7) Cost (Present Worth)					
Cost	N/A	Low	Medium	Medium	High
(8) State Acceptance					
State Acceptance	TBD	TBD	TBD	TBD	TBD
(9) Community Acceptance					
Community Acceptance	TBD	TBD	TBD	TBD	TBD

Notes:

1 Higher scores reflect more environmentally-friendly/sustainable alternatives.
ARAR: Applicable Relevant or Appropriate Requirement
COC: Contaminants of Concern
GREM: Green Remediation Evaluation Matrix
N/A: Not Applicable
TBD: To be determined

TABLE 5-2
SOURCE AREA ALTERNATIVE EVALUATION SUMMARY
MARION PRESSURE TREATING COMPANY SITE

	Alternative S-1: NFA No Further Action	**Alternative S-2: Limited Action** General Remedial Alternatives, Engineering Controls (ECs) and Institutional Controls (ICs)	**Alternative S-3: Select Capping** General Remedial Alternatives, Select Capping, ECs, and ICs	**Alternative S-4: ISCO** General Remedial Alternatives, and *In Situ* Chemical Oxidation (ISCO)	**Alternative S-5: Deep Soil Mixing with Stabilization/Solidification** General Remedial Alternatives, and Deep Soil Mixing with Stabilization/Solidification
(1) Overall Protection of Human Health and the Environment					
	There is no reduction of risk with this alternative. The source area will continue to be a principle threat waste, allowing for possible migration of contaminants, where receptors may come into contact with them above human health and environmental risk levels.	There is some reduction of risk with this alternative by limiting exposure to contamination attributed to the source area by utilizing engineering and institutional controls. Monitoring will provide an indication of contaminant migration.	There will be no unacceptable risk to human health or the environment once the source area is capped. Exposure to contamination above human health and environmental risk levels will be precluded by eliminated points of contact with contaminated surface soils.	There will be no unacceptable risk to human health or the environment once the ISCO remedy has been completed because the source area contamination will be rendered innocuous after treatment.	There will be no unacceptable risk to human health or the environment once the deep soil mixing with stabilization/solidification remedy has been completed because the source area contamination will be rendered innocuous after treatment.
(2) Compliance with ARARs					
	This alternative will comply with ARARs.	See Alternative S-1	See Alternative S-1	See Alternative S-1	See Alternative S-1
(3) Long-Term Effectiveness and Permanence					
	This alternative will not provide long-term effectiveness or permanence. This alternative offers no controls. The source area will continue to be a principal threat waste.	Institutional or engineering controls rely on humans following access restrictions into perpetuity.	This alternative is effective and permanent for the RAO pertaining to direct exposure to contaminated surface and subsurface soils in the source area.	See Alternative S-3	See Alternative S-3
(4) Reduction of Toxicity, Mobility, or Volume through Treatment					
Amount of Hazardous Materials Destroyed or Treated	None	None	None	The hazardous material comprising the source area will be treated with ISCO and rendered innocuous.	The hazardous material comprising the source area will be stabilized/solidified with deep soil mixing.
Degree of Expected Reductions in Toxicity, Mobility, or Volume	None	None	None	This alternative will reduce toxicity by converting the COCs into innocuous substances, and thereby volume of the contaminated soils.	This alternative will reduce mobility by binding the contamination in place. This alternative will not reduce toxicity or volume.
Irreversible Treatment?	No	No	No	Yes	Yes
Residuals Remaining After Treatment	Yes	Yes	Yes	No	Yes
(5) Short-Term Effectiveness					
Community Protection	There are no additional risks.	There is very little additional risk to the community, because the only action is implementing institutional and engineering controls to limit exposure. Additionally, the Site is situated in a remote location, with limited residential or industrial activity.	Increased short-term risks to the community during construction activities and transport of equipment and materials. These can be mitigated through standard construction practices and permitting. Additionally, the Site is situated in a remote location, with limited residential or industrial activity.	See Alternative S-3	See Alternative S-3
Worker Protection	There are no additional risks.	There is very little additional risk to the community, because the only action is implementing institutional and engineering controls to limit exposure. Additionally, the Site is situated in a remote location, with limited residential or industrial activity.	Workers can potentially be exposed to contaminated media during construction activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing controls.	Workers can potentially be exposed contaminated media and/or hazardous ISCO reagents during construction activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing controls.	See Alternative S-3
Environmental Impacts	There is no additional impact.	There is no additional impact.	Limited short term environmental impacts associated with implementation and air emissions.	See Alternative S-3	Significant environmental impacts associated with implementation and air emissions.
Sustainability GREM Score[1]	N/A	N/A	157	161	155
Time Until RAO(s) Achieved	N/A	1 month	1 month	3 months	3 months
(6) Implementability					
Ability to Construct and Operate	N/A	This alternative is technically feasible.	Select capping over the source area is technically feasible, but procuring the clay required may be costly due to lack of local availability.	ISCO in the source area is technically feasible.	Deep soil mixing with stabilization/solidification in the source area will be difficult and costly due to the 45-foot depth to which treatment will have to extend.

TABLE 5-2
SOURCE AREA ALTERNATIVE EVALUATION SUMMARY
MARION PRESSURE TREATING COMPANY SITE

	Alternative S-1: NFA	**Alternative S-2: Limited Action**	**Alternative S-3: Select Capping**	**Alternative S-4: ISCO**	**Alternative S-5: Deep Soil Mixing with Stabilization/Solidification**
	No Further Action	General Remedial Alternatives, Engineering Controls (ECs) and Institutional Controls (ICs)	General Remedial Alternatives, Select Capping, ECs, and ICs	General Remedial Alternatives, and *In Situ* Chemical Oxidation (ISCO)	General Remedial Alternatives, and Deep Soil Mixing with Stabilization/Solidification
(6) Implementability (Continued)					
Monitoring Requirements	N/A	None	Visual inspection of the Source Area.	See Alternative S-3	See Alternative S-3
Availability of Equipment and Specialists	N/A	Equipment and specialists are available for the implementation of all of these technologies.			
Ability to Obtain Approvals and Coordinate with Other Agencies	N/A	Ability to obtain approvals and coordinate with other agencies assumed to be possible.			
(7) Cost (Present Worth)					
Cost	N/A	Low	Medium	High	High
(8) State Acceptance					
State Acceptance	TBD	TBD	TBD	TBD	TBD
(9) Community Acceptance					
Community Acceptance	TBD	TBD	TBD	TBD	TBD

