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Draft Final Alternative Array Document (Rev. 1) for the Old American Zinc Plant Site Fairmont City, Illinois

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Prepared by:

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DRAFT FINAL ALTERNATIVE ARRAY DOCUMENT
OLD AMERICAN ZINC PLANT SITE
FAIRMONT CITY, ILLINOIS

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ACRONYMS/ABBREVIATIONS

AAD	Alternative Array Document
AOC	Administrative Order of Consent
ARAR	Applicable or Relevant and Appropriate Regulation
BERA	Baseline Ecological Risk Assessment
BHHRA	Baseline Human Health Risk Assessment
BTEX	Benzene, Toluene, Ethylene, and Xylene
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act, also known as Superfund
COC	Constituent of Concern
COI	Constituent of Interest
COPC	Constituent of Potential Concern
COPEC	Constituent of Potential Ecological Concern
CWA	Clean Water Act
CSXI	CSX Intermodal, Inc.
ENTACT	ENTACT, LLC
ESL	Ecological Screening Levels
FSAP	Field Sampling and Analysis Plan
FS	Feasibility Study
GAC	Granulated Activated Carbon
GHG	Greenhouse Gas
GPS	Global Positioning System
GRA	General Response Actions
HDPE	High Density Polyethylene
IC	Institutional Control
IEPA	Illinois Environmental Protection Agency
LOEC	Lowest Observable Effect Concentration
MW	Monitoring Well
NCP	National Contingency Plan
NOEC	No Observable Effects Concentration
NPL	National Priority List
O&M	Operation and Maintenance
OSWER	Office of Solid Waste and Emergency Response
PAH	Polycyclic aromatic hydrocarbon
PEC-Q	Probable Effects Concentration Quotient
PEL	Permissible Exposure Limits
RAOs	Remedial/Removal Action Objectives
RBCA	Risk-based Corrective Action
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RO	Remediation Objectives

ACRONYMS/ABBREVIATIONS continued

ROD	Record of Decision
SOW	Statement of Work
SSP	Support Sampling Plan
SVOC	Semi-volatile Organic Compound
TBC	To Be Considered
TCRA	Time Critical Removal Action
TSD	Treatment Storage and Disposal
U.S. EPA	United States Environmental Protection Agency
Village	Village of Fairmont City
VOC	Volatile Organic Compound
XRF	X-Ray Fluorescence
XTRA	XTRA Intermodal, Inc.

SECTION ONE

Section 1

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1.0 INTRODUCTION

On behalf of Blue Tee Corp. (Blue Tee), this Alternative Array Document (AAD) for the former Old American Zinc Plant Site (Site) in Fairmont City, Illinois has been prepared in accordance with the Administrative Order on Consent (AOC) (Docket No. V-W-05-C-8120) and Statement of Work (SOW) entered into between Blue Tee and the U.S. Environmental Protection Agency, Region V, (U.S. EPA) on June 6, 2005.

As defined under Task 5 of the SOW the purpose of the AAD is as follows:

- Develop remedial, and where appropriate, removal action objectives (RAOs) to prevent or abate actual or potential exposures to nearby human populations, (including workers), animals or the food chain from hazardous substances, pollutants or contaminants; to prevent or abate actual or potential groundwater contamination; to stabilize or eliminate hazardous substances in drums, etc. that may pose a threat of release; to treat or eliminate hazardous substances, pollutants or contaminants in soils or sediments that may migrate; to eliminate the threat of fire or explosion; to define acceptable chemical-specific contaminant levels or range of levels for all exposure routes; and to mitigate or abate situations or factors that may pose threats to public health, welfare, or the environment.

- Determine the remedial action scope to define the broad scope and specific short-term and long-term objectives and address the protectiveness of the remedial action;

- Develop the general schedule for remedial action and, where appropriate, removal activities including both the start and completion time for the remedial action.

- Identify all applicable or relevant and appropriate requirements (ARARs) and other federal or state criteria, advisories or guidance to be considered (TBC) that will apply to the remedial action;

- Identify and conduct preliminary screening and evaluation of remedial action alternatives to: select a smaller subset of candidate alternatives (based on the analysis of the nature and extent of contamination and cleanup objectives identified) for detailed analysis in the Feasibility Study (FS); incorporate presumptive remedy guidance, if appropriate and applicable to the Site; and include sufficient detail in the limited number of alternatives for detailed analysis in the FS so that the entire treatment process can be understood.

1.1 SITE BACKGROUND

The Site is located in Fairmont City, Illinois and includes a 132-acre Facility Area where former zinc smelting operations were conducted and areas surrounding the Facility Area where elevated concentrations of metals associated with the former zinc smelter have been found in various media. The Site includes the Facility Area, residential/commercial/vacant properties around the Facility Area, the drainageways that receive drainage from the Facility Area, alleyways and other areas that have been filled or surfaced with slag, and shallow groundwater within and immediately adjacent to the Facility Area. The boundary of the Facility Area and the surrounding Site area is shown on Figure 1.

The Facility Area was historically used as a primary zinc smelter between 1916 and 1953 and produced slab zinc, zinc carbonate, cadmium, lead, and sulfuric acid. The historical operational area is shown on Figure 2. The primary residue generated during the smelter's operation was slag which was poured along the northern and western boundary of the Facility Area in a molten state and allowed to cool over time. The vitrified slag stockpiles once covered over 15 acres of the Facility Area, but were allegedly mechanically disturbed and transported off the Facility Area by employees from the Village of Fairmont City (the Village), local business personnel, and area residents, for use as fill and surfacing material. (ENTACT, 2009). The remaining vitrified slag stockpiles are located along the northern boundary and encompass approximately 4.3 acres, as shown in Figure 3. The estimated volume of the stockpiled slag is 40,000 cubic yards.

The zinc furnace operations ceased in 1953 with operations limited to roasting ores for other smelter facilities and the production of sulfuric acid. These operations continued until 1967 when American Zinc discontinued all operations. All buildings and other facilities associated with former smelting operations were razed between 1967 and 1978 based on aerial photographs (ENTACT 2006).

XTRA Intermodal, Inc. (XTRA) leased the Facility Area property from American Zinc between 1976 and 1979 and purchased the property in 1979, including the clinker and other smelter residues, minerals or metals located on the property. Beginning in 1976 to some time after 2003, XTRA operated a transport trucking terminal on the Facility Area which included the lease, storage, and maintenance of a diverse fleet of over-the-road trailers, intermodal ("piggy-back") trailers, and intermodal equipment. XTRA discontinued operations at the Facility Area sometime after 2003 and the property is currently inactive.

Beginning in 1976 XTRA ground and re-distributed the stockpiled slag across the Facility Area to build up and level the Facility Area for its trucking operations. At present, the ground re-distributed slag covers approximately 100 acres of the Facility

Area, ranging in thickness from 6 inches to over 9 feet, with an estimated volume of over 500,000 cubic yards as shown in Figure 4.

1.2 2006-2009 REMEDIAL INVESTIGATION SUMMARY

A Remedial Investigation (RI) was conducted at the Site between May 2006 and January 2008, and the RI findings are provided in the March 13, 2009 Final RI Report for the Site (ENTACT, 2009), which was approved with modifications by the USEPA on April 17, 2009. A copy of the USEPA approval with modifications letter is included in Appendix A.

The RI activities were conducted in accordance with the approved April 2006 RI Support Sampling Plan and subsequent Addenda 1 through 4, with samples collected of smelter residues and other waste materials, soils, sediment, surface water, biota, groundwater, and air to characterize the Site, perform the risk assessments and provide information for the remedial alternative evaluations. The analytical summary tables and figures showing the extent of contamination are provided in the RI Report.

1.2.1 Source Materials

Sampling conducted for the RI determined that the primary source of elevated metals concentrations at the Site was slag present on the Facility Area both in localized stockpiles of vitrified slag material and as ground, granular slag material re-distributed across the Facility Area for structural fill by XTRA. Slag was also identified beneath compacted gravel in alleyways, and in several surrounding residential, commercial and vacant properties in the Village. Most of the residential properties with elevated concentrations of smelter-related metals were previously addressed by Blue Tee as part of a 2003 time-critical removal action (TCRA) in the Village.

Other potential source areas investigated as part of the RI included two low-lying unvegetated areas located in the northern part of the Facility Area, buried demolition debris and non-slag waste materials associated with historic smelting operations and vaults or potential underground storage tanks (USTs) associated with the former XTRA trucking operations. Of these, only the buried tarry material associated with the buried demolition debris was identified as posing a potential human health risk for commercial/industrial receptors during intrusive activities in these localized areas in the Baseline Human Health Risk Assessment (BHHRA) for the Site.

The tarry materials were observed to be small accumulations of either asphaltic mortar or roofing tars identified during trenching in two localized areas and are assumed to have been used in routine building maintenance. These tarry materials were believed to be commercial-grade products found to contain benzene, toluene, ethylbenzene and xylene compounds (BTEX) and polynuclear aromatic hydrocarbons compounds (PAH) at concentrations summarized in Table 4-10 of the RI. The tarry material is not a listed

RCRA waste and, based on the analytical results, not likely to be deemed characteristically RCRA hazardous.

1.2.2 Contaminants of Concern and Transport Mechanisms

The primary constituents of interest (COIs) associated with slag and soils, as defined in previous investigations and confirmed in the RI by magnitude and frequency of detection, were lead, arsenic, cadmium, and zinc. Other organic and metal COIs were found on the Facility Area at lesser frequencies or in localized areas.

The primary transport mechanisms for the COIs from the slag to various media include physical relocation of the slag for use as fill, storm water run-off over exposed slag to ephemeral drainage ditches and creeks that drain the Facility Area, and leaching of metals from overlying slag to underlying soils and shallow groundwater. Dissolution of metals from drainageway sediments to surface water and dispersion of metals through air migration were not found to be significant transport mechanisms at the Site (ENTACT, 2009).

All COIs found in source materials and various media above preliminary screening levels were evaluated in the BHHRA and Baseline Ecological Risk Assessment (BERA) to identify those COIs that posed a potential risk to human health or the environment. The COIs found to pose a potential risk to human health or the environment under various exposure scenarios are considered constituents of concern (COCs) or constituents of potential ecological concern (COPECs) to be addressed as part of the remedy for the Site. The findings of the BHHRA and BERA are provided in Appendices H and K of the Final RI Report (ENTACT, 2009), as modified by the April 17, 2009 USEPA Approval with Modifications letter, and are summarized below.

1.2.3 Human Health Risk Assessment

The BHHRA determined that the primary COCs in the slag source materials and various affected media that pose a current and/or future potential risk to human receptors include lead, arsenic, cadmium, and/or zinc (AMEC, 2009a). The specific COCs associated with each potential current and or hypothetical future exposure scenario identified in the BHHRA for the Site are summarized in the following table:

Media	COC	Exposure Point	Receptor
SOURCE MATERIALS			
Slag	Arsenic	Facility Area slag surface (fine-fraction)	Commercial worker, Hypothetical future resident
		Facility Area mixed surface slag/soil (fine-fraction)	Hypothetical future resident
	Cadmium	Facility Area slag surface (fine-fraction), Facility Area mixed slag/soil (fine-fraction)	Hypothetical future resident
	Lead	Facility Area surface slag (fine-fraction) Facility Area surface slag	Commercial worker, Utility/Construction worker, Hypothetical future resident

Media	COC	Exposure Point	Receptor
Source Material continued			
Slag con't	Lead continued	Facility Area surface mixed slag/soil (fine-fraction) Facility Area surface and subsurface mixed slag/soil	Commercial worker, Utility/Construction worker, Hypothetical future resident
Tar-like Material	BTEX[1] and PAHs.	Facility Area Subsurface buried debris – localized to Trench 1 and 7	Utility/Construction worker
AFFECTED MEDIA			
Soil	Arsenic	Facility Area native surface soil [2] (fine-fraction)	Hypothetical future resident
		Site Residential Properties Soil [3] (2 properties)	Future potential exposure (ingestion soil and homegrown vegetables)
		Site Commercial Properties (2 properties)	Future resident (ingestion soil and homegrown vegetables)
		Site Vacant Properties (4 properties)	Future resident (ingestion soil and homegrown vegetables)
	Cadmium	Site Residential Property Soil (1 property)	Future potential exposure (ingestion soil and homegrown vegetables)
		Site Vacant properties (2 properties)	Future resident (ingestion soil and homegrown vegetables)
	Lead	Facility Area Native Surface Soil (fine fraction)	Hypothetical future resident
		Facility Area Subsurface Soil	Commercial worker, Utility/Construction worker, Hypothetical future resident
		Site Alleyway (1 alleyway) Surface and Subsurface Soil	Commercial Worker Utility Worker
		Site Residential Property surface soil (fine-fraction) (2 properties)	Resident (child 0-84 months)
		Site Commercial Property surface soil (fine-fraction) (2 properties)	Future resident (child 0-84 months)
		Site Vacant Properties (4 properties)	Future resident (child 0-84 months)
Sediment	Lead	Facility Area Drainage Ditches	Commercial worker, Utility/Construction worker, Hypothetical future resident
		Rose Creek (immediately adjacent to Facility Area)	Commercial Worker Utility Worker
Ground water	Arsenic	Facility Area < 30 feet Facility Area > 30 feet	Hypothetical future resident
	Cadmium	Facility Area < 30 feet	Hypothetical future resident
	Manganese	Facility Area < 30 feet	Hypothetical future resident
	Zinc	Facility Area < 30 feet	Hypothetical future resident

[1] BETX: Benzene, toluene, ethylbenzene and toluene; PAH: polycyclic aromatic hydrocarbons
[2] Native soil – refers to native soil only
[3] Surface or subsurface soil – refers to slag/soil mixes

Of the affected media, complete exposure pathways have been identified for slag source materials, localized tar-like material, sediment and/or affected soils both on and off the

Facility Area under current or hypothetical future use. The limited quantities of buried tarry material believed to be associated with discarded roofing tar or asphaltic tar products during demolition activities (<10 cubic yards) were identified in the BHHRA as the only material other than slag that posed a potential risk to human health. The current or potential future exposures identified in the preceding table will be considered during the Alternative Array screening process and in the more detailed evaluation of the selected remedial alternatives that will be addressed in the FS.

Arsenic, cadmium, manganese, and zinc were also identified as COCs in groundwater representing the uppermost saturated horizons of the shallow Cahokia Alluvium (less than 30 ft below ground surface (bgs)) that is assumed to be used as a source of drinking water. This exposure scenario is strictly hypothetical as shallow groundwater less than 30 ft bgs is unlikely to have sufficient yield based on measured hydraulic conductivity values to supply a residential or commercial potable water system. In horizons below 30 feet, a potential complete exposure pathway was identified for arsenic only under a hypothetical future residential land use scenario within the southwestern corner of the Facility Area and up to 100 feet beyond the western Facility Area boundary. Under current conditions, there are no potable wells on the Facility Area or downgradient of the Facility Area as Village residents are served exclusively by a public water supply that draws on surface water from the Mississippi River, as detailed in Section 3.4.2 of the RI. Future residential land use of the Facility Area is not an intended or likely future land use option given the Facility Area conditions and the proximity of neighboring heavy industrial operations.

1.2.4 Ecological Risk Assessment.

Since the Site is located in a developed area with limited terrestrial habitat, the BERA focused on potential risks to aquatic receptors (assessment endpoints) that may occupy the ephemeral ditches and creeks which drain the Facility Area or the Old Cahokia Creek Watershed which receives the surface water runoff from the Facility Area. Multiple lines of evidence were used in evaluating whether chemicals from the Site were potentially affecting the assessment endpoint which included the following:

- Comparing measured COPEC concentrations in sediment and surface water to conservative screening levels;
- Comparing tissue metals concentrations of benthic macroinvertebrate and plants from areas potentially affected by the Facility Area to tissue concentrations from a reference location and to tissue concentrations from the literature;
- Comparing the benthic invertebrate and wetland plant communities in areas potentially affected by the Facility Area to the benthic invertebrate and plant communities at reference locations.