Notes:

1 Higher scores reflect more environmentally-friendly/sustainable alternatives.
ARAR: Applicable Relevant or Appropriate Requirement
COC: Contaminants of Concern
GREM: Green Remediation Evaluation Matrix
ISCO: In situ chemical oxidation
N/A: Not Applicable
TBD: To be determined

TABLE 5-3
BIG CREEK EXPOSURE AREA ALTERNATIVE EVALUATION SUMMARY
MARION PRESSURE TREATING COMPANY SITE

	Alternative B-1: NFA	**Alternative B-2: Limited Action**	**Alternative B-3: Consolidation and Capping**	**Alternative B-4: Excavation and Offsite Disposal/Offsite Incineration**
	No Further Action	General Remedial Alternatives, ECs, and ICs	General Remedial Alternatives, Consolidation and Capping, ECs, and ICs	General Remedial Alternatives and Excavation and Offsite Disposal/Offsite Incineration
(1) Overall Protection of Human Health and the Environment				
	There is no reduction of risk with this alternative. The contaminated sediment and surface soils will still pose a human health and environmental risk.	There is some reduction of risk with this alternative by limiting exposure via engineering and institutional controls Monitoring will provide an indication of contaminant migration.	There will be no unacceptable risk to human health or the environment once the contaminated sediment and surface soil is moved from the Big Creek Exposure Area to the Former Impoundment Area and capped.	There will be no unacceptable risk to human health or the environment once the contaminated sediment and surface soils is removed from the Site.
(2) Compliance with ARARs				
	This alternative will comply with ARARs.	See Alternative B-1	This alternative will comply with ARARs. Measures must be taken to ensure compliance with location- specific ARARs when performing construction activities in and around Big Creek.	See Alternative B-3
(3) Long-Term Effectiveness and Permanence				
	This alternative will not provide long-term effectiveness or permanence. This alternative offers no controls.	Institutional or engineering controls rely on humans following access restrictions into perpetuity.	This alternative will provide long-term effectiveness or permanence by preventing receptor exposure to contaminated sediment and surface soil.	See Alternative B-3
(4) Reduction of Toxicity, Mobility, or Volume through Treatment				
Amount of Hazardous Materials Destroyed or Treated	None	None	None	If the removed soils are incinerated, then contamination in the excavated sediment and surface soil will be destroyed. However, if the removed soils are transported to a landfill for disposal, the contaminated material may not be destroyed or treated.
Degree of Expected Reductions in Toxicity, Mobility, or Volume	None	None	None	Removing the contaminated sediment and surface soil will reduce volume.
Irreversible Treatment?	No	No	No	Yes
Residuals Remaining After Treatment	Yes	Yes	Yes	No
(5) Short-Term Effectiveness				
Community Protection	There are no additional risks.	There is very little additional risk to the community, because the only action is implementing institutional and engineering controls to limit exposure. Additionally, the Site is situated in a remote location, with limited residential or industrial activity.	Increased short-term risks to the community during construction activities and transport of equipment and materials to site. Dust will be produced during construction activities. These can be mitigated through standard construction practices and permitting. Additionally, the Site is situated in a remote location, with limited residential or industrial activity.	See Alternative B-3
Worker Protection	There are no additional risks.	None	Workers can potentially be exposed to contaminated media during construction activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing controls.	See Alternative B-3

TABLE 5-3
BIG CREEK EXPOSURE AREA ALTERNATIVE EVALUATION SUMMARY
MARION PRESSURE TREATING COMPANY SITE

	Alternative B-1: NFA	Alternative B-2: Limited Action	Alternative B-3: Consolidation and Capping	Alternative B-4: Excavation and Offsite Disposal/Offsite Incineration
	No Further Action	General Remedial Alternatives, ECs, and ICs	General Remedial Alternatives, Consolidation and Capping, ECs, and ICs	General Remedial Alternatives and Excavation and Offsite Disposal/Offsite Incineration
(5) Short-Term Effectiveness (continued)				
Environmental Impacts	There is no additional impact.	There is no additional impact.	Significant environmental impacts associated with implementation along Big Creek and air emissions.	See Alternative B-3
Sustainability GREM	N/A	N/A	152	144
Time Until RAO(s) Achieved	N/A	1 month	2 months	1 month
(6) Implementability				
Ability to Construct and Operate	N/A	This alternative is technically feasible.	Consolidating and capping the contaminated sediment and surface soil is technically feasible, but the terrain of the Big Creek Exposure Area will prove difficult to access.	Excavation and offsite disposal/offsite incineration of the contaminated sediment and surface soil is technically feasible, but the terrain of the Big Creek Exposure Area will prove difficult to access.
Monitoring Requirements	N/A	None	Visual inspection of the area where contaminated soil is consolidated.	See Alternative B-3
Availability of Equipment and Specialists	N/A	Equipment and specialists are available for the implementation of all of these technologies.		
Ability to Obtain Approvals and Coordinate with Other Agencies	N/A	Ability to obtain approvals and coordinate with other agencies assumed to be possible.		
(7) Cost (Present Worth)				
Cost	N/A	Low	Medium	High
(8) State Acceptance				
State Acceptance	TBD	TBD	TBD	TBD
(9) Community Acceptance				
Community Acceptance	TBD	TBD	TBD	TBD

Notes:

1 Higher scores reflect more environmentally-friendly/sustainable alternatives.
ARAR: Applicable Relevant or Appropriate Requirement
COC: Contaminants of Concern
GREM: Green Remediation Evaluation Matrix
N/A: Not Applicable
TBD: To be determined

TABLE 5-4
SHALLOW (S1) GROUND WATER ALTERNATIVE EVALUATION SUMMARY
MARION PRESSURE TREATING COMPANY SITE

	Alternative GW-1: NFA	**Alternative GW-2: Limited Action**	**Alternative GW-3: ISCO**
	No Further Action	General Remedial Alternatives, ICs, Long Term Monitoring (LTM), Monitored Natural Attenuation (MNA), and TI Waiver	General Remedial Alternatives, *In Situ Chemical Oxidation* (ISCO), ICs, Monitoring, and TI Waiver
(1) Overall Protection of Human Health and the Environment			
	There is no reduction of risk with this alternative. The ground water will continue to pose an unacceptable human health and environmental risk.	There is some reduction of risk with this alternative by limiting human health exposure via institutional controls. If MNA is proven, this remedy can be protective of human health and the environment by biodegrading, dispersing, or diluting COCs in the ground water. Long term monitoring will provide an indication of contaminant migration. This alternative may require a TI waiver to be a stand alone remedy.	There will be no unacceptable risk to human health or the environment once ISCO has been implemented and the COCs in the ground water have been converted into innocuous substances.
(2) Compliance with ARARs			
	This alternative will not comply with chemical specific ARARs (i.e., MCLs) unless a TI Waiver is obtained as part of the remedy.	See Alternative GW-1	ISCO of the ground water will comply with chemical- and location- specific ARARs. Construction activities must comply with action- specific ARARs.
(3) Long-Term Effectiveness and Permanence			
	This alternative will not provide long-term effectiveness or permanence. This alternative offers no controls. The ground water will continue to pose an unacceptable human health and environmental risk	If MNA is proven, this alternative will be effective and permanent for the ground water RAOs because it will degrade the COCs in the ground water.	This alternative will be effective and permanent for the ground water RAOs because it will convert the COCs in the ground water to innocuous substances.
(4) Reduction of Toxicity, Mobility, or Volume through Treatment			
Amount of Hazardous Materials Destroyed or Treated	If MNA is taking place, the contaminants in the shallow ground water will be physically, chemically, and/or biologically degrade (be destroyed) into innocuous substances. However, because no monitoring is performed, this cannot be definitively concluded.	If MNA is taking place, the contaminants in the shallow ground water will be physically, chemically, and/or biologically degraded (be destroyed) into innocuous substances. Monitoring will allow the confirmation of this degradation.	The contaminants in the shallow ground water will be treated with ISCO and rendered innocuous.
Degree of Expected Reductions in Toxicity, Mobility, or Volume	If MNA is taking place, the shallow ground water contamination will reduce in toxicity, volume, and mobility. However, because no monitoring is performed, this cannot be definitively concluded.	If MNA is taking place, the shallow ground water contamination will reduce in toxicity, volume, and mobility. Monitoring will allow the confirmation of this reduction.	This alternative will reduce toxicity by converting the COCs in the shallow ground water into innocuous substances, and thereby reduce mobility and volume of contaminated ground water.
Irreversible Treatment?	No	Yes	Yes
Residuals Remaining After Treatment	Yes	Yes	No
(5) Short-Term Effectiveness			
Community Protection	There are no additional risks.	There are no additional risks.	Increased short-term risks to the community during construction activities and transport of equipment and materials. These can be mitigated through standard construction practices and permitting. Additionally, the Site is situated in a remote location, with limited residential or industrial activity.
Worker Protection	There are no additional risks.	There are some additional risks to workers who perform sampling activities.	Workers can potentially be exposed to hazardous material during construction activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing controls.
Environmental Impacts	There is no additional impact	There is very little additional impact from the sampling activities for LTM/MNA.	Limited short term environmental impacts associated with construction activities, including air emissions.

TABLE 5-4
SHALLOW (S1) GROUND WATER ALTERNATIVE EVALUATION SUMMARY
MARION PRESSURE TREATING COMPANY SITE

	Alternative GW-1: NFA	Alternative GW-2: Limited Action	Alternative GW-3: ISCO
	No Further Action	General Remedial Alternatives, ICs, Long Term Monitoring (LTM), Monitored Natural Attenuation (MNA), and TI Waiver	General Remedial Alternatives, *In Situ Chemical Oxidation* (ISCO), ICs, Monitoring, and TI Waiver
(5) Short-Term Effectiveness (Continued)			
Sustainability GREM Score[1]	N/A	177	161
Time Until RAO(s) Achieved	N/A	Will be determined by LTM results - expected to be measured in decades.	6 months
(6) Implementability			
Ability to Construct and	N/A	See Alternative GW-2	See Alternative GW-2
Monitoring Requirements	N/A	Ground water samples will be taken and analyzed to assess the effectiveness of the remedy and the reduction in human health and environmental risk.	See Alternative GW-3
Availability of Equipment and Specialists	N/A	Equipment and specialists are available for the implementation of all of these technologies.	
(6) Implementability (continued)			
Ability to Obtain Approvals and Coordinate with Other Agencies	N/A	Ability to obtain approvals and coordinate with other agencies assumed to be possible.	
(7) Cost (Present Worth)			
Cost	N/A	Low	High
(8) State Acceptance			
State Acceptance	TBD	TBD	TBD
(9) Community Acceptance			
Community Acceptance	TBD	TBD	TBD

Notes:

1 Higher scores reflect more environmentally-friendly/sustainable alternatives.
ARAR: Applicable Relevant or Appropriate Requirement
COC: Contaminants of Concern
GREM: Green Remediation Evaluation Matrix
ISCO: In situ chemical oxidation
N/A: Not Applicable
TBD: To be determined

TABLE 5-5
COMPARATIVE EVALUATION OF FORMER IMPOUNDMENT AREA ALTERNATIVES
MARION PRESSURE TREATING COMPANY SITE

(Alternative Ranking, from best rating 1, alternatives ranked relative to each other)

	(1) Overall Protection of Human Health and the Environment	(2) Compliance with ARARs	(3) Long-Term Effectiveness and Permanence	(4) Reduction of Toxicity, Mobility, or Volume through Treatment	(5) Short-Term Effectiveness	(6) Implementability	(7) Cost
Alternative F-1 No Further Action	No	Yes	4	3	5	1	1
Alternative F-2 Limited Action	Yes	Yes	3	3	1	2	2
Alternative F-3 Erosion Control	Yes	Yes	2	2	2	3	3
Alternative F-4 Capping	Yes	Yes	2	2	3	4	4
Alternative F-5 Excavation and Offsite Disposal/Offsite Incineration	Yes	Yes	1	1	4	5	5

Notes:

ARAR - Applicable Relevant or Appropriate Requirement

TABLE 5-6
COMPARATIVE EVALUATION OF SOURCE AREA ALTERNATIVES
MARION PRESSURE TREATING COMPANY SITE

(Alternative Ranking, from best rating 1, alternatives ranked relative to each other)

	(1) Overall Protection of Human Health and the Environment	(2) Compliance with ARARs	(3) Long-Term Effectiveness and Permanence	(4) Reduction of Toxicity, Mobility, or Volume through Treatment	(5) Short-Term Effectiveness	(6) Implementability	(7) Cost (Present Value)
Alternative S-1 No Further Action	No	Yes	4	4	4	1	1
Alternative S-2 Limited Action	Yes	Yes	3	4	1	2	2
Alternative S-3 Select Capping	Yes	Yes	2	3	2	4	3
Alternative S-4 *In Situ* Chemical Oxidation	Yes	Yes	1	1	3	3	4
Alternative S-5 Deep Soil Mixing with Stabilization/Solidification	Yes	Yes	1	2	2	5	5