Both ecological and chemistry data were used to aid in interpreting potential risks of COPECs (metals, primarily lead, zinc and cadmium) and to help the risk manager judge the likelihood and ecological significance of the estimated potential risks in order to help

determine what future actions, if any, are to be undertaken. The results of the BERA are summarized in the following table:

Location	BERA Results
Facility Area Ditches	While comparison of surface water and sediment chemistry data to generic and conservative benchmarks suggests potential impacts to the aquatic ecosystems in the East Ditches, all of the Site-specific lines of evidence suggest the potential effects related to COPECs are no different on-Site than in Reference Areas unaffected by discharges from the Facility Area. The ditches have been altered to enhance stormwater flow on the Facility Area. Overall, given the physical characteristics and ephemeral conditions of the Facility Area ditches, the aquatic communities would likely change little if the metals were removed from the systems.
Rose Creek	While comparison of surface water and sediment chemistry data to generic and conservative benchmarks suggests potential impacts to the aquatic ecosystems in Rose Creek, most of the Site-specific lines of evidence suggest no apparent difference between the on-Site locations and the Reference locations. Rose Creek is a relatively narrow ephemeral stream that flows along the north side of the CSX Rail Corridor with slag and slag-like material present along the banks where Rose Creek flows through and adjacent to the Facility Area. Given physical characteristics and ephemeral conditions of Rose Creek, the aquatic communities would likely change little if the metal were removed from the system.
West Ditch Outfall to the Old Cahokia Watershed	Comparison of surface water and sediment chemistry data from the West Ditch Outfall into the Old Cahokia Wetland complex to conservative benchmarks suggests that potential adverse effects to aquatic organisms may exist. The Site-specific lines of evidence also suggest a potential impact to the benthic macroinvertebrate community based on the total number of organisms and taxa found at this outfall location being lower than at the other sample locations and the concentration of zinc in invertebrate tissues being slightly greater than the conservative tissue residue effects level (12.6 mg/kg as opposed to 11.2 mg/kg benchmark). The lines of evidence suggest that while COPECs may be adversely affecting the aquatic ecosystems in a very spatially limited area (with a radius as small as 10 meters) at the West Ditch #1 Outfall, the area immediately surrounding this limited area does not appear to be affected.
Rose Creek Outfall to the Old Cahokia Watershed	Some overt effect on plant growth were observed (e.g. chlorosis) at the Rose Creek Outfall to the Old Cahokia Watershed, though this was localized at the mouth of the stream channel. Plant tissue COPEC concentrations at the Rose Creek outfall were below levels considered toxic. The results of the samples collected in this area indicate no significant ecological risk exists and that the spatially limited impacts observed in the plant community may not be related to smelter-related COPECs.
Schoenberger Creek	While surface water and sediment chemistry suggests some impact to aquatic organisms within Schoenberger Creek, the sample locations were in stretches of the creek that do not receive drainage from the Facility Area and COPEC concentrations do not appear elevated compared to the reference location in the creek. The benthic community survey shows that the community within the creek is similar to the sampling locations in the reference area as well as to locations in the Facility Area ditches with COPECs in benthic macroinvertebrate tissues below NOECS and LOECS.

In summary, the sediment chemistry data show that surface water flow from the Facility Area has resulted in COPEC migration to some of the down-gradient aquatic habitats within the Old Cahokia Watershed, within the immediate vicinity of the West Ditch and Rose Creek outfalls, though other anthropogenic sources have contributed COPECs at

these locations. The lines of evidence considered in the BERA suggest that smelter-related COPECs may be affecting the macroinvertebrate community in a very localized area of the West Ditch Outfall at the edge of the open water habitat but the area immediately surrounding this localized area does not appear to be effected. In addition, some evidence suggests that smelter-related COPECs may be affecting wetland plants in a localized area downgradient of both outfalls, but are not affecting the overall plant community; only individual plants in the immediate vicinity of the outfall. The BERA found no evidence that the diversity and viability of the aquatic ecosystems in the drainage features draining the Facility Area or within the Old Cahokia Creek Watershed are being adversely affected by COPECs associated with historic smelter activities (AMEC, 2009b). Therefore, the development of alternatives to address potential ecological risks will be focused on eliminating the potential for migration of metals from the Facility Area via stormwater transport. The Old Cahokia Watershed receives discharge from multiple point and non-point sources not related to the former smelter operations, including interstate highway run-off, various industrial facility discharges, Milam Landfill, and mobile home park septic systems and these discharges will continue despite any remedial action aimed at limiting migration of metals from the Facility Area

Based on the results of the RI and the risk assessments, the preliminary screening process of remedial options will focus on eliminating human health exposures to identified COCs under current use or potential future use scenarios and in preventing any further migration of COPECs from the Facility Area to aquatic ecosystems that receive discharge from the Facility Area.

1.2.5 Site Clean-up Standards

1.2.5.1 Source Materials and Affected Soils Cleanup Standards

Risk-based levels for lead that are considered to be protective in source materials, soils and ephemeral sediments were developed as part of the BHHRA. The inputs and outputs and model type used in the development of residential, commercial, recreational or construction criteria are provided in detail in Attachment C to the BERA and summarized below:

Receptor	Lead Criteria Considered Protective (mg/Kg)
On-Facility Area	
Commercial Worker [1]	945 – 1,048
Construction Worker [1]	1,193 – 1,324
Recreational User [1]	3,263 – 3,620
Hypothetical Future Resident (Child) [2]	400
Off-Facility Area	
Commercial Worker [1]	945 – 1,048
Construction Worker [1]	1,193 – 1,324
Recreational User [1]	3,263 – 3,620
Hypothetical Future Resident (Child) [2]	400

[1]: Represent soil/sediment criteria developed for recreational user, commercial worker, and construction worker exposures (non-residential scenarios) using U.S.EPA's Adult Lead Model (2005).
[2]: Represents residential soil criterion of 400 mg/Kg per "All EPA Region Screening level and User's Guide", September 12, 2008.

Site-specific risk-based calculated levels for the remaining co-located metal COCs identified in the BHHRA (cadmium, arsenic, zinc, manganese) that are considered to be protective of human health were not developed as part of the BHHRA. For source materials and soils, the U.S.EPA has developed the human health risk-based screening levels (RSLs) for cadmium and zinc that may be used as preliminary remediation goals in the absence of site-specific risk-based screening criteria. For arsenic, use of the Illinois background value established by the IEPA under Title 35 of the Illinois Administrative Code Part 742 (35 IAC 742), Appendix A, Table G for counties within Metropolitan Statistical Areas (MSAs) were used for both residential and commercial preliminary cleanup standards as the background level for naturally-occurring arsenic found in soils within Illinois exceeds the risk-based RSLs. The standards are as follows:

Metal	Residential	Commercial/Industrial
Cadmium	70	800
Manganese	1,800	23,000
Zinc	23,000	310,000
Arsenic	13	13

These cleanup standards may be replaced with site-specific values that are developed as part of the FS.

1.2.5.2 Sediment/Surface Water Cleanup Standards

Sediments
The Facility Area ditches and Rose Creek are ephemeral in nature, and do not receive base flow from the underlying shallow aquifer. The only flow through these drainage features is in response to precipitation events. Therefore, the soil cleanup standards outlined above will be used as cleanup standards to address human health exposures identified in the BHHRA within the ephemeral drainage ditches and Rose Creek.

The Rose Creek Outfall and West Ditch Outfall lie at the edge of a terrace that borders the north side of Collinsville Road. The Rose Creek Outfall discharges to wetland areas that border the terrace slope and extend into the Old Cahokia Watershed Area. These wetlands may be intermittently inundated (i.e. possessing shallow standing water resulting from seasonably high water table). At the West Ditch Outfall area, these border wetlands grade abruptly to perennially open water which is inundated more or less perennially. As indicated in the BERA, though U.S.EPA media-specific conservative ecological screening levels (ESLs) were used as a preliminary screening of metals to identify the primary smelter-related COPECs in sediment at the Site which includes arsenic, cadmium, copper, lead and zinc, they are not intended to be used as cleanup goals and are not considered ARARs for this Site. The multiple lines of evidence used

to assess effects to aquatic receptors (macroinvertebrate and plants) from COPECs in sediments indicated that there are two very localized, potentially affected areas in each outfall area that may be attributable or partially attributable to COPECs in sediments that were transported from the Facility Area, with no adverse effects to the ecological receptors in the immediate surrounding areas (AMEC, 2009b). In addition, the Old Cahokia Watershed has been determined to be impaired for aquatic life due to other multiple point and nonpoint pollution sources including agriculture, crop-related sources, non-irrigated crop production, construction, land development, urban runoff/storm sewers, hydromodification, and channelization (IEPA, 2009).

Surface Water

For surface water, calculated hardness-dependent ecological screening criteria were used to identify the COPECs for surface water but these are also not to be used as cleanup standards as they are very conservative and do not take into account the nature of the source of the surface water (i.e. that many of the surface waters sampled in the vicinity of the Site are from standing to stagnant shallow pools within ephemeral channels). The IEPA has made a determination that all waters in the Old Cahokia Creek Watershed, as well as the ephemeral channels draining the Site, are classified as general use waters. The general use classification is defined by the Illinois Pollution Control Board (IPCB) as standards that will protect the state's aquatic life, wildlife, agricultural use, secondary contact use and most industrial uses, and ensure the aesthetic quality of the state's aquatic environment (IEPA, 2009). The comparison of dissolved COPECs concentrations detected in perennial surface water features (specifically the open water habitat and engineered drainage ditch within the Old Cahokia Watershed) to generic Illinois General Use Surface Water Quality standards reveals no exceedence to these standards within Old Cahokia Creek which can sustain ecological communities. Therefore to date, metals loading of COPECs to surface water draining the Facility Area in the dissolved or very fine particulate state has not affected identified ecological communities in the Old Cahokia Watershed.

Levels of COPECs in the isolated pools of standing water within the ephemeral channels draining the Site have shown exceedences of the Illinois General Use water quality standards. However, the levels of dissolved metals in surface water found in reference samples collected in streams and in the Old Cahokia not hydraulically connected to the Facility Area also are above these standards.

The BERA has not shown any significant adverse impact to ecological receptors from affected sediments or surface water outside the two very localized areas in the Old Cahokia Watershed either from the bulk-transport of metal COPECs in sediments from source material or affected media on the Facility Area, or as dissolved or fine particulate metal COPECs in surface water draining the Site during precipitation events. Therefore, the focus of the cleanup efforts to address potential future impacts to ecological receptors will be solely to mitigate any further metals loading of COPECs to the ephemeral channels that ultimately discharge into the Old Cahokia Watershed.

1.2.5.3 Groundwater

The shallow groundwater underlying the Facility Area is not currently used for potable purposes and, based on observed conditions during the RI, is unlikely able to produce sufficient yield to support a potable supply. However, there is no existing ordinance preventing the use of shallow groundwater below 10 feet, so shallow groundwater exceeding applicable groundwater standards will need to be addressed as part of any remedial alternative selected for the Site. The cleanup standards for groundwater COCs will include the Illinois Tier 1, groundwater remedial objectives (GROs) listed in 35 IAC 742, Appendix B, Table E for both Class I and/or Class II groundwater (<30 feet as follows):

Metal	Class I (Potable)	Class II (Nonpotable)
Cadmium	0.005	0.05
Arsenic	0.05	0.2
Manganese	0.15	10
Zinc	5	10

The Class I GROs are considered to be the applicable cleanup criteria for shallow groundwater in the south-central area of the Facility Area, for Facility Area groundwater ≥ 30 feet below ground surface (bgs), and for off-Facility Area shallow groundwater within the modeled plume boundary. The Class II groundwater GROs are considered to be the applicable cleanup criteria for shallow groundwater on the Facility Area above 30 bgs with the exception of the south-central portion of the Facility Area.

1.3 AAD ORGANIZATION

The AAD is organized as follows:

Section	Description
Section 1.0	Provides background information on the Site including Site description and history, a brief summary of the RI findings and report organization.
Section 2.0	Presents the Site-specific RAOs and the ARARs for the Site.
Section 3.0	Summarizes the process of identifying and screening General Response Actions (GRAs) and potentially applicable technology types and process options for use in the development and screening of alternatives.
Section 4.0	Presents the results of the development and screening of candidate alternatives for the Site. Candidate alternatives for source materials and affected media are developed and screened with respect to their effectiveness, implementability and cost.
Section 5.0	Estimates the remedial action schedule for proposed alternatives to be carried forward in the FS.
Section 6.0	Presents references cited in the AAD.

SECTION TWO

Section 2

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2.0 REMEDIAL/REMOVAL ACTION OBJECTIVES AND ARARS

This section presents a summary of the remedial objectives and regulatory requirements for developing remedial alternatives for the Site. Section 2.1 presents the RAOs that consist of medium-specific and Site-specific goals for protecting human health and the environment. Section 2.2 identifies the ARARs and other federal or state criteria, advisories or guidance to be considered (TBC) that may apply to the remedial action alternatives developed for the Site.

2.1 REMEDIAL/REMOVAL ACTION OBJECTIVES

RAOs have been identified for each contaminated medium at the Site and consist of medium-specific or Site-specific goals for protecting human health and the environment. The RAOs for the Site have been developed to assist in identifying a range of alternatives that may achieve protection of human health and the environment by reducing exposure to contaminated media.

The media of concern at the Site include source materials, affected soils/ephemeral sediments, surface water and shallow groundwater. These media were identified based on the results of the RI and risk assessments summarized in Section 1.2.2 of this report and detailed in the March 13, 2009 RI Report (ENTACT, 2009).

2.1.1 Source Materials

The source material RAOs are designed to address the potential human health risks associated with direct exposure to, and ingestion of, COCs in smelter-related source materials. The scope of the source material RAOs for human receptors applies to source materials located both on and off the Facility Area (including slag used as structural fill in commercial areas, residential lots, vacant lots, or public alleyways) and are intended to address risks associated only with the source materials, including slag and a localized small volume of buried tarry material. Risks associated with affected media (soils, sediment and groundwater) are addressed in separate media-specific RAOs.

Based on the exposure scenarios discussed in Section 1.2.3, the source material RAOs are stated as follows:

- Prevent direct contact with, or ingestion and inhalation of, COCs in source materials that could result in unacceptable human health risks as defined in the BHHRA.

- Minimize the transport of COCs from source material through the defined transport mechanisms of concern that could result in additional affected media or re-contamination of remediated areas.

2.1.2 Affected Soil/Sediment RAOs

The affected soil/sediment RAOs are as follows:

- Prevent direct human contact with, or ingestion and inhalation of, COCs in affected soils/sediment that could result in an unacceptable human health risk as determined in the BHHRA;

- Minimize the transport of COCs in affected soils/sediment through the defined transport mechanisms of concern that could result in additional affected media or re-contamination of remediated areas;

- Minimize the potential of exposure by construction workers conducting intrusive activities to the discarded tarry material found with buried demolition debris that could result in an unacceptable human health risk as determined in the BHHRA;

- Prevent direct contact with, or ingestion or inhalation of COCs in affected soils at residential yards, commercial properties, and vacant lots by current residential or potential future residential receptors that could result in an unacceptable human health risk as determined in the BHHRA; and

- Prevent direct contact with, or ingestion or inhalation of COCs of affected soils and source materials in alleyways by commercial or utility workers receptors as determined in the BHHRA.

2.1.3 Affected Surface Water RAOs

The surface water RAOs are designed to meet ARARs and to prevent potential risks identified in the BHHRA and BERA risk evaluations to potential human health or ecological receptors. For surface water, the applicable ARARs include meeting the Illinois Water Quality Standards which the IEPA has determined apply to ephemeral drainage ditches, Rose Creek, and the Old Cahokia Watershed. Though no potential human risks were identified for surface water, COPECs in source material may continue to be mobilized and transported from the Facility Area to the two outfall areas as out-washed source material deposits or as dissolved or very fine particulate in surface water that has come into contact with source material that could pose a future risk to aquatic receptors.

Given the Site conditions, an RAO requiring that surface water be addressed to meet Illinois water quality standards is considered impractical and technically and economically infeasible. Though surface water samples collected from the ephemeral drainage ditches, Rose Creek and the Old Cahokia wetland showed metals at levels marginally above the Illinois general use water quality standards, samples collected from upgradient or hydraulically separated reference locations not receiving discharge from the Site (Schoenberger Creek and the Old Cahokia Watershed) were also found to contain

metals above Illinois water quality standards. This indicates that metals loading to these surface water systems from other sources is also occurring which will not be affected by any remedy developed for the Site. There are several upgradient sources contributing metals loading to Rose Creek and, based on the results of sampling conducted as part of the RI, the concentrations of the COCs in surface water exceed the Illinois Water Quality Standards upgradient of the Site. Point sources discharging into the Old Cahokia Watershed based on an IEPA on-going study of the impaired Final Cahokia Canal/Horseshoe Lake Watershed, as detailed in the RI, include several industrial facilities (Elementis Pigments, General Chemical), the Illinois Department of Transportation (DOT) and Maryville wastewater treatment plants (WTP), and two mobile home parks. Non-point source pollutant loading sources include cropping practices, animal operations, and area septic systems. The IEPA has to date developed and approved specific water quality standards for the Old Cahokia Watershed for some constituents and has indicated that this is an impaired area receiving major point and nonpoint discharges. Though meeting Illinois water quality standards for surface water is considered unattainable based on current conditions of the aquatic systems and the multiple sources of metals loading, remedial actions can be taken to eliminate metals loading from runoff from the Facility Area that would cause an exceedence of the Illinois water quality standards in the ephemeral drainage ditches, Rose Creek, and the Old Cahokia Watershed.