Notes:

ARAR - Applicable Relevant or Appropriate Requirement

TABLE 5-7
COMPARATIVE EVALUATION OF BIG CREEK EXPOSURE AREA ALTERNATIVES
MARION PRESSURE TREATING COMPANY SITE

(Alternative Ranking, from best rating 1, alternatives ranked relative to each other)

	(1) Overall Protection of Human Health and the Environment	(2) Compliance with ARARs	(3) Long-Term Effectiveness and Permanence	(4) Reduction of Toxicity, Mobility, or Volume through Treatment	(5) Short-Term Effectiveness	(6) Implementability	(7) Cost (Present Value)
Alternative B-1 No Further Action	No	Yes	4	3	3	1	1
Alternative B-2 Limited Action	Yes	Yes	3	3	1	2	2
Alternative B-3 Consolidation and Capping	Yes	Yes	2	2	2	3	3
Alternative B-4 Excavation and Offsite Disposal/Offsite Incineration	Yes	Yes	1	1	2	5	5

Notes:

ARAR - Applicable Relevant or Appropriate Requirement

TABLE 5-8
COMPARATIVE EVALUATION OF SHALLOW (S1) GROUND WATER ALTERNATIVES
MARION PRESSURE TREATING COMPANY SITE

(Alternative Ranking, from best rating 1, alternatives ranked relative to each other)

	(1) Overall Protection of Human Health and the Environment	(2) Compliance with ARARs	(3) Long-Term Effectiveness and Permanence	(4) Reduction of Toxicity, Mobility, or Volume through Treatment	(5) Short-Term Effectiveness	(6) Implementability	(7) Cost (Present Value)
Alternative GW-1 No Further Action	No	No*	3	3	3	1	1
Alternative GW-2 Limited Action	Yes	No*	2	2	1	2	2
Alternative GW-3 *In Situ* Chemical Oxidation	Yes	Yes	1	1	2	3	3

Notes:

* = Alternative does not comply with chemical- specific ARARs (i.e., Maximum Contaminant Levels), but may be effective if a Technical Impracticability Waiver is obtained.
ARAR - Applicable Relevant or Appropriate Requirement

Figures

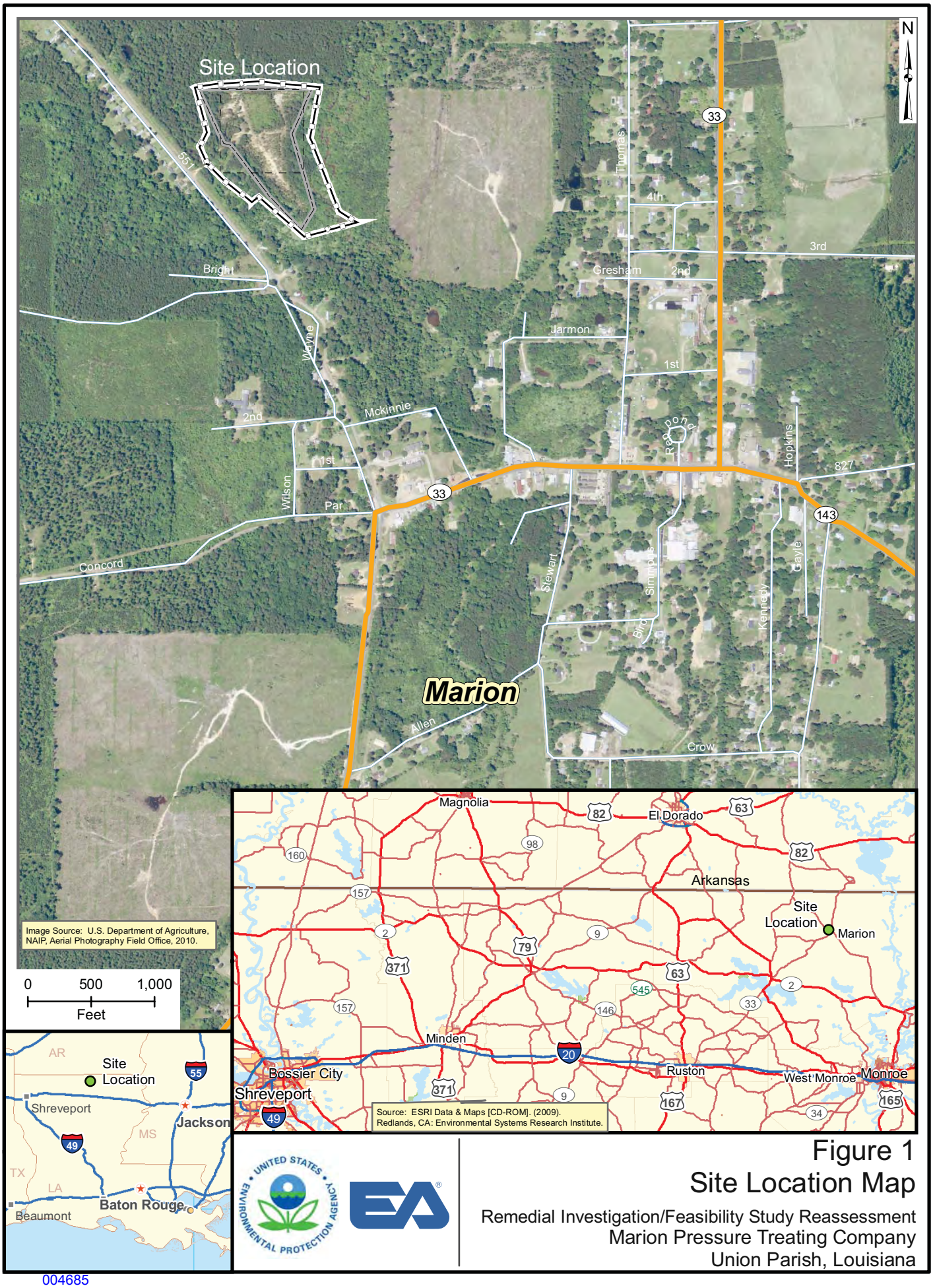


Figure 1
Site Location Map

Remedial Investigation/Feasibility Study Reassessment
Marion Pressure Treating Company
Union Parish, Louisiana

2011-07-21 r:\federal\epa\rac iii\0062-marion fsr\gis\mxds\fig\xx_siteloca.mxd EA-Dallas jschwertz

004685

Legend:

Operational Boundary	Wastewater Treatment Sump	Pond, Intermittent
10-acre Tract	Overhead Electrical	Consolidation Area
Fence	Exposed Water Line	Former Surface Impoundment
Dirt road	Culvert	Tanks
Building	Stream, Intermittent	Waste Pile

0 100 200
Feet

Image Source: U.S. Department of Agriculture, NAIP, Aerial Photography Field Office, 2010.

Figure 2
Site Layout Map

Remedial Investigation/Feasibility Study Reassessment
Marion Pressure Treating Company
Union Parish, Louisiana

2011-07-21 r:\federallepalrac iii\0062-marion fsr\gis\mxds\fig\xx_sitelayouta.mxd EA-Dallas jschwertz

004686

CA-02
Top Depth: 5 Elev.: 179.763
Bottom Depth: 27 Elev.: 157.763
Bore Depth: 27 Elev.: 157.763

MW-1
No Creosote Staining
Bore Depth: 40.77 Elev.: 141.58

MW-7
No Creosote Staining
Bore Depth: 52.14 Elev.: 119.2

MW-11
No Creosote Staining
Bore Depth: 50 Elev.: 128.555

MW-17
Top Depth: 16 Elev.: 169.10
Bottom Depth: 35 Elev.: 150.10
Bore Depth: 88 Elev.: 97.10

A-1
No Creosote Staining
Bore Depth: 16.12 Elev.: 154.86

MW-6
No Bore Data

E-2
Top Depth: 9 Elev.: 176.93
Bottom Depth: 31 Elev.: 154.93
Bore Depth: 31.76 Elev.: 154.17

A-2
Top Depth: 14.5 Elev.: 156.47
Bottom Depth: 19 Elev.: 151.97
Bore Depth: 19.57 Elev.: 151.4

B-1
No Creosote Staining
Bore Depth: 31.89 Elev.: 137.27

MW-12
Top Depth: 44 Elev.: 128.18
Bottom Depth: 45.6 Elev.: 126.58
Bore Depth: 45 Elev.: 127.18

CA-01
Top Depth: 1 Elev.: 186.33
Bottom Depth: 13 Elev.: 174.33
Bore Depth: 16 Elev.: 171.33

MW-18
Top Depth: 16 Elev.: 154.9
Bottom Depth: 19 Elev.: 151.9
Bore Depth: 75 Elev.: 95.9

MW-13
No Creosote Staining
Bore Depth: 50 Elev.: 119.958

I08
Top Depth: 0 Elev.: 178.38
Bottom Depth: 22 Elev.: 156.38
Bore Depth: 22 Elev.: 156.38

F-2
Top Depth: 15 Elev.: 170
Bottom Depth: 20 Elev.: 165
Bore Depth: 29.34 Elev.: 155.66

L08
Top Depth: 0 Elev.: 170.06
Bottom Depth: 23.5 Elev.: 146.56
Bore Depth: 23.5 Elev.: 146.56

MW-15
Top Depth: 2 Elev.: 175.80
Bottom Depth: 4 Elev.: 173.80
Bore Depth: 82.5 Elev.: 95.30

MW-2
No Creosote Staining
Bore Depth: 43 Elev.: 128.66

CA-04
Top Depth: 5 Elev.: 180.34
Bottom Depth: 13 Elev.: 172.34
Bore Depth: 20 Elev.: 165.34

MW-9
No Creosote Staining
Bore Depth: 70 Elev.: 107.38

B-2
No Creosote Staining
Bore Depth: 21.68 Elev.: 147.58

C-2
No Creosote Staining
Bore Depth: 27.07 Elev.: 140.04

A-3
Top Depth: 0 Elev.: 170.83
Bottom Depth: 27 Elev.: 143.83
Bore Depth: 29.34 Elev.: 141.49

E-1
Top Depth: 5 Elev.: 182
Bottom Depth: 29 Elev.: 158
Bore Depth: 30.72 Elev.: 156.28

MW-3
No Creosote Staining
Bore Depth: 41 Elev.: 127.14

MW-14
Top Depth: 0 Elev.: 171.74
Bottom Depth: 33 Elev.: 138.74
Bore Depth: 48 Elev.: 123.74

CA-03
Top Depth: 1 Elev.: 185.83
Bottom Depth: 16 Elev.: 170.83
Bore Depth: 16 Elev.: 170.83

B-3
No Creosote Staining
Bore Depth: 19.67 Elev.: 149.5

A-4
Top Depth: 10 Elev.: 161.41
Bottom Depth: 17 Elev.: 154.41
Bore Depth: 18.73 Elev.: 152.68

F-1
Top Depth: 18 Elev.: 168.57
Bottom Depth: 33 Elev.: 153.57
Bore Depth: 33.18 Elev.: 153.39

MW-20
No Creosote Staining
Bore Depth: 75 Elev.: 95.5

C-1
Top Depth: 18.5 Elev.: 145.49
Bottom Depth: 19.5 Elev.: 144.49
Bore Depth: 31.39 Elev.: 132.6

G-2
No Creosote Staining
Bore Depth: 28.97 Elev.: 157.11

MW-21
No Creosote Staining
Bore Depth: 71 Elev.: 92.3

G-1
Top Depth: 4 Elev.: 183
Bottom Depth: 7 Elev.: 180
Bore Depth: 30.95 Elev.: 156.05

MW-4
No Creosote Staining
Bore Depth: 64.79 Elev.: 106.27

CA-05
Top Depth: 5 Elev.: 182.83
Bottom Depth: 16 Elev.: 171.83
Bore Depth: 16 Elev.: 171.83

MW-19
No Creosote Staining
Bore Depth: 78 Elev.: 94.1

MW-16
No Creosote Staining
Bore Depth: 87 Elev.: 93

CA-06
Top Depth: 3 Elev.: 182.20
Bottom Depth: 13 Elev.: 172.20
Bore Depth: 16 Elev.: 169.20

N

0 25 50
Feet

Legend:

- Bore Locations (2010)
- Bore Locations (2002)
- Bore Locations (2000)
- Monitor Well Locations
- Operational Boundary
- 10-acre Tract
- Fence
- Dirt Road
- Building
- Stream, Intermittent
- Pond, Intermittent
- Consolidation Area
- Former Impoundment
- Areal Extent of DNAPL

NOTES:

Location Designation
Top Depth: "Top of Observed Creosote"
Bottom Depth: "Bottom of Observed Creosote"
Bore Depth: "Total Depth of Boring"

Elevations are above Mean Sea Level, and are associated with referenced depth.