Based on the BERA, the outwashed source materials may pose risks to aquatic biota, though the BERA found that adverse impacts to aquatic ecosystems to date have been limited to very small localized areas within the Old Cahokia Watershed, with no overall adverse effects to the surrounding ecological receptors. A surface water RAO to address potential ecological risk has been developed to mitigate future potential exposure risks by mitigating the transport of COPECs from Facility Area source materials via stormwater run-off through the ephemeral ditches and Rose Creek to the seasonally inundated wetland and perennial open water areas in the Old Cahokia Watershed where ecological receptors can be sustained.

Therefore, in developing surface water RAOs, there is first a recognition that achieving compliance with Illinois water standards is outside the ability of any remedial option aimed at addressing the contribution of smelter-related COPECs. However, attainable and feasible measures include focusing efforts on reducing surface water metals loading attributable to source materials from the Facility Area, as summarized below:

- The elimination of the discharge of storm water to the ephemeral ditches and Rose Creek from areas containing source materials and affected media with smelter-related metal concentrations in excess of Illinois water quality standards ; and

- The elimination of the transport of COPECs from surficial source material deposits to potential ecological aquatic receptors in the inundated wetland or perennial open water area of the Old Cahokia Watershed

2.1.4 Affected Groundwater RAOs

Currently there are no human receptors within one mile downgradient of the Facility Area that could be exposed to the COCs identified in shallow groundwater. Both the Facility Area and the Village are served exclusively from a public water supply that draws from the Mississippi River and there are no downgradient receptors of shallow groundwater. In addition as detailed in the RI, cadmium has been detected in both upgradient wells and in off-Site adjacent chemical plant wells at levels that are at or above the levels of cadmium found along the downgradient Facility Area boundary.

According to U.S.EPA guidance, RAOs for groundwater should take into consideration both current and potential future uses of the affected groundwater. Where there is a potential for future use of the affected groundwater, the U.S.EPA expects to return the groundwater to beneficial reuse wherever practicable, within a timeframe that is reasonable given the particular circumstances of the Site. Based on the area well survey conducted as part of the RI, shallow groundwater above 60 feet has not been used for drinking water purposes within a one mile radius of the Facility Area . This is likely due to the overall low permeability and discontinuous areal extent of thin saturated horizons found within of the alternating layers of clays, silts and silty sands that comprise the upper 50 feet of Cahokia Alluvium in the vicinity of the Site. As found in the majority of slug tests conducted on shallow water wells as part of the RI, hydraulic conductivities on the Facility Area are generally less than 10-04 cm/sec. Therefore, the ability of shallow groundwater to be used for potable purposes under a potential future use is not considered a practical expectation in the immediate vicinity of the Site and within the modeled boundary of the plume.

In addition as detailed in the RI, analytical results and background information indicate there are upgradient sources that have been contributing metals to shallow groundwater. Cadmium has been detected in upgradient wells sampled as part of the RI and in samples from other wells upgradient of the Site at levels at or above those found in the wells downgradient of the Facility Area. This indicates that any remedial option aimed at addressing groundwater affected by smelter source materials will not be able to attain Class I drinking water standards as long as off-Site sources continue to source load metals to shallow groundwater. The U.S.EPA has taken the position that "where restoration of groundwater to beneficial uses is not practical, U.S.EPA expects to prevent further migration of the plume, prevent exposure to contaminated groundwater and evaluate further risk reduction." (40 CFR 300.430 (a)(1)(iii)(F) .

Therefore, the RAO for groundwater is to ensure that there is no future exposure to affected shallow groundwater. The groundwater RAO is as follows:

- Prevent further migration of the shallow groundwater plume; and

- Prevent the ingestion of shallow affected groundwater that could pose an unacceptable risk to human health.

The migration of groundwater to date in both a vertical and lateral direction has been limited primarily to the confines of the Facility Area even with exposed ground smelter residues that cover the majority of the Facility Area. This is expected to be due in large part to the low permeability of the unconsolidated deposits including a native clay layer that ranges between 5 to 20 feet beneath the smelter residues across the Facility Area. Remedial technologies and process options aimed at removing or containing source material and affected soil will aid in preventing further migration of the plume by reducing the leaching potential even further. The second groundwater RAO can be meet by either using institutional controls to prohibit the use of water from shallow aquifer wells on and immediately downgradient of the Facility Area as a domestic water supply or by treating the groundwater to meet Class I drinking water standards.

2.2 IDENTIFACTION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

CERCLA and the National Contingency Plan (NCP) require that potential ARARs be identified during the RI/FS process and have defined two ARAR components: 1) applicable requirements; and 2) relevant and appropriate requirements. Applicable requirements are defined as environmental requirements, criteria or standards promulgated under federal or state laws that apply specifically to the conditions and circumstances at the Site. Relevant and appropriate requirements consist of environmental requirements, criteria, or standards promulgated under federal or state law that do not technically apply under the exact conditions of the Site, but are applicable to similar conditions or circumstances. In addition to ARARs, U.S. EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* indicates that other information (e.g. advisories, criteria, guidance) that does not meet the definition of an ARAR may be considered. This information is referred to as "To Be Considered" (TBC).

Identification of ARARs requires evaluation of the body of federal and state environmental and health regulations with respect to chemicals of concern, site characteristics and proposed remedial alternatives. Requirements that pertain to the remedial response at a CERCLA site can be placed into three categories:

- **Chemical-specific** requirements generally involve health- or risk-based numerical values of methodologies that establish site-specific acceptable chemical concentrations or amounts of a chemical that may be found in, or discharged to, the environment.
- **Action-specific** requirements involve performance, design, or other action-specific requirements and are generally technology- or activity-based.
- **Location-specific** requirements involve restrictions established for specific substances or activities based on their location.

2.2.1 Chemical-Specific ARARs

The chemical-specific ARARs are numerical values or procedures that, when applied to the Site or areas within the Site, establish numerical limits for individual chemicals or groups of chemicals in one or more media. These ARARs are generally health- or risk-based standards limiting the concentration of a chemical found in or discharged to the environment. Chemical-specific ARARs provide either actual cleanup levels or the basis for calculating such levels. Table 2-1 presents chemical-specific ARARs and TBCs listed by media to which they apply.

2.2.2 Action-Specific ARARs

Action-specific ARARs are technology- or activity-based requirements that direct how remedial actions are conducted. The applicability of this set of requirements is directly related to the particular remedial activities considered for the Site. Table 2-2 identifies those ARARs and TBCs that may pertain to the remedial actions required at the Site. The action-specific ARARs will be refined as part of the FS based on the actions required for the various alternatives in the FS.

2.3 Location-specific ARARs

Location-specific ARARs represent restrictions placed on the conduct of activities relative to natural site features (e.g. wetlands, floodplains). Table 2-3 presents potential location-specific ARARs and TBCs identified for the Site.

SECTION THREE

Section 3

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3.0 IDENTIFCATION AND SCREENING OF REMEDIAL TECHNOLOGIES

This section presents and screens applicable remedial technology types and associated process options that could be used to remediate the Site. The first step in the process is the identification of GRAs which address the source materials and affected media at the Site. GRAs are defined as broad groupings of remedial technologies or technology types that share common elements for addressing the RAOs outlined in Section 2.0. Technology types are subdivisions within the GRAs that describe families of related process options. Process options consist of specific remedial actions that fall within a general technology type (EPA, 1988).

The GRAs have been defined based on Site conditions, RI data, U.S.EPA-issued presumptive remedies for metals-in-soils sites, and engineering judgment.

3.1 IDENTIFICATION OF GENERAL RESPONSE ACTIONS, REMEDIAL TECHNOLOGIES

The following subsections describe the GRAs, technology types and process options for source materials and affected media for the Site.

3.1.1 Institutional Controls

Institutional controls are defined as non-engineered GRAs (e.g access, land use or groundwater use restrictions) that are designed to reduce or prevent residual human health and/or ecological risks that may remain following implementation of engineered remedial actions at CERCLA sites. Since first introduced in 1980, legal and administrative controls have been used successfully to help reduce or prevent risks at numerous sites, including smelter sites and are recognized under the NCP as an acceptable means of supplementing remedial actions when active response measures are determined to be impractical for meeting the ARARs or TBCs. In 2000 and 2004, the U.S. EPA issued guidance for implementing institutional controls at Superfund, Brownfield, RCRA and federally listed sites (U.S.EPA, 2000; U.S.EPA, 2004).

There are two general categories of institutional controls that are recognized by the U.S. EPA and authorized under both CERCLA and the NCP as potentially applicable to the conditions found at the Site:

- Land use restrictions, zoning regulations, and health ordinances to enhance the remedy's protectiveness of human health; and
- Land use restrictions to protect engineered components of the remedy.

At the Site, a future residential land use of the Facility Area is considered impractical due to the historical size and use of the Site for industrial purposes for the past 90 years, and

the proximity of heavy industry including a main railroad loading terminal and transfer station, and chemical plants. However, as there is currently no legally recognized environmental use control prohibiting use of the Facility Area for residential purposes in the future, an institutional control would be necessary as part of the remedy to ensure that land use remains nonresidential in perpetuity.

Ingestion of shallow groundwater by residential well users is also considered highly unlikely due to the expected low well yield of saturated horizons above 30 feet, the limited areal extent of affected shallow groundwater below 30 feet outside and downgradient of the Facility Area (less than 250 feet beyond the western Facility Area boundary), and the availability of a public surface water supply that serves all of the Village. However since there is no state or local ordinance prohibiting installation of a well below 10 feet, institutional controls would be necessary to prohibit well installation and use of shallow groundwater on and downgradient of the Facility Area.

Land use restrictions will also be necessary to protect the engineered components of the remedy including unauthorized intrusive activities through the cover or cap and/or access controls to protect engineered components of the remedy.

3.1.2 Smelter-Related Source Materials and Affected Soil/Ephemeral Sediment Technologies

While the stockpiled slag is different in its physical form from the re-distributed ground slag (less prone to leaching to the subsurface or being carried by overland stormwater run-off due to its massive, vitrified physical state) or to other minor potential source areas (i.e. buried tarry material, low-lying unvegetated area), the potentially applicable remedial technologies identified for all smelter-related source materials, and affected soils and ephemeral sediments are similar. Therefore, affected soils and ephemeral sediments are combined with source materials to simplify the initial technology identification process.

The following GRAs are identified as potentially applicable for addressing the Site-specific risks and the source materials, soil and ephemeral sediment RAOs. Some of the GRAs may only be applicable to source materials or to affected soils/sediments based on their locations within specific physical settings.

- **No Action** – Evaluation of No Action GRA is required under NCP [40 CFR Part 300.430(e)6].

- **Institutional Controls** - Use of applicable ICs to minimize exposure to source materials, as described in Section 3.1.1

- **Containment and Stabilization** – The containment and stabilization GRA includes actions such as capping, covering, or armoring and/or stabilization and fixation that are designed to reduce contaminant mobility and toxicity by

physically containing or stabilizing the source materials. The intent of the GRA is to reduce the potential for direct contact of both current and future human receptors and to prevent transport of metals from source materials to off-Facility Area soils or drainageways via the primary transport mechanisms of leaching and surface water run-off. Containment and stabilization are proven technologies for similar sites and are included in the U.S.EPA *Presumptive Remedy for Metals-in-Soils Sites* (EPA, 1998). It should be noted that chemical stabilization of metals in excess of RCRA toxicity criteria is not required for slag source material contained on Site based on the Beville exclusion of primary zinc smelting residues. However, stabilization may be required if source materials are disposed of at a licensed landfill.

- **Surficial Source Removal** – Source removal activities refer to excavating, transporting, consolidating, and/or disposing of materials for the purpose of reducing their availability as exposure media and the susceptibility to mobilization.

- **Treatment** – Treatment includes chemical and/or physical methods of reducing volume, mobility, and toxicity of source materials. This GRA includes recycling or reuse of source materials, sizing and grading of the more mobile or toxic fractions, and various treatment technologies to reduce volume and/or surface area of source materials or affected soils/sediments. Treatment technologies are included as presumptive remedies for metal-in-soil sites. Identification of treatment technologies will take into consideration the general lack of viable opportunities for stabilization or volume reduction of smelter residues due to the presence of high-volume, low-grade slag source materials and the regulatory limitation of a viable reuse or recyclable option.

The following list of potentially applicable technologies for each of the source material, affected soils and sediments GRAs is provided for further evaluation during the screening process. The bulleted items listed under the bolded GRAs consist of the representative remedial technology types and the subset of process options identified for each general category of response actions:

No Action
- No Action

Institutional Controls
- Deed Restrictions
- Access Controls to Protect Engineered Components of the Remedy

Containment and Stabilization
- Capping
    - Surface Armoring
    - Soil or Clay Covering Systems

  - Synthetic Membrane Cover Systems
  - Geotextile Cover Systems
  - Asphaltic Cover Systems
  - Composite Cover Systems

- Physical Reconfiguration
  - Slope Stabilization
  - Grading and Slope Reduction
  - Terracing
  - Deep Tilling

- Stabilization
  - Stabilization with Phosphate or Hydroxide-Apatite
  - Lime Stabilization
  - Fly Ash Stabilization
  - Pozzolanic (Cement-based) Stabilization
  - In-Situ Vitrification
  - In-Situ Grout Injection
  - In-situ Pyrokiln Thermal Encapsulation

Surficial Source Removal

- Excavation and Disposal
  - Excavation with On-Facility Area Consolidation and Capping with a Soil Cover
  - Excavation with On-Facility Area Consolidation in an Engineered Repository
  - Excavation with Off-Site Disposal

Treatment

- On-Site or Off-Site Reprocessing or Re-use
  - Direct Reuse or Recycling as Construction Fill or Concrete and Asphalt Aggregate
  - Direct recycling
  - Hydrometallurgical or Pyrometallurgical Reprocessing for Metals Recovery

- Physical/Chemical Treatment
  - In Situ Leaching
  - Soil Washing
  - Chemical Extraction
  - Batch Leaching
  - Size Grading or Screening for Toxicity, Mobility, Volume Reduction
  - Electro-Kinetic Remediation
  - In-Situ or Ex-situ Metal Reduction
  - In-Situ Metal Precipitation

- Biological Treatment
  - Pytoremediation or Phyto-extraction
  - Organic Matter or Biosolids Addition

3.1.3 Surface Water Technologies

Based on the BERA results, the identification and evaluation of surface water GRAs, technology types and process options are limited to those actions or technologies that are capable of preventing the transport of metals from Facility Area source materials to the ephemeral drainages draining the Site and the Old Cahokia Watershed that receives the drainage from the Site. The surface water GRAs are:

- ***No Action*** – Evaluation of No Action GRA is required under NCP [40 CFR Part 300.430(e)6].

- ***Monitoring*** – Surface water monitoring to monitor levels of COPECs in surface water prior to leaving the Facility Area.

- ***Containment and Stabilization*** – Although containment and stabilization technologies specifically address the source material and affected soil/sediment RAOs, they also address the potential for the transport of metals by runoff to the ephemeral ditches and the Old Cahokia Watershed.. In order to streamline the evaluation of these technologies, the discussion of the Containment and Stabilization GRA is presented in Section 3.1.2 under Source Materials and Affected Soils/Ephemeral Sediments and is not repeated in this section.

- ***Source Removal*** – Source removal actions refer to the excavation and disposal of surficial source materials for the purpose of reducing their availability for surface water transport. The discussion of the source removal GRAs is presented in Section 3.1.1 under Source Materials and Affected Soils/Ephemeral Sediments and is not repeated in this section.

- ***Drainage and Erosion Controls*** – Actions contained in this GRA include diversion, runoff detention, stream channelization and bank stabilization technologies designed to reduce contaminant transport to surface water by controlling or preventing the mobilization and transport of metals from the Site by storm runoff during rainfall events.

The following list of potentially applicable technologies for each of the surface water GRA is provided for further analysis during the initial screening described in Section 3.2. Potential remedial technologies and potential process options for each GRA include the following:

No Action

- No Action

Monitoring

- Surface Water Monitoring

Containment and Stabilization (Refer to Section 3.1.2)

Surficial Source Removal (Refer to Section 3.1.2)

Drainage and Erosion Controls

- Embankment and Channel Stabilization
  - Berms, Check Dams, Rip-Rap
  - Channel Liners or Channelization
  - Detention and Sedimentation Basins
  - Grade Control Structures
- Stream Diversions
  - Open Channel Diversion or Ditches
  - Seep Collection Impoundments
  - Run-off Impoundments or Retention Basins
  - Closed Channel Storm Drains

3.1.4 Groundwater Technologies

The identification and evaluation of groundwater GRAs, technology types and process options is limited to those actions or technologies that are capable of meeting the RAOs. This includes preventing further migration of the groundwater plume and ensuring that there continues to be no exposures to affected shallow groundwater on and downgradient, of the Facility Area, which modeling has predicted to extend 100 to 250 feet west of the Facility's western boundary. The modeled predictions of the plume extent will be verified as part of design activities, as indicated in the Final RI and the EPA Approval Letter with Modifications.

The groundwater GRAs are:

- ***No Action*** – Evaluation of No Action GRA is required under NCP [40 CFR Part 300.430(e)6].

- ***Monitoring*** – Groundwater monitoring of shallow groundwater within the affected plume boundary.

- ***Institutional Controls*** Use of applicable ICs to minimize exposure to affected groundwater, as described in Section 3.1.1

- ***Containment and Stabilization*** – Containment and stabilization technologies that address the source material and affected soil/sediment RAOs will also address the potential for leaching of metals via infiltrating precipitation to the shallow groundwater. The discussion of the Containment and Stabilization GRA is presented in Section 3.1.2 under Source Materials and Affected Soils/Ephemeral Sediments and is not repeated in this section. This GRA will not address metals-loading to shallow groundwater from upgradient, off-Site sources.

- ***Source Removal*** – Source removal actions refer to the excavation and disposal of surficial source materials for the purpose of reducing their availability for groundwater water transport. The discussion of the source removal GRAs is presented in Section 3.1.2 under Source Materials and Affected Soils/Ephemeral Sediments and is not repeated in this section. This GRA will not address metals loading to shallow groundwater from upgradient, off-Site sources.

- ***Alternative Water Supply*** – This GRA is designed to provide potentially affected households under a hypothetical future land use scenario within the modeled plume boundary with domestic water from other sources other than the shallow aquifer, such as the existing public water supply that draws from the Mississippi River, bottled water or drilling private deep wells (> 60 feet).

- ***Extraction/Collection/Removal/Discharge*** – This GRA is designed to prevent migration of affected shallow groundwater beyond the modeled plume boundary which is predicted to be within 250 feet west of the Facility Area's western boundary on commercial property currently owned by Garcia Trucking and to attempt to return the aquifer to Class I standards.

- ***Groundwater Treatment-*** The technologies listed under this GRA consist of shallow groundwater treatment systems to address potential future human health risks under the assumption that the Site would be remedied to the extent that would be suitable for residential development and that the future resident would elect not to use the available public water supply that currently serves all of the Village of Fairmont.

The following list of potentially applicable technologies for each of the groundwater GRAs is provided for further evaluation during the screening process. The bulleted items listed under the bolded GRAs consist of the representative remedial technology types and the subset of process options identified for each general category of response actions:

No Action

- No Action

Monitoring

- Groundwater Water Monitoring

Institutional Controls

- Deed Restrictions
- Groundwater Use Restrictions

Source Removal (Refer to Section 3.1.2)

Source Containment and Stabilization (Refer to Section 3.1.2)

Alternative Water Supply

- Connecting to Existing Public Water Supply
- Providing Bottled Water
- Organize and Construct New Domestic Supply

Extraction/Removal/Collection/Discharge

- Extraction
  - Extraction Wells
  - Dual Phase Extraction
- Subsurface Drains
  - Trench/Gallery Drains
  - Interceptor Trenches
- Injection
  - Reinjection Wells
  - Infiltration Gallery
- Discharge
  - POTW
  - Surface Water Drainage

Groundwater Treatment

- In-situ Treatment
  - In-situ chemical oxidation
  - Passive/Reactive Treatment Wells
- Ex-situ Treatment
  - Groundwater Extraction
  - Adsorption/Absorption
  - Ion Exchange
  - Precipitation/Coagulation/Flocculation

3.2 INITIAL TECHNOLOGY TYPES AND PROCESS OPTIONS SCREENING

This section presents the initial screening of the remedial technologies types and process options identified in Section 3.1. This initial screening step is designed according to U.S.EPA guidance to be a qualitative screen for the purpose of obtaining a manageable subset of technically feasible and generally applicable process options from the larger universe of identified technologies. During this step, process options that have no

technical applicability or possibility of being implemented due to technical or economic infeasibility are eliminated from further consideration to streamline the subsequent technology evaluations.

The following criteria are used to evaluate the technical feasibility and general applicability of process options during the initial screening step:

- Applicability of the process option to the Site-specific conditions;
- Applicability of the process options for addressing the RAOs; and
- Effectiveness of the process options in addressing the Site-specific COCs.

The initial screening of technology types and process options for addressing source materials and affected soils/sediments and for addressing shallow groundwater are presented in the following subsections. To simplify these presentations, the results of the initial screening process are summarized in tabular form with the rationales for eliminating whole technology types or individual process options discussed in the text of each subsection.

3.2.1 Initial Screening of Source Material and Affected Soils/Ephemeral Sediments Technology Types and Process Options

The results of the initial screening of source material technology types and associated process options are presented in this subsection and in Table 3-1. The rationales for eliminating technology types and/or specific process options in this initial screening step are summarized as follows:

- Under the Containment and Stabilization GRA, deep tilling has been eliminated as a process option because the source materials are too deep to be effectively treated by mixing with un-affected soils located beneath the source materials.
- Under the Containment and Stabilization GRA, the in-situ stabilization options of in-situ vitrification, grout injection and pyro-kiln thermal encapsulation are eliminated from further consideration because they have not been tested or proven to be effective in immobilizing metal contaminants in large-scale metal sites (>500,000 cubic yards) and other process options are equally effective at a much lower cost.
- Under the Treatment GRA, all the process options under the Recycling, Reuse and Reprocessing Technology Type have been eliminated from further consideration based on technical infeasibility and the anticipated ineffectiveness to reduce the metal concentrations to environmentally acceptable levels for beneficial reuse or recycling. As slag is the final end-product of smelting operations geared to remove the usable metals, there is no expectation that

reprocessing for additional metal removal could be technically or economically possible.

- Under the Treatment GRA, the only process option under the Physical/Chemical Treatment Technology Type that was retained for further consideration was ex-situ stabilization for excavated source materials and/or affected soils that are to be disposed of at an off-Site landfill. Though smelter wastes are Bevill excluded from the requirements of RCRA, landfills have the option of requiring treatment of this material before accepting the waste. The process options of in-situ leaching, soil washing, chemical extraction, batch leaching, electro-kinetic remediation, in-situ or ex-situ metal reduction, and in-situ chemical precipitation, are unproven for extracting and permanently reducing metal concentrations in wide-spread smelter residues. While some of these process options could be applicable for addressing the residential yards, vacant/commercial lots, and alleyways identified in the BHHRA, the high cost of implementing these options for these few locations along with the uncertainty of success eliminates these process options from further consideration. Size grading and screening is also eliminated since the original source material (stockpiled vitrified slag) has already undergone a significant amount of sizing and grading by XTRA with the resultant product (the ground re-distributed slag) representing the largest volume of source material to be addressed as part of the remedial action.

- Under the Treatment GRA, the biological process options of phyto-remediation and phtyo-extraction are eliminated from further consideration because they are generally not sufficiently effective at removing immobile metals such as arsenic and lead to meet PRGs.

3.2.2 Initial Screening of Surface Water Technologies

The results of the initial screening of surface water technology types and associated process options are presented in this subsection and in Table 3-2. The rationales for eliminating technology types and/or specific process options in this initial screening step are summarized as follows:

- Under the Embankment and Channel Stabilization GRA, the only process option eliminated from further evaluation was grade control structures. These sort of structures are designed for use where: 1) head cutting or gully erosion is active in natural or constructed streams; 2) where beds of intersecting channels are at different elevations; or 3) where a flatter grade is needed for stability in a proposed channel or water disposal system. These conditions are not applicable for this Site since the drainage ditches and Rose Creek that drain the Facility Area are shallow, ephemeral man-made or man-altered channels draining relatively flat areas which are dry for most of the year except during or immediately after storm events.

- Under the Drainage and Erosion Control GRA, the only process option eliminated from further screening was the seep collection impoundments which are not applicable to the Site. The ephemeral channels are not fed by base flow and hold flowing water only during or immediately after storm events and are dry for most of the year.

3.2.3 Initial Screening of Groundwater Technologies

The results of the initial screening of groundwater GRAs, technology types and associated process options to meet the groundwater RAOs are presented in Table 3-3 and summarized in this subsection. The rationales for eliminating technology types and/or specific process options in this initial screening step are summarized as follows:

- Under the Alternative Water Supplies GRA, providing bottled water and construction of a new supply were eliminated since there is already in place a public drinking water supply for the whole of the Village which draws from the Mississippi River.

- Under the Extraction/Removal/Collection/Discharge GRA, both process options under the extraction technologies (extraction wells and dual-phase extraction) were eliminated. The low permeability of the shallow saturated horizons in combination with the high sorption capabilities of the metal COCs in the clay-rich alkaline soils limit the ability of this technology type to be effective. Dual phase extraction is also not applicable for addressing metal COCs.

- Under the Extraction/Removal/Collection/Discharge GRA, the infiltration gallery process option under injection technologies (injecting treated water back into the aquifer) was eliminated as this process would not be as effective as other process options based on the low permeability of the upper unconsolidated deposits. The low permeability of the underlying geology which consists of alternating layers of clays, silts and silty sands would hinder effective infiltration of treated water back into the saturated horizons

- Under the Ex-situ Groundwater Treatment GRA, groundwater pump and treat was eliminated based on the low permeability of the shallow saturated horizons which limits the effectiveness of this process option. Furthermore this process option has shown limited effectiveness for metals as demonstrated at pilot or full-scale sites per U.S.EPA literature.

- Under the Ex-situ Groundwater Treatment GRA, ion exchange process option was eliminated because though the technology has a demonstrated effectiveness in reducing metals to concentrations of 0.01 mg/L, there is no consistent demonstration of its effectiveness in achieving concentrations below 0.01 mg/L. The cadmium PRG is 0.005 mg/L.

3.3 GREEN REMEDIATION STRATEGY

As part of the final screening process of GRAs, technology types and process options that passed the initial screening process were evaluated in accordance with the August 2009 U.S.EPA Superfund Green Remediation Strategy guidance document (the Strategy) and the January 2009 IEPA Bureau of Land Greener Cleanup Strategies for Sites. Technology types and process options were evaluated for the ability to reduce greenhouse gas (GHG) emissions and other negative environmental impacts that might occur during implementation and maintenance of remedial options.

In selecting viable remedial options for the Site, consideration was given to response actions, technology types and process options that effectively meet long-term health and environmental goals while at the same time reducing the overall environmental footprint of cleanup activities. Treatment technologies that are high in energy consumption were identified and eliminated if there was little overall gain in protection to human health or the environment in comparison to other technologies. Construction and operation activities associated with the cleanup of hazardous waste sites are often sources of GHG and other air pollutants including heavy equipment that is usually powered by diesel engines so durations of estimated timeframes to implement the remedies were also be considered.

3.4 FINAL SCREENING OF POTENTIALLY APPLICABLE PROCESS OPTIONS

The final screening of candidate remedial process options for each of the viable remedial technology types for the Site was conducted in accordance with the NCP (40 CFR Part 300.430(e)(7)) and U.S. EPA guidance. Process options that were proved technically implementable for the Site in the initial screening step discussed in Section 3.2 are further evaluated with respect to their effectiveness, implementability, cost, and in meeting EPA green energy strategies.

At this stage, the effectiveness criterion is a measure of a specific process option's ability to reliably and permanently address the RAOs and to eliminate any unacceptable risks to human health.

The implementability criterion is a judgment of the process option's technical and administrative feasibility to be installed and operated under the Site-specific conditions, which include availability of equipment and personnel needed to install, operate and maintain the technology for that process option.

The cost evaluation at this level of screening is limited to qualitative judgments of the capital and long-term operation and maintenance (O&M) costs associated with a specific process option. Cost evaluations take Site conditions, such as affected land area, volume of materials present, and other factors into consideration to arrive at a qualitative estimate of the costs which are assigned ratings of low, medium, high, or very high.

The final criteria in final screening was the selection of technology types and process options that better meet Agency green technology strategies and goals over other options that were equally effective at protecting human health or the environment but less effective in reducing GHG emissions. This includes: use of institutional controls and environmental land use controls where applicable and appropriate to eliminate unnecessary and energy-consuming removal; selection of green engineered barrier cover materials that will allow for future land reuse; and elimination of treatment technologies, such as groundwater pump and treat systems, that use energy from fossil fuel powered utilities for many years and in some cases decades.

3.4.1 Final Screening of Source Materials and Affected Soils/Ephemeral Sediments

The final screening results of source materials and affected soils/ephemeral sediments process options are summarized in Table 3-3. As indicated in Table 3-3, different process options may be applicable to the different types of source materials and affected media depending on where these materials are found at the Site. For example, slope stabilization and grading and slope reduction may be applicable for the stockpiled materials, but not for wide-spread surficial materials. Therefore any remedial approach will most likely be a combination of process options, rather than a single process option which is expected considering the diversity and scale of the Site. A categorical approach to remediation will be used to evaluate candidate technologies most appropriate for the following categories:

- Stockpiled vitrified slag;
- Re-distributed ground slag;
- Localized buried tarry material and other non-slag smelter residues;
- Affected soils and ephemeral sediments; and
- Affected residential yards, commercial properties, vacant lots and alleyways.

The final list of process options for addressing source materials and affected soils also reflects the large scale of the Site and the large volume of both source materials (>540,000 cubic yards) and the area of affected soils/ephemeral sediments (~120 acres) that will need to be addressed under the selected remedy. Process options that are generally suitable for addressing significantly smaller volumes of materials (such as phosphate, fly ash or pollozanic stabilization; asphalt or synthetic membrane cover systems; or biological remineralization) are removed from further consideration since these process options are not cost-effective or implementable for the conditions found at the Site.

The process options retained in the final list of candidate remedial alternatives are proven remedies appropriate to one or more of the listed source and affected soil/sediment categories and have all been demonstrated to be effective and implementable at similar smelter metal sites.

3.4.2 Final Screening of Surface Water Technologies

The final list of surface water technologies, as summarized in Table 3-5, includes surface water drainage and erosion control process options that may be used along with source and affected soils/ephemeral sediment removal or containment and stabilization technologies (summarized in Table 3-4) to address potential future ecological risks or metals loading associated with the transport of metals from Facility Area source material deposits to surface waters draining the Site. As shown in Table 3-5 the only surface water process option that was eliminated from consideration in the final screening was runoff impoundments or retention basins because these options are really not applicable to highly variable stream flow environments such as the ephemeral drainages on the Site, and there are a variety of other cost-effective and readily implementable civil engineering options available to prevent the transport of metals from source materials to surface water.

3.4.3 Final Screening of Groundwater Technologies

The final screening of groundwater technologies is summarized in Table 3-6. Currently there are no receptors for shallow affected groundwater, so the exposure pathway is not complete. As discussed in Section 3.2.3, the groundwater GRAs are designed to ensure that there continues to be no receptors of shallow affected groundwater under hypothetical future residential land use and to mitigate further migration of metals from Facility Area source materials to groundwater. The retained technologies and process options of groundwater use restrictions and connection to the existing public water supply will prevent any future ingestion of affected groundwater within the plume boundary. GRAs and technologies selected to address the RAOs for surficial source materials and affected soils will also address the groundwater RAO of mitigating further migration by reducing transport of metals via infiltrating precipitation.

Information obtained from the water well survey and from aquifer testing conducted as part of the RI indicated that the shallow saturated horizons above 50 feet within a one mile radius of the Site have not, and most likely cannot, be used for potable purposes. The return of the shallow groundwater to beneficial reuse is deemed impracticable based on upgradient off-Site metals loading which will hinder the effectiveness of groundwater treatment technologies in meeting Illinois drinking water standards until the off-Site sources are identified and controlled. However, at the request of U.S. EPA the most applicable technologies with a groundwater treatment component have been carried through the final screening process. This technology includes:

- Interceptor trenches for shallow groundwater capture at a suitable point, ex-situ treatment using precipitation, coagulation and/or flocculation and surface water discharge; and

- In-situ permeable reactive barrier process option.

SECTION FOUR

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Section 4

4.0 DEVELOPMENT AND SCREENING OF CANDIDATE REMEDIAL ALTERNATIVES

The development and screening of candidate remedial alternatives for the Site combines the process options retained through the final screening process (Table 3-4 through 3-6) into comprehensive Site-wide alternatives described in this section.

These alternatives are initially screened to define those alternatives to be evaluated in detail in the FS.

4.1 DEVELOPMENT OF CANDIDATE REMEDIAL ALTERNATIVES

The general categories of source material and affected media are paired with physical Site conditions where these materials and media are found to develop remedial alternatives that will:

- Consider the interactions between source materials and various media to more precisely focus the proposed remedial actions on more narrowly defined risks, exposure pathways and receptors; and

- Consider the differences in the effectiveness and implementability of various process options when applied to different materials, media, physical settings and risks.

4.1.1 Defining Source Material and Affected Media Categories

The source material and affected media categories are defined as follows:

- **Stockpiled Slag Source Material**– The stockpiled slag was generated during the smelter's operation and was poured along the northern and western boundary of the Facility Area in a molten state and allowed to cool over time. The vitrified slag stockpiles once covered over 15 acres on the Facility Area, but were routinely mechanically disturbed and transported off the Facility Area for use as fill and surfacing material or ground and used as structural fill on the Facility Area (ENTACT, 2009). Currently approximately 40,000 cubic yards of vitrified slag is stockpiled along the northern boundary of the Facility Area covering approximately 4.3 acres.