Remedial Investigation/Feasibility Study Reassessment
Marion Pressure Treating Company
Union Parish, Louisiana

Image Source: USDA-FSA-APFO NAIP MrSID Mosaic, USDA/FSA - Aerial Photography Field Office, 2010

Figure 3
Observed and Calculated
Area of Creosote/DNAPL Soil Contamination

004687

2011-07-22 r:\federal\epa\rac iii\0062-marion fs\gis\mxds\fig\xx_creosote25.mxd EA-Dallas jschwertz

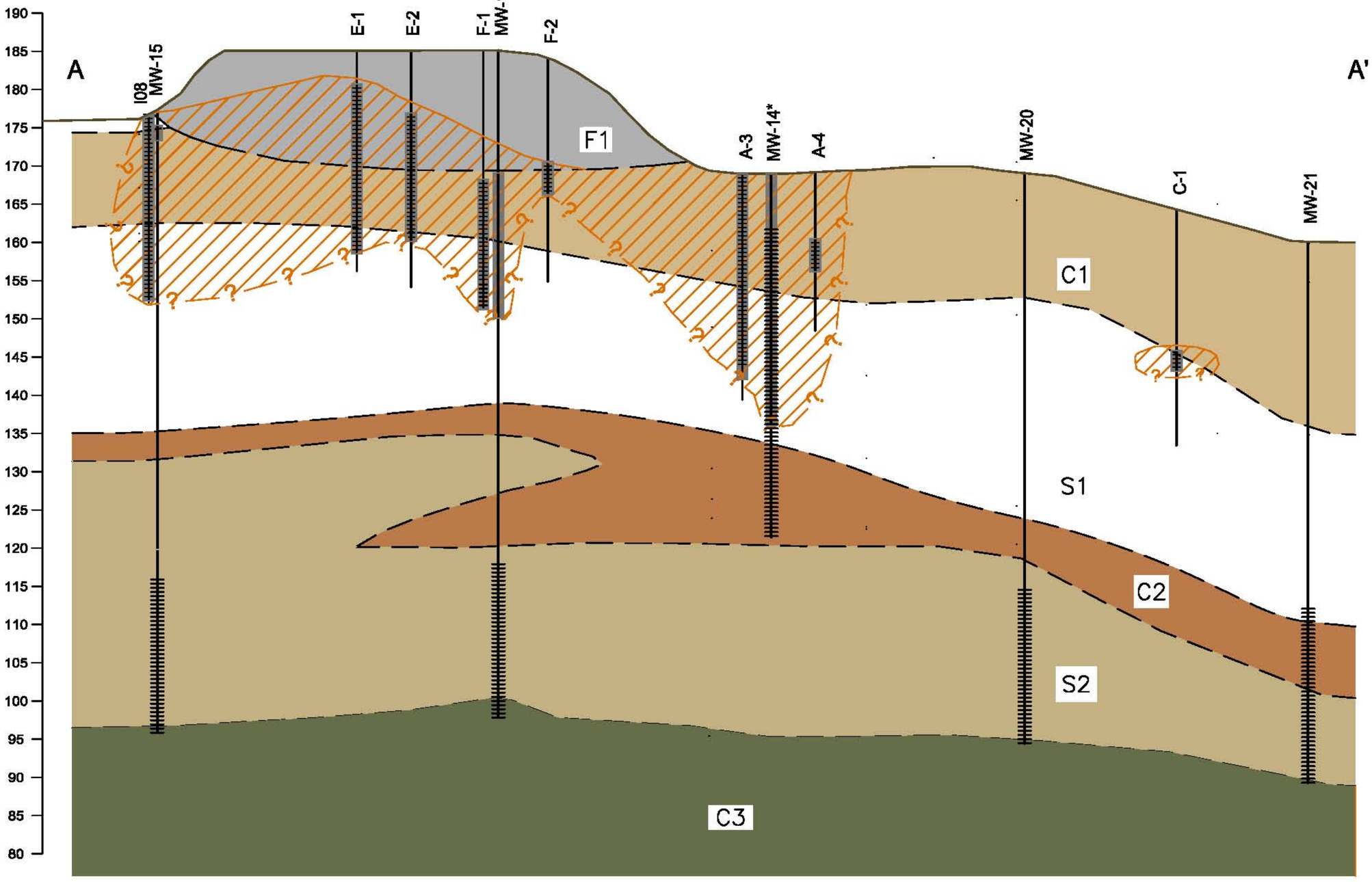
Remedial Investigation/ Feasability Study Reassessment
Marion Pressure Treating Company
Union Parish, Louisiana

Image Source: 2008-2009 Texas Orthoimagery Program, Texas Strategic Mapping Program, TNRIS, 2009.

Figure 4
Cross Section Location Map

004688

2011-07-22 r:\federal\epa\rac ii\0062-marion fs\gis\mxds\figxx_xsect2.mxd EA-Dallas jschwertz



Legend:

- S1 - Sand and fine sand with silt clay and lignite
- S2 - Fine sand and sand with silt clay and lignite
- C1 - Clay with silt and sand stringers
- C2 - Clay and silty clay
- C3 - Silty clay
- F1 - Fill with visible DNAPL, Consolidation Cap
- Extent of Observed DNAPL