- **Re-distributed Slag Source Material** – The re-distributed slag represents the majority of source material for the Site. Beginning in 1976, XTRA began grinding and re-distributing the stockpiled slag across the Facility Area for use as structural fill to build up and level the Facility Area for its trucking operations. At present, the ground re-distributed slag covers approximately 100 acres of the Facility Area, ranging in thickness from 6 inches to over 9 feet, with an estimated volume

of over 500,000 cubic yards. Slag has also allegedly been re-distributed by area residents, businesses and employees of the Village. The Village allegedly applied slag to alleyways within the Village for surfacing, and slag was observed in many of the Village alleyways during the RI.

- **Low-Lying Unvegetated Area Source Material** – The low-lying, poorly draining, unvegetated area encompasses a 3.6-acre area in the northern portion of the Facility Area and is proximal to historic acid plant operations. This area is covered with a fine, powdery grey material that averages a thickness of 0.5 feet for an estimated volume of 2,775 cubic yards.

- **Buried Non-Slag Source Materials** – Limited quantities of buried non-slag wastes were found among demolition debris including the tarry material identified in the BHHRA as posing a potential risk to future construction/utility workers. This material is considered to be residual roofing tar products or asphaltic tar products used during Facility Area operations. The estimated quantity of the tar material and other buried non-slag potential source materials investigated as part of the RI was less than 120 cubic yards. However, only the tarry material was determined to represent a potential human health risk and this material represents less than 30 cubic yards.

- **Affected Soils/Ephemeral Sediments** – Affected soils and ephemeral sediments include soils on the Facility Area located below or adjacent to source materials, soils below source materials in Village alleyways, and soils and sediment located in ephemeral channels that have been affected by the transport of source materials and contain sufficient concentrations of metals or other COIs to pose potential human health risks. The potential human health risks associated with the affected soils and ephemeral sediments are the same regardless of the physical setting of these media and are based on both current and intended future land use as nonresidential with the exception of off-Facility drainage channels that pass through residential areas. Not included in this category are residential yard soils (or vacant lots that may be used for residential purposes in the future) that pose different risks based on exposure and receptors (children) than general affected soils and ephemeral sediments. Approximately 200,000 cubic yards of affected soils/sediments covering approximately 120 acres have been identified at the Site.

- **Affected Soils at Residential Yards, Commercial Properties, and Vacant Lots** This affected media includes affected soils in off-Facility Area residential yards, commercial properties, or vacant lots which could hypothetically be used for residential purposes in the future, where the BHHRA determined that COCs were found at sufficiently elevated concentrations to pose a potential human health risk. The majority of residential and commercial properties and vacant lots where elevated metals concentrations were measured in soils were addressed as part of an earlier removal action, with a small number of properties to be addressed as part of the remedial action. These remaining properties are:

Property	Current Land Use
5514 Kinder Drive	Residential
2768 N. 42nd Street	Residential
2845 N. 44th Street	Vacant [1]
4012 Maple	Zoned Residential/Used as Commercial [2]
3022 N. 48th Street	Vacant [1]
Maryland Avenue	Vacant [1]
47th Street	Vacant [1]

[1]: The risk for vacant properties was based on a future residential land use scenario and an evaluation of potential adverse effects to a young child (0-84 months).
[2]: The risk to this property was based on an evaluation of potential adverse effects to a young child though this property is currently used for commercial purposes.

Surface Water –The continued transport of COPECs through ephemeral channels to the two discharge outfalls to the Old Cahokia Watershed via surface water was identified as posing a potential future risk to ecological receptors. As affected surface water has not adversely affected ecological receptors in the Old Cahokia Watershed as yet, the focus of any remedial alternative for surface water is to prevent further metals loading of COPECs from the Facility Area source materials and affected media to surface water draining the Site that ultimately drains into the Old Cahokia Watershed. None of the remedial alternatives will address metals loading from other point and non-point sources that drain or discharge to the Old Cahokia Watershed as identified in the Final RI. Metals loading to the Old Cahokia Watershed from these other point and nonpoint sources is specifically excluded from consideration in the FS by the AOC.

- ***Shallow Groundwater*** – Shallow groundwater was determined to pose a potential risk only under a hypothetical and unlikely residential land use scenario, as previously discussed. As there are no current risks, the focus of any remedial alternative would be to ensure that there continues to be no consumption of affected shallow groundwater in the future and to prevent further migration of the plume. Due to Site conditions, groundwater treatment options are generally not considered viable options since metals loading from upgradient sources have resulted in cadmium-affected shallow groundwater coming onto the Facility Area at levels over Illinois drinking water standards. However groundwater treatment will be evaluated for inclusion in one alternative that incorporates complete removal of source materials and affected soils for further evaluation in the FS..

4.1.2 Development of Candidate Remedial Alternatives

The process of developing a set of Site-wide comprehensive remedial alternatives for the AAD consists of the following steps:

- Step 1: Develop process options of viable technology types that are deemed effective and implementable through the technology screening process described

in Section 3.1 and 3.2 and to insure that these options are carried forward to address the media-specific risks and RAOs; and

- Step 2: Insure that the process options carried forward are grouped around categories designed to comprehensively address the combined risks and RAOs for the Site and are selected to ensure that a full range of alternatives is developed.

As summarized in Table 4-1, six alternatives were developed for the Site including the No Action alternative, as required under the NCP, and various combinations of process options under the following categories: Containment and Stabilization, Surficial Source Removal, Institutional Controls and Monitoring, Drainage and Erosion Controls and/or Groundwater Treatment. These remedial technology types are listed below:

- Alternative 1: No action

- Alternative 2: No action with Monitoring and Institutional Control
    - Deed Restrictions limiting land use on Facility Area
    - Surface and groundwater monitoring.

- Alternative 3: In-place covering of source materials and affected media on the Facility Area with soil/vegetative cap, removal of affected soils and sediments outside Facility Area, drainage or erosion controls, institutional controls and sediment, surface water and groundwater monitoring.
    - Removal of affected soils outside Facility Area and ephemeral sediments for on-Site consolidation into stockpiled slag to meet affected residential, commercial and vacant yard soils and ephemeral sediments RAOs;
    - Soil and vegetative cap over stockpiled slag and consolidated off-Facility Area soils and ephemeral sediments to meet source materials RAOs;
    - Soil and vegetative cover over re-distributed slag within Facility Area and affected off-Facility Area alleyways where slag was used as structural fill to meet source materials and affected soil RAOs;
    - Use of riprap, check dams and channel liners at drainage channels draining Facility Area to meet surface water RAOs;
    - Monitoring of surface water and groundwater to determine effectiveness of remedy in meeting RAOs; and
    - Institutional controls to control access to engineered components of the remedy, land use restrictions on Facility Area to prohibit future residential land use, restriction of intrusive activities in capped areas, and the prohibition of well installation or use of shallow groundwater within affected plume to meet source materials and affected soils and groundwater RAOs.

- Alternative 4: In-place covering with mixed engineered barriers for capping (i.e. concrete/asphalt and soil/vegetative cap), drainage or erosion controls institutional controls, and surface water and groundwater monitoring.

- Removal of affected residential, commercial and vacant yard soils outside Facility Area and affected ephemeral sediments for placement and consolidation with stockpiled slag to meet affected residential, commercial and vacant yard soils and ephemeral sediments RAOs;
- Soil and vegetative cover over stockpiled slag and soils;
- Refurbishing and maintenance of existing concrete asphalt covers on re-distributed slag or affected soils on Facility Area;
- Soil and vegetative cover over re-distributed slag and affected Facility Area soils outside the areas with concrete/asphalt covers and in affected off-Facility Area alleyways to meet source materials RAOs;
- Use of riprap, check dams and channel liners at drainage channels draining Facility Area to meet surface water RAOs;
- Monitoring of surface water and groundwater to determine effectiveness of remedy in meeting RAOs; and
- Institutional controls to control access to engineered components of the remedy, land use restrictions on Facility Area to prohibit future residential land use, restricting of intrusive activities in capped areas, and prohibition of well installation or use of shallow groundwater within affected plume.

- Alternative 5: Partial Facility Area source excavation of ground slag/affected soils/ephemeral sediments for on-Facility Area consolidation with stockpiled slag, capping with soil and geocomposite cover system, institutional controls, drainage controls on ephemeral channels draining Facility Area, and surface water and groundwater monitoring.
    - Excavation of re-distributed slag and affected soils on the Facility Area and affected alleyways, affected off-Facility Area residential yards, commercial properties and vacant lots, and ephemeral sediments for placement and consolidation with stockpiled slag;
    - Placement of soil and geocomposite cover system over consolidated slag, soils and sediments to meet source materials and affected soils/sediment RAOs;
    - Use of riprap, check dams and channel liners at drainage channels draining Facility Area to meet surface water RAOs;
    - Monitoring of surface water and groundwater to determine effectiveness of remedy in meeting RAOs ; and
    - Institutional controls to control access to engineered components of the remedy, land use restrictions on Facility Area to prohibit future residential land use, restriction of intrusive activities in capped areas, and prohibition of well installation or use of shallow groundwater within affected plume.

- Alternative 6: Excavation and off-Site disposal of all source material and affected soils exceeding applicable cleanup standards, institutional controls, and groundwater treatment.
    - Removal and stabilization, as needed, of all source material, affected soils and ephemeral sediments for off-Site disposal at designated landfill(s)

capable of receiving estimated volume of materials (~550,000 cubic yards);
- Institutional controls prohibiting well installation or use of shallow groundwater;
- Use of riprap, check dams and channel liners at drainage channels draining Facility Area to meet surface water RAOs; and
- Groundwater treatment of shallow groundwater using an in-situ permeable reactive barrier or ex-situ capture and treatment using interceptor trenches, for ex-situ treatment and discharge of treated water to ephemeral channels.

All of these are considered proven and effective presumptive remedial alternatives for metals-in-soil sites and all, except No Action (Alternative 1) and No Action with Monitoring and Institutional Controls (Alternative 2), meet ARARs and the RAOs for source materials and affected media. The non-engineering component of institutional controls to control future land use, access controls to engineered components of the remedy, and/or intrusive activities within the Facility Area and adjacent property owned by XTRA (co-Respondent), and the prohibition of well drilling or the use of shallow groundwater within the affected groundwater plume area have been added to all action alternatives, except Alternative 6, to enhance the ability of the remedy to ensure long-term protection to human health and the environment. Even though all source materials and affected media will be addressed under Alternative 6, institutional controls will be required to prohibit well drilling or the use of shallow groundwater within the affected plume area because of other additional upgradient sources of metals to the shallow groundwater. A summary of the alternatives in meeting media RAOs is provided in Table 4-1.

Based on modeling results, the predicted lateral extent of the plume is within 250 feet of the Facility Area boundary which would limit those off-Facility Area properties requiring groundwater institutional controls. The modeled predictions will be confirmed as part of pre-design activities to verify the modeled extent of the plume and identify any off-Site properties where institutional controls may be required and where permission to place ICs on the property prohibiting well installation or groundwater use will need to be obtained.

4.2 INITIAL SCREENING OF CANDIDATE REMEDIAL ALTERNATIVES

This section describes the initial screening of the candidate remedial alternatives developed in Section 4.1. In accordance with U.S. EPA guidance, each candidate alternative is evaluated with respect to three required criteria including effectiveness, implementability and cost, and a fourth criteria, effectiveness at meeting green technology goals, with more emphasis placed on effectiveness and implementability at this stage of the evaluation process.

The purpose of the initial screening step is to ensure that only the most effective and implementable alternatives are carried forward for detailed analysis in the FS. Elimination of less effective alternatives early on in the evaluation process streamlines

the FS analysis and allows more detailed scrutiny to be focused on the more viable and cost effective alternatives and helps ensure that the selected remedy is appropriate and effective in addressing all identified risks and RAOs.

Consistent with U.S EPA guidance, the three screening-level evaluation criteria use in this initial evaluation of alternatives is defined below:

- Effectiveness: At this level of screening the effectiveness criterion is a qualitative judgment regarding an alternative's ability to protect human health and the environment. This judgment involves the alternative's ability to address all identified human health and ecological risks and all the Site-wide, media-specific RAOs. Both short-term and long-term effectiveness are included in this evaluation. Short-term effectiveness refers to the alternative's anticipated protectiveness during the remedial action period, while the long-term effectiveness refers to the period after completion of remedial actions continuing into the future.

- Implementability: Implementability refers to an alternative's ability to be constructed, operated and maintained under the Site-specific conditions. Factors considered under this criterion include the alternative's technical as well as administrative feasibility. Technical feasibility refers to the ability to construct and operate the hardware and structural elements of the alternative, whereas administrative feasibility refers to the ability to establish the necessary legal, human and regulatory components.

- Cost: Screening level cost evaluations are comparative and qualitative in nature. The cost comparisons among candidate alternatives consist of order-of-magnitude estimates of the direct and indirect capital costs as well as long-term O&M costs. No qualitative costs are assigned. Instead of relative cost, indicators are assigned to each alternative including low, moderate, high or very high cost to provide a means of comparing alternatives which are equally effective and implementable.

- Green technologies: Refers to the identification of those technologies which are less energy-consumptive and more effective in reducing GHG emissions than other options which are equally protective, implementable and meet ARARs.

The resulting screening-level analysis of each alternative is detailed in Table 4-2. Of the alternatives screened, five alternatives are retained for further analysis in the FS. Alternative 2 was eliminated based on the inability to meet ARARs and RAOs. Alternative 1, which also does not meet ARARs, was carried forward in accordance with the requirements of the NCP to provide a baseline for comparison of all other alternatives. Alternative 6 is provided as an upper "bookend" option that includes a complete remediation of the Site to the extent possible given other contributing sources to both the Old Cahokia Watershed and shallow groundwater. Alternative 6 will have more potential adverse impacts during implementation based on the amount of material to be

excavated, managed and disposed of off-Site, with the largest carbon footprint of any of the other alternatives.

SECTION FIVE

Section 5

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5.0 GENERAL SCHEDULE

The following estimated timeframe for implementation of the candidate alternatives proposed for further evaluation as part of the FS is as follows:

Candidate Alternative	**Estimated Timeframe for Implementation (years)**
Alternative 1	No implementation required
Alternative 3	1.5 years to implement; O&M and monitoring to be performed routinely following completion of remedy
Alternative 4	1.5 years to implement; O&M and monitoring to be performed routinely following completion of remedy
Alternative 5	3 years to implement; O&M and monitoring to be performed routinely following completion of remedy
Alternative 6	4 - 5 years to implement; Groundwater monitoring to be performed routinely.

SECTION SIX

Section 6

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6.0 REFERENCE

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U.S. EPA, 2004. Strategy to Ensure Institutional Control Implementation at Superfund Sites. OSWER No. 9355.0-106. September 2004

FIGURES

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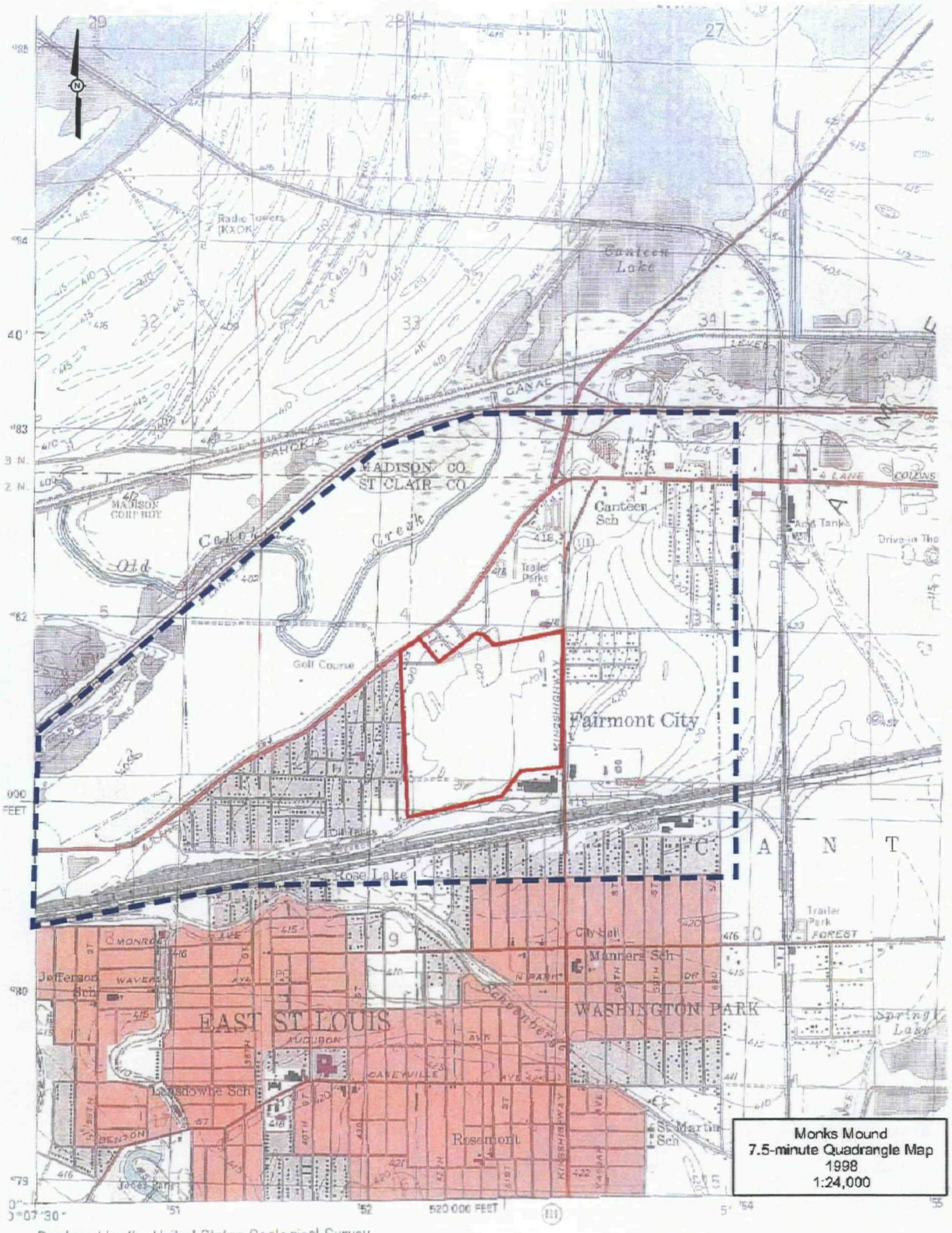
Figures



Monks Mound
7.5-minute Quadrangle Map
1998
1:24,000

Produced by the United States Geological Survey
Topography compiled 1952. Planimetry derived from imagery taken

Facility Area Boundary
Approximate Site Area Boundary

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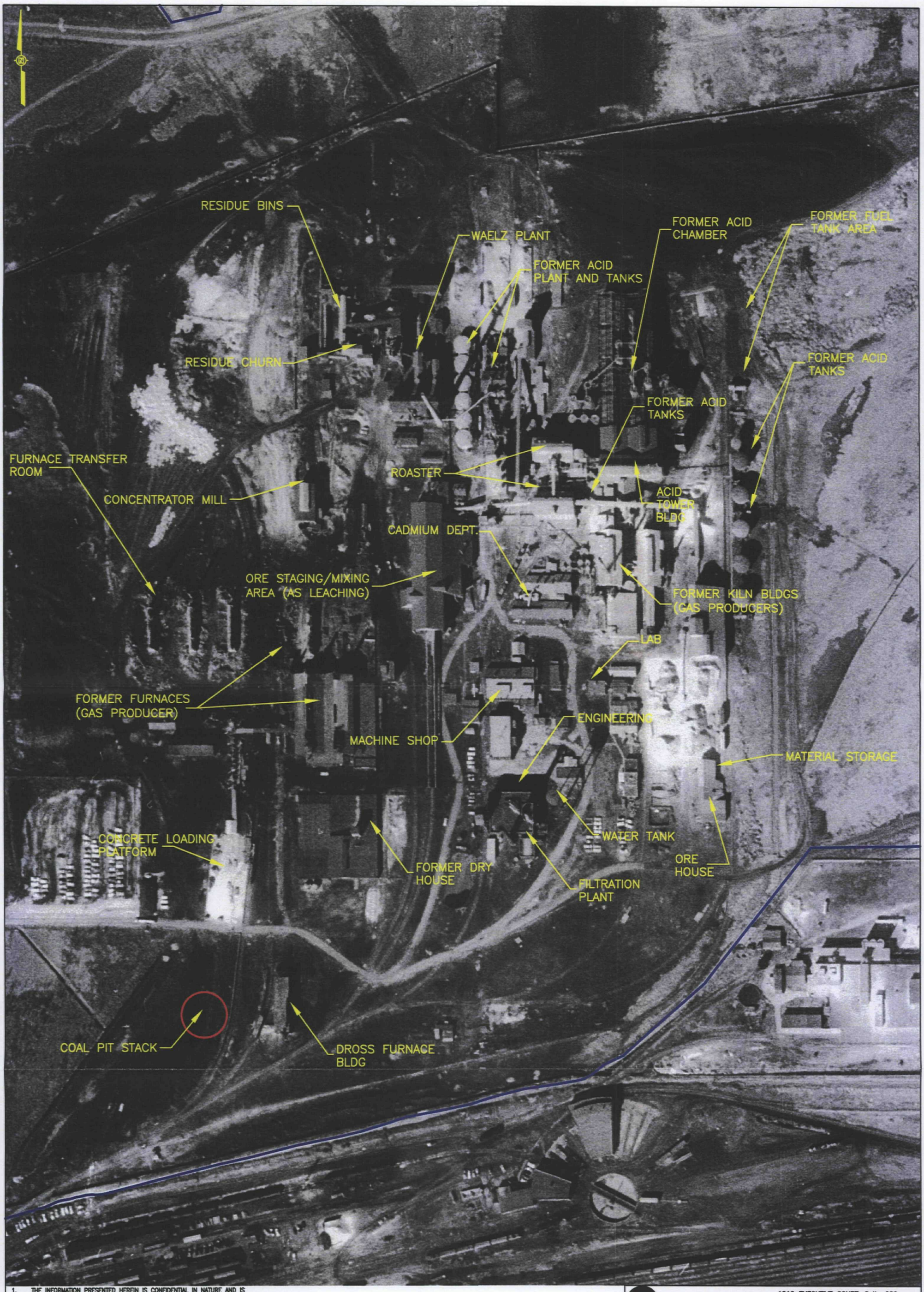
				ENTACT & ASSOCIATES, LLC	ENTACT	AMERICAN ZINC RPS FAIRMONT CITY, ILLINOIS
						FACILITY AREA AND SITE LOCATION MAP
					1"=0.5MI	C-1727	FIGURE 1	—



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SCALE

0' 200' 400'

LEGEND

FACILITY AREA BOUNDARY

REV	DATE	BY	CHK'D	APR'VD	DESCRIPTION
1	12/15/06	MMC	PT	PT	ISSUED FOR FINAL RI REPORT
0	08/07/06	MMC	PT	PT	ISSUED FOR DRAFT RI REPORT

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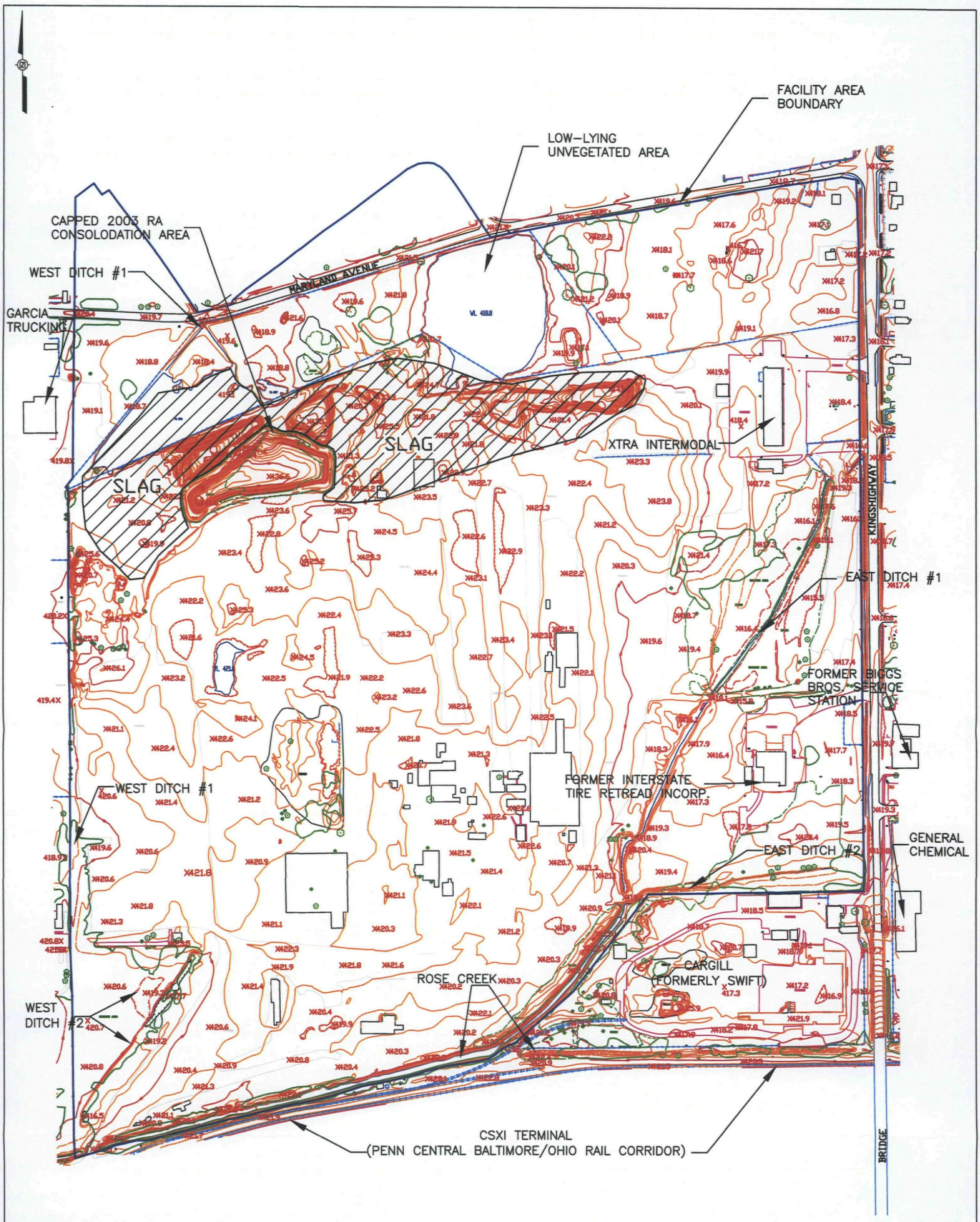
DRAWING NAME
HISTORICAL SMELTER FACILITY BUILDINGS AND OPERATIONS

PROJECT NAME & LOCATION
AMERICAN ZINC RIFS
FAIRMONT CITY, ILLINOIS

DRAWN BY	M. CARLSON	APPROVED BY	P. THOMSON	REVISION	SHEET NO.
DATE	01-16-06	DATE	01-16-06	0	1 OF 1
PROJECT NO.	C1727	FIGURE NO.	2		



LEGEND

- PROPERTY BOUNDARY
- EXISTING GRADE INDEX CONTOUR
- EXISTING GRADE INTERMEDIATE CONTOUR
- EXISTING GRADE DEPRESSION CONTOUR
- ×425.2 SPOT ELEVATION
- WATER WAY
- FOUNDATION
- PAVED ROADS
- TREE LINE
- PAVED PARKING/SIDEWALKS
- EXISTING FENCE

SCALE
0' 300' 600'

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REV	DATE	BY	CHK'D	APR'VD	DESCRIPTION
1	12/15/08	MMC	PT	PT	ISSUED FOR FINAL RI REPORT
0	08/07/08	MMC	PT	PT	ISSUED FOR DRAFT RI REPORT

ENTACT
1010 EXECUTIVE COURT, Suite 280
WESTMONT, ILLINOIS 60559
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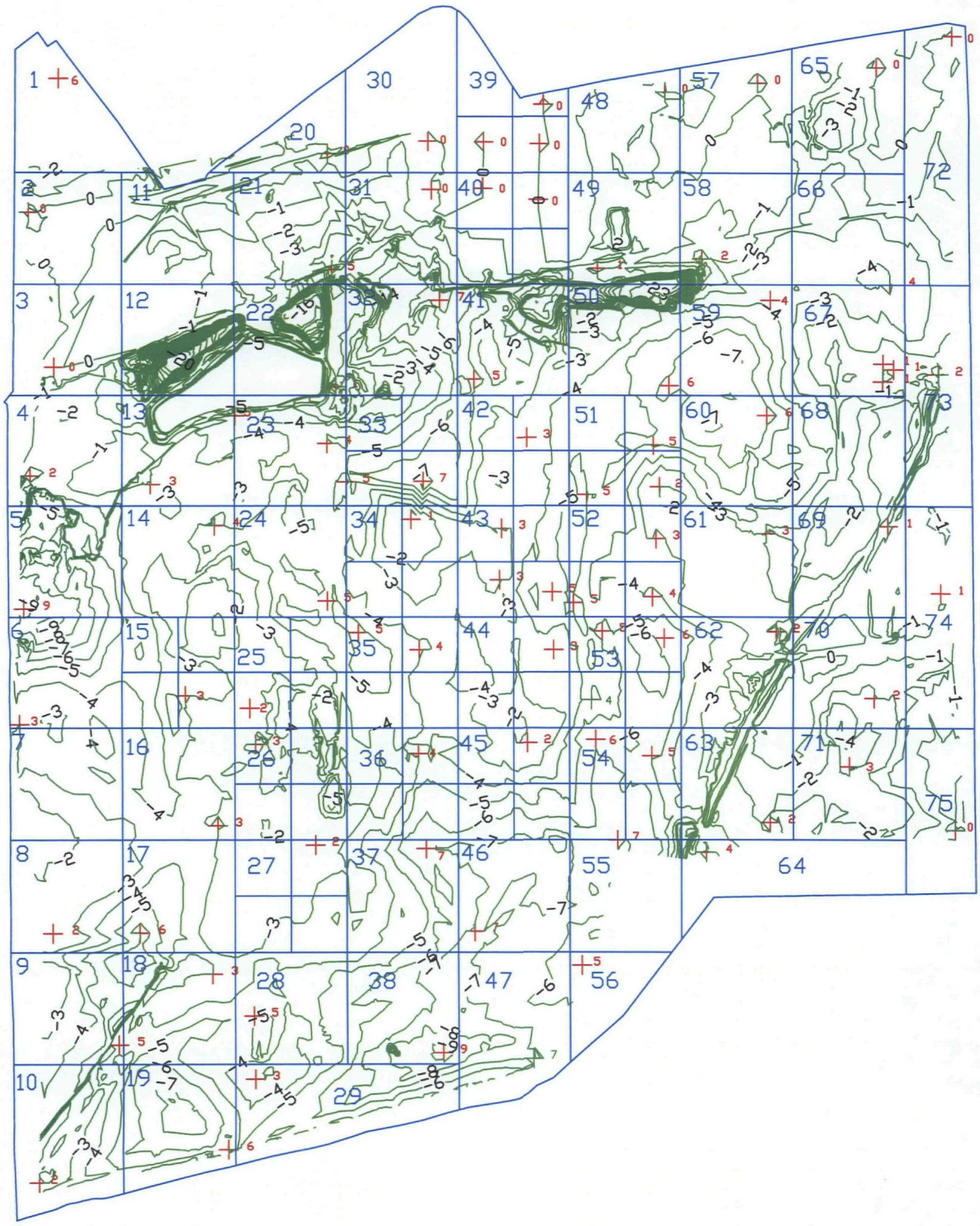
DRAWING NAME: FACILITY AREA FEATURES

PROJECT NAME & LOCATION: AMERICAN ZINC RIFS, FAIRMONT CITY, ILLINOIS

DRAWN BY	M. CARLSON	APPROVED BY	P. THOMSON	REVISION	SHEET NO.
DATE	01-16-06	DATE	01-16-06	0	1 OF 1
PROJECT NO.	C1727	FIGURE NO.	3		



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LEGEND

300' X 300' SAMPLING GRID LAYOUT

SLAG DEPTH CONTOURS (BASED ON BORING LOG 3D INTERPOLATION)

SLAG DEPTH AT BORING (BASED ON BORING LOGS)

SCALE

0' 300' 600'

REV	DATE	BY	CHK'D	APR'VD	DESCRIPTION
1	12/15/06	MMC	PT	PT	ISSUED FOR FINAL RI REPORT
0	08/07/06	MMC	PT	PT	ISSUED FOR DRAFT RI REPORT

ENTACT

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DRAWING NAME
LATERAL AND VERTICAL EXTENT OF GROUND SLAG ACROSS THE FACILITY AREA

PROJECT NAME & LOCATION
AMERICAN ZINC RIFS
FAIRMONT CITY, ILLINOIS

DRAWN BY	M. CARLSON	APPROVED BY	P. THOMSON	REVISION	SHEET NO.
DATE	01-16-06	DATE	01-16-06	1	1 OF 1
PROJECT NO.	C1727	FIGURE NO.	4		

ENTACT

Tables

Tables

Table 2-1
Potential Federal and State Chemical-Specific ARARs and Guidance to be Considered