MW-15 — Bore Designation

DNAPL found at boring location

Monitoring Well Screening Interval

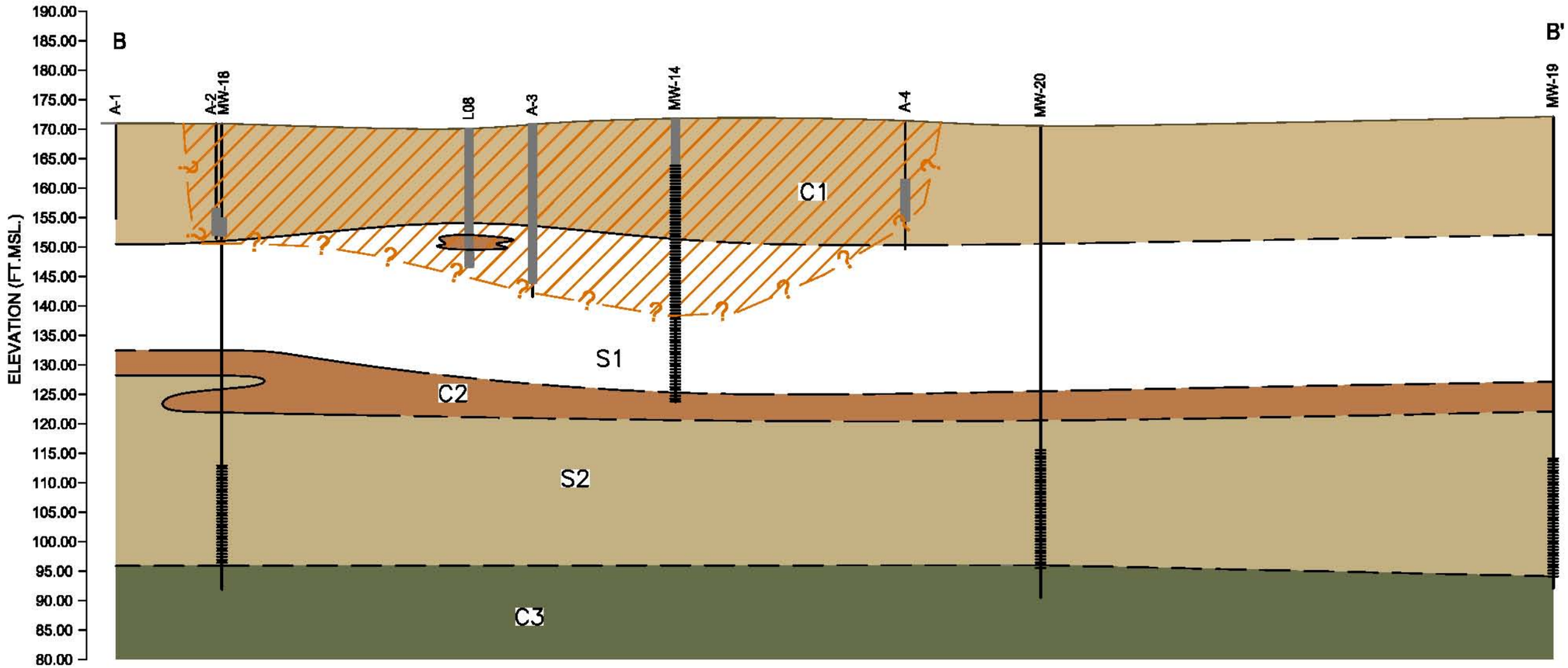
NOTES:
FT.MSL. - Feet above Mean Sea Level
DNAPL - Dense non-aqueous phase liquid.
* - DNAPL has been present at the bottom of MW-14, however, due to the well construction it is assumed to have flowed down the well.

Remedial Investigation/Feasibility Study Reassessment
Marion Pressure Treating Company
Union Parish, Louisiana

Horizontal scale in feet
0 25 50

Figure 5
A-A' Cross Section

004689



Legend:

- S1 - Sand and fine sand with silt clay and lignite
- S2 - Fine sand and sand with silt clay and lignite
- C1 - Clay with silt and sand stringers
- C2 - Clay and silty clay
- C3 - Silty clay
- Known extent of DNAPL

MW-18 — Bore Designation

DNAPL found at boring location

Monitoring Well Screening Interval

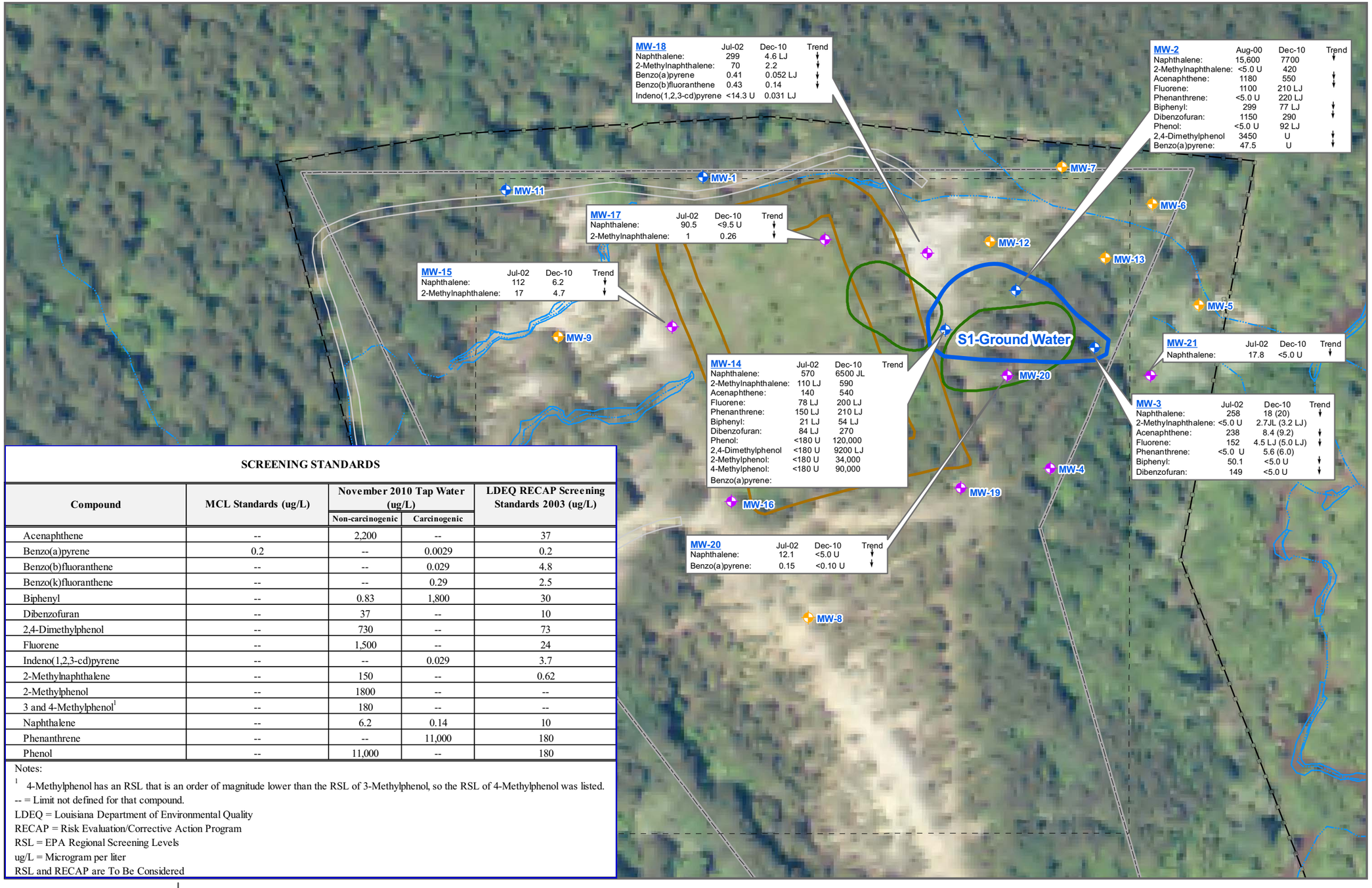
NOTES:
FT.MSL. - Feet above Mean Sea Level
DNAPL - Dense non-aqueous phase liquid,