Standard, Requirement or Limitation	Citation	Description	Potential ARARs	To Be Considered
AIR				
FEDERAL REQUIREMENTS				
Clean Air Act - National Primary and Secondary Ambient Air Quality Standards	42 USC Sections 7401-7671 40 CFR Part 50	The Clean Air Act and implementing regulations define air quality criteria for protecting human health, including standards for particulate matter and lead	X	
STATE REQUIREMENTS				
Illinois Environmental Protection, Title 35, Air Quality Standards	35 IAC Subtitle B, Chapter I, Part 243-245	Set ambient air quality standards for a variety of constituents including particulate matter and lead	X	
SURFACE WATER				
FEDERAL REQUIREMENTS				
Clean Water Act - Water Quality Standards, Chronic Aquatic Life Criteria	CWA Section 303 40 CFR Part 131	The Federal chronic aquatic life criteria (ALC) are not deemed ARARs by precedent for unclassified or ephemeral streams. Therefore the federal ALC are only considered relevant and appropriate for perennial streams within the Site. This would include the open water area and possibly the seasonally inundated wetlands in the Old Cahokia Watershed.	X	
Ambient Water Quality Criteria	CWA Section 304(a)(1) Quality Criteria for Water, EPA, 1986	Establishes non-enforceable guidelines for States to set water quality standards for perennial surface water. Criteria based on protection of aquatic life and human health. Technically not applicable for ephemeral streams or drainageways.	X	
STATE REQUIREMENTS				
Section 13 of the Illinois Environmental Protection Act	Section 27 of the Environmental Protection Act [415 ILCS 5/13 and 27]	Authorizes the Illinois Pollution Control Board to issue regulations to adopt water quality standards, effluent standards, standards for the issuance of permits, and requirements for the inspection of pollution sources and for monitoring the aquatic environment, and which directs the Board to adopt requirements, standards, and procedures which will enable the State to implement and participate in the National Pollutant Discharge Elimination System (NPDES) established by the Clean Water Act (33 USC 1251 et seq.).	X	
Illinois Title 35 Part 303: Water Use Designations and Site-Specific Water Quality Standards	35 IAC Part 303	Part 303 contains water use designations which determine for a given body of water which set of Part 302 water quality standards applies. Part 303 also contains short site specific water quality standards. Part 302 contains water quality standards which are either applicable to more than one area or are lengthy.	X	
General Use Water Quality	35 IAC Part 302: Water Quality Standards Subpart B: General Use Water Quality Standards; 35 IAC 302.208, 210	This criterion which establishes numerical standards for chemical constituents in general use waters of the state, and establishes procedures for deriving criteria for other toxic substances without numerical standards - the IEPA has indicated this is applicable or relevant and appropriate for the ephemeral or unclassified streams of the Site. These regulations are relevant and appropriate for the open water areas and the seasonally inundated wetland areas of the Old Cahokia Watershed.	X	

Table 2-1
Potential Federal and State Chemical-Specific ARARs and Guidance to be Considered

Standard, Requirement or Limitation	Citation	Description	Potential ARARs	To Be Considered
GROUNDWATER				
FEDERAL REQUIREMENTS				
Federal Safe Drinking Water Act - National Primary and Secondary Standards	40 CFR Parts 141 and 143	Establishes maximum contaminant levels (MCLs) and MCL goals that are health-based standards for public drinking water systems, as well as secondary MCLs and MCLGs that are standards for constituents that affect only the aesthetic qualities of the drinking water. According to NCP, MCLs and MCLGs are ARARs for groundwater at Superfund Sites.	X	
STATE REQUIREMENTS				
Illinois Environmental Protection, Title 35 Groundwater Quality	35 IAC, Subtitle F, Chapter I, Part 620	Groundwater quality regulations governing groundwater classification, groundwater quality standards, and groundwater monitoring and analytical procedures	X	
Illinois Environmental Protection, Title 35, Tiered Approach to Corrective Action Objectives	35 IAC, Subtitle G, Chapter I, Subchapter f, Part 742, Appendix B, Table E	Illinois risked-based groundwater corrective action goals for both potable and general resource groundwater based in part on Federal Primary and Secondary MCLs and MCLGs as incorporated by reference.	X	
SOURCE MATERIALS AND SOILS				
FEDERAL REQUIREMENTS				
Draft Soil Screening Guidance	OSWER Directive 9355.4-14FS, December 1994 EPA/540/R - 94/101 and 106	Recommends the development of site-specific soil screening levels. Provides general screening levels below which areas are determined to be adequate and do not need further assessment. Evaluation of risk above the screening levels have been evaluated as part of the RI risk assessments.		X
Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action	OSWER Directive 9355.4-12, July 14, 1994	Recommends a soil screening level of 400 ppm in residential soils. Describes a methodology for developing site-specific preliminary remediation goals and media cleanup standards. Describes a plan for soil lead cleanup at sites with multiple sources of lead. This directive provides guidance for evaluating the extent to which proposed remedial action might enhance protection of human health.		X
STATE REQUIREMENTS				
Illinois Environmental Protection, Title 35, Tiered Approach to Corrective Action Objectives	35 IAC, Parts 742, Appendices A and B	Illinois risk-based cleanup goals for soils and generic state background levels for metals below which soils are determined to be adequate and do not need further assessment.. Allows use of generic state background levels in lieu of risk-based criteria if the state background level exceeds the risk-based value (i.e. arsenic). Evaluation of risk above the screening levels have been evaluated as part of the RI risk assessments.		X

Standard, Requirement or Limitation	Citation	Description	Potential ARARs	To Be Considered (TBC)
FEDERAL ARARs				
National Ambient Air Quality Standards	42 USC Sections 7401 et seq.; 40 CFR Part 250	These regulations establish ambient air quality for emissions of lead and particulate matter. Remedial actions taken under any of the alternatives (except no action) are likely to result in release of airborne lead and dust. These regulations are applicable to "major sources" as defined under the Clean Air Act. Although remedial actions at the Site are not expected to result in major emission sources, these regulations would be relevant and appropriate.	X	
Resource Conservation and Recovery Act (RCRA)	42 USC Sections 6941; 40 CFR Part 257 Criteria for Classification of Solid waste Disposal Facilities and Practices	This section of RCRA regulations requires the closure of existing solid waste facilities, design of new landfills, and disposal of solid waste to be in accordance with numerous standards and criteria. These standards are applicable to solid waste disposal facilities, including smelter facilities. Among other things, these regulations require that facilities be maintained to prevent wash-out of solid wastes and that the public not be allowed uncontrolled access.	X	
RCRA, Subtitle C , Identification and Listing of Hazardous Wastes	RCRA Section 3001(b)(3)(A)(iii) Beville exclusion of mineral extraction and beneficiation of wastes; 40 CFR Part 264.4(b)(7)	Slag from primary zinc processing and residues derived from co-processing mineral processing secondary material are specifically excluded from regulations as hazardous waste under the Beville exemption because they are wastes resulting from mineral extraction and beneficiation. Therefore the RCRA Subtitle C regulations are not ARARs. However these regulation are TBCs because of the guidance they provide regarding smelter waste exclusion.		X
RCRA, Subtitle C, Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities	RCRA Section 3001et seq. 42 USC Section 6921, et seq., 40 CFR Part 264.522 Disposal of Hazardous Wastes in Designated Corrective Action Management Units (CAMUs). 40 CFR Part 264.554(D)(1)(i) and (ii), Staging Piles	This section defines CAMUs to be used in implementing corrective actions at Superfund Sites. A CAMU is defined as a disposal site used for consolidation or placement of remediation wastes within the contaminated areas of the Site. Under these regulations, placement of remediation wastes in a CAMU does not constitute creation of a unit subject to RCRA land disposal regulations and minimum technology requirements (40 CFR Part 268). This section of RCRA is not an ARAR because of the Beville exclusion, but is a TBC because certain substantive requirements related to design, operation and closure of disposal sites should be considered. Part 264(D)(1)(i) and (ii) describes standards and design criteria for establishing staging piles within a CAMU. The design criteria to be developed for each staging pile facilitate a reliable, effective and protective remedy and be designed so as to prevent or minimize releases of hazardous wastes and hazardous constituents to the environment, and minimize or adequately control cross-media transfer, as necessary to protect human health and the environment (i.e. use of liners, covers, run-c		X
Toxic Substances Control Act - Strategies for Reducing Lead Exposures	EPA, February 21, 1991	This document presents strategies for reducing lead exposures and blood lead levels in children by reducing the amount of lead in the environment.		X
Department of Transportation (DOT) Hazardous Materials Transportation Regulations	49 CFR Parts 107, 171-177	This section regulates transportation of hazardous materials and would not be relevant and appropriate for the transport of excavated source materials from the Site that are Bevill exempt but may be considered a TBC if an off-Site disposal remedial option is selected.		X
Federal Clean Water Act - National Pollutant Discharge Elimination System (NPDES)	40 CFR Part 122.26(b)(14)(x).	This section requires a Construction General Permit and Notice of Intent (NOI) associated with managing stormwater discharges from large construction activities (more than 5 acres of land disturbance) construction activities where more than one acre of land transportation of hazardous materials and would be relevant and appropriate for remedial actions involving excavation, management and/or consolidating source or soils materials.	X	
Land Use in CERCLA Remedy Selection Process	OSWER Directive No. 9355.7-04	This guidance presents information for considering land use in making remedy selection decisions		X
Role of BHHRA in Superfund Remedy Selection Process	OSWER Directive No. 9355.0-30	This guidance clarifies role of BHHRA in developing Superfund remedial alternatives and supporting risk management decisions		X
Occupational Safety and Health Act (OSHA)	40 CFR Part 122.26(b)(15)(11).	Specifies minimum requirements to maintain worker health and safety for hazardous waste sites. Includes specific training, monitoring, respiratory protection and personal protective equipment (PPE) requirements based on site-specific conditions.	X	

Table 2-2
Potential Federal and State Action-Specific ARARs and Guidance to be Considered

Standard, Requirement or Limitation	Citation	Description	Potential ARARs	To Be Considered (TBC)
STATE REQUIREMENTS				
Illinois Clean Fill Regulations	Illinois Administrative Code 1100 Public Act 094-0725	Regulations governing clean fill or demolition debris fill operations	X	
Illinois Environmental Protection Agency, Division of Water Pollution Control	Guidance of NPDES permits for construction site stormwater discharges in the state of Illinois	Enforces the Federal CWA General Construction Permit program in Illinois and establishes specific requirements for Illinois sites		X
Illinois Environmental Protection Title 35, Part 620, Groundwater Quality	35 IAC 620.260	Allows for reclassifying groundwater based on multiple factors including but not limited to: existing and anticipated uses of groundwater, existing and anticipated quality of groundwater, technical feasibility or reasonableness of eliminating or reducing contamination of the specific groundwater, existing and anticipated impact on any potable supply due to contamination and availability and cost of alternate water sources of treatment for those users potentially affected.	X	
Illinois Environmental Protection Title 35 Hazardous Waste Management System: General	35 IAC Part 720 et seq.; 35 IAC Section 721.104(b)(7)	The Illinois hazardous waste management regulations incorporate much of the federal RCRA regulations, as incorporated by reference. As with the federal regulations, the Illinois regulations are not applicable relevant or appropriate to zinc processing wastes per 35 IAC 721.104(b)(7) which states that wastes specific to ore beneficiation and processing operations including roasting, drying, calcining, and slag from zinc smelting processes are not considered hazardous wastes but solid wastes. While not ARARs, some sections are expected to be TBCs. If other non-Beville exempt source materials are present among the localized buried debris that are deemed to be characteristically hazardous, this will be considered an ARAR for those materials.		X
Illinois Environmental Protection Title 35, Solid Waste and Special Waste Handling	35 IAC Part 800 et seq. (Parts 807 through 832)	The Illinois solid waste management regulations apply to the design, permitting, operations, and closure of solid waste disposal facilities used for nonhazardous wastes. These regulations are potential ARARs including those regulations governing special waste classification and waste hauling and manifesting.	X	
"Groundwater in Monitoring Network for Non-Hazardous Disposal Facilities" Guidance Document	Guidance document associated with 35 IAC 812 through 814	Guidance document for design of groundwater systems at non-hazardous landfills		X
Illinois Environmental Protection Title 35, Standards for New Solid Waste Landfills	35 IAC Part 811 et seq.:	Standards for new solid waste landfills may be potentially considered relevant and appropriate as related to the design, construction, monitoring, and O&M of an on-Facility Area capping system. Outlines requirements for disposal of inert wastes (Subpart B), putrescible and chemical wastes (Subpart C), and special wastes (Subpart D).	X	
Illinois Environmental Protection Title 35 Emission Standards and Limitations for Stationary Sources	35 IAC Sections 212.301, 212.315, 212.316©	Emission standards for visible emissions, vehicle covers, and roadway emissions.	X	
Illinois Environmental Protection Title 35 Permits	35 IAC Sections 703.121 and 703.207	RCRA permit program and waste stream authorization. Slag is Beville-excluded from hazardous waste regulations and though not an ARAR will be considered.		X
Illinois Superfund Program	35 IAC Part 750	Establishes procedures for assessing and remediating Illinois State Superfund sites. While this is a CERCLA Superfund Site, these state Superfund regulations may be considered.		X
Illinois Environmental Protection Title 35 Solid Waste and Special Waste Handling	35 IAC Subtitle G, Chapter I, Subchapter i	Regulates classification, transport, and disposal of solid and special waste.	X	
Illinois Environmental Protection Title 35 Noise	35 IAC Subtitle H	Sound emission standards and limitations that will be applicable or relevant and appropriate during implementation of the remedy	X	
Standards for Owners and Operators of Hazardous Waste Treatment, Storage or Disposal (TSD) Facilities, Leachate Collection	35 IAC Section 724.401(c)(2)	Liner requirements and collection and removal standards are related to hazardous materials TSD facilities and therefore not ARARs for Bevill-exempt primary source materials but are considered TBCs that will be considered for some remedial options.		X

Potential Federal and State Action-Specific ARARs and Guidance to be Considered

Standard, Requirement or Limitation	Citation	Description	Potential ARARs	To Be Considered (TBC)
Standards for Owners and Operators of Hazardous Waste TSD Facilities Run-on and Run-off Management and Collection Systems	35 IAC Section 724.401(g), (h), and (i)	These standards establish requirements for run-on prevention, run-off design storm, and holding facilities are related to hazardous materials TSD facilities and therefore are not ARARs for Bevill-exempt primary source materials but are considered TBCs that will be considered for some remedial options.		X
Illinois Environmental Protection, Title 35, Groundwater Quality	35 IAC, Subtitle F, Chapter I, Part 620	Groundwater quality regulations governing groundwater monitoring and analytical procedures	X	
Illinois Environmental Protection Title 35 Standards for Owners and Operators of Hazardous Waste TSD Facilities, Construction Quality Assurance Plan	35 IAC Section 724.119	CQA written plan components and contents of program, inspection, and sampling requirements are related to hazardous materials TSD facilities and therefore are not ARARs for Bevill-exempt primary source materials but are considered TBCs that will be considered during implementation of remedial action.		X

Table 2-3
Potential Location-Specific ARARs and Guidance to be Considered

Standard, Requirement or Limitation	Citation	Description	Potential ARARs	To Be Considered
FEDERAL REQUIREMENTS				
Fish and Wildlife Coordination Act	16 USC Sections 661-666 40 CFR Part 6.302(g)	Requires federal agency or permitted entity to consult with the U.S. Fish and Wildlife Service and appropriate state agency prior to modification of any stream or other water body. The intent of this requirement is to conserve, improve, or prevent the loss of wildlife habitat and resources. Not expected to be an ARAR based on ecological risk evaluation but will be considered, if necessary, for addressing impacted sediment in ephemeral Rose Creek or East Ditch #1.		X
Fish and Wildlife Conservation Act	16 USC Sections 2901 - 2912	Requires federal agencies to utilize their statutory and administrative authority to conserve and promote conservation of non-game fish and wildlife species. Not expected to be an ARAR based on ecological risk evaluations but will be considered, if necessary, for addressing impacted sediment in ephemeral Rose Creek .		X
Executive Order on Floodplain Management	Executive Order No. 11988 40 CFR Part 6.302(b) and Appendix A	Requires Federal agencies to evaluate the potential effects of actions they may take in a floodplain to avoid, to the maximum extent possible, the adverse impacts associated with direct and indirect development of a floodplain.		X
Executive Order on Protection of Wetlands	Executive Order No. 11990 40 CFR Part 6.302(a) and Appendix A	Requires Federal agencies to avoid, to the maximum extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid new construction in wetlands, if a practical alternative exists.		X
Locations Standards for Waste Disposal Facilities	42 USC Section 6901, 40 CFR Part 257 Solid Waste Landfill Standards, 35 IAC 811	Requires that solid or hazardous waste facilities be located outside hazardous zones, such as floodplains or seismically active zones. Also requires disposal facilities to be designed, constructed, operated, and maintained to avoid wash-out and control stormwater run-on and run-off. The RCRA solid waste regulations may be ARARs but the hazardous waste regulations are only TBCs.	X	X
National Historic Preservation Act	16 USC Section 470	The National Historic Preservation Act requires that historically significant properties be protected. The National Register of Historic Places is a list of sites, buildings or other resources identified as significant to United States history. An eligibility determination provides a site the same level of protection as a site listed on the National Register of Historic Places. The requirements of this federal law are potentially applicable based on a determination of whether such properties occur on the Site.	X	
Migratory Bird Treaty Act of 1972	16 USC Sections 703-712	Establishes federal responsibility for the protection of the international migratory bird resource and requires continued consultation with the U.S. FWS during remedial design and remedial construction to ensure that the cleanup of the Site does not unnecessarily impact migratory birds.	X	
Clean Water Act Section 404	40 CFR Part 230 and 33 CFR Parts 320-330	These sections of the Clean Water Act and associated regulations prohibit discharge of dredge or fill material to United States' waters, including wetlands as defined by the U.S. Army Corps of Engineers.	X	