Remedial Investigation/Feasibility Study Reassessment
Marion Pressure Treating Company
Union Parish, Louisiana

Horizontal scale in feet
0 10 20

Figure 6
B-B' Cross Section

004690



SCREENING STANDARDS

Compound	MCL Standards (ug/L)	November 2010 Tap Water (ug/L)		LDEQ RECAP Screening Standards 2003 (ug/L)
		Non-carcinogenic	Carcinogenic	
Acenaphthene	--	2,200	--	37
Benzo(a)pyrene	0.2	--	0.0029	0.2
Benzo(b)fluoranthene	--	--	0.029	4.8
Benzo(k)fluoranthene	--	--	0.29	2.5
Biphenyl	--	0.83	1,800	30
Dibenzofuran	--	37	--	10
2,4-Dimethylphenol	--	730	--	73
Fluorene	--	1,500	--	24
Indeno(1,2,3-cd)pyrene	--	--	0.029	3.7
2-Methylnaphthalene	--	150	--	0.62
2-Methylphenol	--	1800	--	--
3 and 4-Methylphenol[1]	--	180	--	--
Naphthalene	--	6.2	0.14	10
Phenanthrene	--	--	11,000	180
Phenol	--	11,000	--	180

Notes:
[1] 4-Methylphenol has an RSL that is an order of magnitude lower than the RSL of 3-Methylphenol, so the RSL of 4-Methylphenol was listed.
-- = Limit not defined for that compound.
LDEQ = Louisiana Department of Environmental Quality
RECAP = Risk Evaluation/Corrective Action Program
RSL = EPA Regional Screening Levels
ug/L = Microgram per liter
RSL and RECAP are To Be Considered

N

0 50 100
Feet

Legend:

Monitoring Well
- S1 Formation
- S1,S2 Formation
- S2 Formation
- S1 - Ground Water
- Operational Boundary
- 10-acre Tract
- Fence
- Dirt Road
- Stream, Intermittent
- Pond, Intermittent
- Consolidation Area
- Former Impoundment

NOTES:

Well Designation
"Chemical" "Concentration" "Qualifier"

"Concentration"
units = µg/L - microgram(s) per Liter
() - indicates duplicate sample results

"Qualifier"
J = Estimated value
L = Reported concentration is below the Contract-required Quantitation Limit

MCL = Maximum Contaminant Level
RSL = Regional Screening Level (US EPA)
LDEQ = Louisiana Department of Environmental Quality

Wells without analytical data shown did not exceed screening standards.

Remedial Investigation/Feasibility Study Reassessment
Marion Pressure Treating Company
Union Parish, Louisiana

Image Source: USDA-FSA-APFO NAIP MrSID Mosaic, USDA/FSA - Aerial Photography Field Office, 2010

Figure 7
Monitoring Wells Exceeding MCL/RSL/LDEQ Screening Standards
December 2010

2011-11-15 r:\federalleparlrac ii\0062-marion fsr\gis\mxds\fgxx_welllocanaly120111.mxd EA-Dallas jschwertz

N

0 50 100
Feet

Legend:

Monitoring Well

- S1 Formation
- S1,S2 Formation
- S2 Formation
- Operational Boundary
- 10-acre Tract
- Fence
- Dirt Road
- Stream, Intermittent
- Pond, Intermittent
- Consolidation Area
- Former Impoundment

NOTES:

Well Designation
"Chemical": "Concentration"

"Concentration"
units = µg/L - microgram(s) per liter

Primary MCL:
Arsenic: 10 µg/L
Lead: 15 µg/L
Thallium: 2 µg/L

Secondary MCL:
Iron: 300 µg/L
Manganese: 50 µg/L
Zinc: 5000 µg/L

MCL = Maximum Contaminant Level

Wells without analytical data shown did not exceed screening standards.

Wells MW-15 through MW-21 did not exist in 2000.

Remedial Investigation/Feasibility Study Reassessment
Marion Pressure Treating Company
Union Parish, Louisiana

Image Source: USDA-FSA-APFO NAIP MrSID Mosaic, USDA/FSA - Aerial Photography Field Office, 2010

Figure 8
Monitoring Wells Exceeding Metal MCLs During 2000 Remedial Investigation

004692

2011-07-21 r:\federal\epa\rac iii\0062-marion fsr\gis\mxds\fig#x_wellmetalsanalyt.mxd EA-Dallas jschwertz

Remedial Investigation/ Feasibility Study Reassessment
Marion Pressure Treating Company
Union Parish, Louisiana

Image Source: USDA-FSA-APFO NAIP MrSID Mosaic, USDA/FSA - Aerial Photography Field Office, 2010

Figure 9
Big Creek Exposure Area

2011-09-09 r:\federallepa\rac ii\0062-marion fs\gis\mxds\figxx_sedsoil_hotx.mxd EA-Dallas jschwertz

N

0 50 100
Feet

Legend:

Areas of Interest

- Area A - Erosion Control
- Area B - Former Impoundment Area
- Area C- Source Area

Monitoring Well

- S1 Formation
- S1,S2 Formation
- S2 Formation

Remedial Investigation/ Feasibility Study Reassessment
Marion Pressure Treating Company
Union Parish, Louisiana

Image Source: USDA-FSA-APFO NAIP MrSID Mosaic, USDA/FSA - Aerial Photography Field Office, 2010

Figure 10
Areas of Interest Map

004694

2011-09-08 r:\federal\epa\rac ii\0062-marion fs\gis\mxds\figxx_welllocareaedefsoil.mxd EA-Dallas jschwertz