Table 3-1: Results of Initial Screening of Source Materials and Affected Soils/Sediments Technologies

Boxes outlined in red indicate an identified 'Presumptive Remedial Technology' per U.S. EPA "Remedy for Metals-in-Soils Sites"
Grey shaded cells indicate process option is eliminated from further consideration

General Response Action	Remedial Technology Type	Process Option	Screening Comments	Retained for further analysis
No Action	None	No further action	Consideration required by NCP	Yes
Institutional Controls	Deed Restrictions	Land use restrictions prohibiting residential use and intrusive activities where barriers are in place	Effective in prohibiting residential use where source material remains in place and in protecting any engineered components of the remedy.	Yes
	Site access controls	Perimeter fencing, locked entry gates	Perimeter fencing around Facility Area with locked gates already present. Not effective at meeting RAOs as a sole option but may be effective in protecting engineered components of a selected remedy.	Yes
Containment and Stabilization	Capping	Surface armoring	Armoring may be effective along ditches and stockpiles in controlling sediment transport of COCs from source materials but is not effective as a sole option to meet RAOs. Could be effective as a component of other remedial technologies that are aimed at reducing direct contact exposure to source materials.	Yes
		Vegetated Soil/Clay cover systems	Soil cover used extensively to immobilize contaminants in various forms. Highly applicable for smelter sites where metals in slag are primary COCs.	Yes
		Synthetic membrane or geotextile covers	Potentially applicable for capping individual smelter residue piles or as part of an engineered cover system for a waste repository	Yes
		Asphalt/concrete covers	Not applicable for the wide-spread source materials on Facility Area based on excessive costs to install and maintain. Other capping process options are equally protective and more applicable for Site conditions. May be incorporated as part of mixed capping options in localized areas	Yes
		Soil geocomposite cover systems	Potentially applicable for capping widely distributed smelter residues as part of an engineered cover system	Yes
		RCRA-compliant cover systems	Not applicable for capping stockpiled or widely distributed slag as these are exempt under the Beville exclusion and are not required to meet RCRA regulations pertaining to hazardous waste disposal on Site. There are other less costly cover systems that will still attain RAOs	No
	Physical Reconfiguration	Slope stabilization	Though effective in preventing erosional transport of source materials, not effective as a sole option in meeting RAOs. However, may be applicable and effective in enhancing other process options that are aimed at preventing exposure risks such as capping and on-Facility Area consolidation.	Yes
		Grading and slope reduction	Effective in preventing erosional transport of source materials but do not meet RAOs as sole option. Could be used in enhancing the effectiveness of other remedial technologies such as capping and on-Facility Area consolidation	Yes
		Deep tilling	Not applicable for Site based on depth of wide-spread ground slag source materials	No
	In-place stabilization or fixation	In-situ stabilization w/ phosphate or hydroxide apatite	Has little applicability for addressing widely distributed smelter residues that reach depths up to 9 feet or stockpiled slag piles but may be used, as needed, for an off-Site disposal option.	Yes
		Fly ash/pozzolonic stabilization	Has been effectively used in solidifying many different types of waste materials including metal wastes. Potentially applicable for the Site .	Yes
		Pozzolanic stabilization	Has been demonstrated to be effective at large-scale mine sites. May have some applicability for addressing ground slag.	Yes
		In-situ Vitrification	Has little applicability for addressing large volumes of stockpiled slag or redistributed slag that reach depths of up to 9 feet	No
		Grout Injection	Not applicable for addressing slag source materials at the Site	
		Pyro-Kiln Thermal Encapsulation	May be effective in stabilizing small batches of waste but has little applicability for addressing large waste piles or large volume of source materials and affected underlying soils	No

Table 3-1 continued: Results of Initial Screening of Source Materials and Affected Soils/Sediments Technologies

Boxes outlined in red indicate an identified 'Presumptive Remedial Technology' per U.S. EPA "Remedy for Metals-in-Soils Sites"

Grey shaded cells indicate process option is eliminated from further consideration

General Response Action	Remedial Technology Type	Process Option	Screening Comments	Retained for further analysis
Surficial Source Removal	Excavation and Disposal	Excavation and on-Site Consolidation	Applicable and potentially effective for the RAOs for the Site when used in combination with other remedial technologies such as capping	Yes
		Excavation w/Off-Site Disposal	Potentially applicable though disposal of large-volume of source and affected media material would be costly	Yes
Treatment	On-Site/Off-Site Reprocessing/ Recycling/Reuse	Direct Reuse as Construction Fill	Slag is associated with elevated COCs and is not acceptable for use as fill in Illinois	No
		Direct Recycling	Not applicable - no viable market for recycling slag source materials	No
		Hydrometallurgical Reprocessing	Not effective in reducing metal concentrations to acceptable levels. Slag is final end product of smelting process and no significant additional metal removal is likely	No
		Pyrometallurgical Reprocessing	Technically infeasible without first concentrating the metals by by hydrometallurgical processes	No
	Physical/Chemical Treatment	In-situ leaching	Technically infeasible to perform leaching due to wide-spread nature of slag materials. Unlikely to reduce metal concentrations to acceptable levels	No
		Soil Washing	Has little applicability for Site given Site conditions, and lateral and vertical extent of slag	No
		Chemical extraction	Not proven effective for removing metals in slag source materials	No
		Batch leaching	Not proven effective for removing metals in slag source materials	
		Size grading or screening for TMV reduction	Technology can be effective in reducing toxicity by concentrating metals in smaller particle fractions. However slag has already been ground and redistributed across Facility Area	No
		Electro-kinetic remediation	Technical feasibility of this technology is uncertain and not generally applicable for large-scale metal sites.	No
		In-situ or ex-situ metal reduction	Technical feasibility of this technology is uncertain and not generally applicable for large-scale metal sites.	No
		In-situ chemical precipitation	Technical feasibility of this technology is uncertain and not generally applicable for large-scale metal sites.	No
	Biological Treatment	Phytoremediation or phyto-extraction	Currently unproven experimental technology for addressing large-scale land areas.	No
		Organic Matter or Biosolids Addition	Adding biosolids or organic matter may enhance the effectiveness of other process options (vegetative caps) but use of this option as the sole means of reducing bioavailability of metals has not been conclusively proven	Yes
		In-situ Biological remediation	Potentially effective. Has been used successfully at large mine sites	Yes

Table 3-2: Results of Initial Screening of Surface Water Technologies

Grey shaded cells indicate process option is eliminated from further consideration

General Response Action	Remedial Technology Type	Process Option	Screening Comments	Retained for further analysis
No Action	None	No further action	Consideration required by NCP	Yes
Monitoring	Environmental Monitoring	Surface water monitoring	Used as a tool for assessing environmental conditions. Not effective in meeting surface water RAOs as a sole option but could be effective as component of other remedial options to evaluate the effectiveness of any selected remedy.	Yes
Containment and Stabilization	Refer to Table 3-1 for the initial screening of Containment and Stabilization technologies and process options			
Surficial Source Removal	Refer to Table 3-1 for the initial screening of Surficial Source Removal technologies and process options			
Drainage and Erosion Controls	Embankment and Channel Stabilization	Berms, check dams, revetments, riprap	Effective in preventing or reducing metals loading to surface water from source material deposits that are located along drainage ditches and portions of Rose Creek	Yes
		Channel liners or Channelization	Effective in preventing or reducing metals loading to surface water from contact with source material deposits that are located along drainage ditches and portions of Rose Creek	Yes
		Detection and sedimentation basins	Effective as a best management practice for improving runoff water quality by controlling bulk transport of source materials during storm events	Yes
		Grade control structures	Though potentially effective in preventing head cutting or gully erosion in active stream channels, this process option is not needed for the relatively flat, ephemeral manmade and natural channels connecting the Facility Area to the Old Cahokia Watershed that are typically dry with little to no flowing water except during storm events.	No
	Diversion and Collection Actions	Open Channel Stream Diversions or Ditches	Potentially effective in preventing erosion of source materials, diverting clean storm water away from source materials.	Yes
		Seep collection impoundments	Not applicable for the ephemeral ditches and Rose Creek which are not fed by base flow and are typically dry for most of the year except during storm events.	No
		Runoff impoundments or Retention Basins	May be potentially effective in diverting or storing storm water that has come into contact with source material.	Yes
		Closed Channel Storm Drains	Effective in preventing metals loading to surface water by diverting storm water from source materials.	Yes

Table 3-3: Results of Initial Screening of Groundwater Technologies

Grey shaded cells indicate process option is eliminated from further consideration

General Response Action	Remedial Technology Type	Process Option	Screening Comments	Retained for further analysis
No Action	None	No further action	Consideration required by NCP	Yes
Monitoring	Environmental Monitoring	Groundwater Monitoring	Provides a tool for assessing environmental conditions and hypothetical future potential risks. Required for future review of any selected remedy where contamination is left in place above use levels.	Yes
Institutional Controls	Deed Restrictions	Groundwater use restrictions prohibiting well installation and use of shallow groundwater for potable purposes.	Effective in prohibiting future residential land use where source material remains in place and in protecting any engineered components of a remedy.	Yes
Containment and Stabilization	Refer to Table 3-1 for the initial screening of Surficial Source Removal technologies and process options			
Surficial Source Removal	Refer to Table 3-1 for the initial screening of Surficial Source Removal technologies and process options			
Alternative Water Supplies	Public water Supply System	Provide bottled water to *hypothetical future* resident	Potentially effective but unnecessary as there is a readily available public water supply in the event of any hypothetical future residential development on or downgradient of Facility Area	No
		Connect to existing system	Technically feasible for any hypothetical future resident on or downgradient of the Facility Area	Yes
		Organize and Construct new domestic water supply	Not applicable - a public water supply drawing from the Mississippi River is already available and in service for the entire Village.	No
Extraction/ Removal/ Collection/ Discharge	Extraction	Extraction wells	Per EPA literature, ground water pumping is not applicable for contaminants with high residual saturation or high sorption capabilities or for saturated horizons with hydraulic conductivities less than 10-5 cm/sec. Primary metal COCs (i.e. cadmium, lead and zinc) have high sorption capabilities in clay-rich alkaline soils as found at the Site. Measured hydraulic conductivity of saturated horizons at most well locations ranging between 10-5 and 10-6 cm/sec, at or below the limitation range for this technology to be effective. High energy consumption and excessive waste in removing, managing and treating the large volumes of water to address the range of metal concentrations found during the RI.	No
		Dual Phase Extraction	A high vacuum system is applied to simultaneously remove various combinations of contaminated groundwater, separate phase petroleum product or hydrocarbon vapor from the subsurface. Not applicable for conditions at Site	No
	Subsurface Drains	Trench/Gallery Drains	Trenches lined with perforated pipes and backfilled with porous media to collect contaminated groundwater is an option generally limited to less than 30 feet below ground surface. Affected shallow groundwater horizons encountered in horizons below 30 feet may impact feasibility of this option.	Yes
		Interceptor Trenches	Open trench/gallery tunneled into subsurface with contaminated groundwater infiltrating into the tunnel collected at a suitable point generally limited to 30 feet below ground surface. Affected shallow groundwater horizons encountered in horizons below 30 feet which may impact feasibility of this option.	Yes
	Injection	Reinjection wells	Extracted or captured groundwater reinjected to wells after treatment - would require installation of injection wells.	Yes
		Infiltration Gallery	Extracted water discharged to infiltration gallery after treatment would be hindered by low permeability of the upper unconsolidated deposits consisting of alternating layers of clays, silts and silty sands.	No
	Discharge	POTW	Potentially effective if agreeable to local authorities since the extracted groundwater would be discharged to local POTW for treatment.	Yes
		Surface Water Discharge	If used with treatment technologies may be potentially feasible but not suitable as a sole option in meeting GRAs	Yes

Table 3-3 continued: Results of Initial Screening of Groundwater Technologies

Grey shaded cells indicate process option is eliminated from further consideration

General Response Action	Remedial Technology Type	Process Option	Screening Comments	Retained for further analysis
Groundwater Treatment	In-situ GW Treatment	In-situ chemical oxidation	Potentially technically feasible based on reagent and mixing apparatus but level of effectiveness highly dependent upon contaminant and its application and design. Technology has tested applications found effective for arsenic and chromium, but has not been proven effective in addressing cadmium, the primary COC in groundwater at the Site.	Yes
		Permeable Reactive Barriers (PRB)	May be potentially effective and considered an innovative technology. Has been used in some pilot and full-scale sites in addressing metals including Site COCs. Maximum installation depth for this process option is typically < 30 feet based on reach of construction equipment. Affected shallow groundwater horizons encountered in horizons below 30 feet which may impact feasibility of this option.	Yes
	Ex-situ GW Treatment	Groundwater Pump and Treat	Refer to comments under Extraction. EPA technology matrix (www.clu-in.org) indicates this option has a limited effectiveness for inorganics as demonstrated at pilot or full-scale sites. Low permeability of unconsolidated deposits and upgradient off-Site metal loading likely to affect removal rates and ability to meet RAOs over the long-term.	No No
		Ion Exchange	Demonstrated effectiveness in addressing arsenic with remediation goals greater than 0.01 mg/L but not effective in consistently achieving levels less than 0.01 mg/L which is above cadmium's PRG. Not proven effective for primary COCs (cadmium or lead)	No
		Precipitation/Coagulation/ Flocculation	May be potentially effective in treating captured groundwater through conversion of soluble metals salts to insoluble salts that will precipitate. While effectiveness as a sole process option is proven in treating wastewaters with higher treatment goals, the applicability of this process option in treatment of groundwater to Illinois Class I GROs is unproven and may be effective only as a pretreatment for other treatment technologies.	Yes
	Point-of-Use Treatment	Water Softeners with NaCl or KCl	Technically feasible and proven effective in removing metals from drinking water but likely not required as there is a readily available public water supply.	Yes
		Reverse Osmosis Systems	Technically feasible and proven effective in removing metals from drinking water but likely not required as there is a readily available public water supply.	Yes

Table 3-4: Results of Final Screening of Source Materials and Affected Soils/Sediments Technologies

Boxes outlined in red indicate an identified 'Presumptive Remedial Technology' per U.S. EPA "Remedy for Metals-in-Soils Sites"

Grey shaded cells indicate process option is eliminated from further consideration

General Response Action	Remedial Technology Type	Process Option	Effectiveness	Implementability	Cost	Retained for further analysis
No Action	None	No further action	Required for evaluation process though not effective for addressing risks through direct contact with source or affected soils	Readily implementable	None	Yes
Institutional Controls	Deed Restrictions	Land use restrictions prohibiting residential use and intrusive activities where barriers are in place.	Ensures future land use remains nonresidential after completion of remedy to prevent future risks to levels of residual metals below industrial PRGs.	Readily implementable	Low capitol Low O&M	Yes
	Site access controls	Fencing around engineered components of remedy	May be effective in visually marking or protecting capped consolidation areas if part of final remedy.	Readily implementable	Low capitol Low O&M	Yes
Containment and Stabilization	Capping	Surface armoring	Potentially effective in localized areas such as drainage ditch spoil banks or stockpiled slag.	Implementable on a small scale in localized areas	Moderate capitol Low O&M	Yes
		Soil/Clay cover systems	Effective for reducing infiltration, surface erosion and run-off from source materials	Readily implementable	Moderate capitol Low O&M	Yes
		Synthetic membrane or geotextile covers	Not a permanent remedy as a stand-alone option and is considered under the composite cover system process option below	Readily implementable	High capitol High O&M	No
		Composite cover systems	Effectively eliminates COC transport through leaching or surface water run-off	Readily implementable	High capitol Moderate O&M	Yes
	Physical Reconfiguration	Slope stabilization	Not considered a permanent remedy as the only option but could be an effective component of other remedial options to reduce bulk transport of stockpiled source materials	Readily implementable by a variety of means	Moderate capitol Moderate O&M	Yes
		Grading and slope reduction	Effective for reducing surface erosion and bulk transport of stockpiled source materials when used to enhance effectiveness of other remedial options	Readily implementable by a variety of means	Moderate capitol Moderate O&M	Yes
	In-place stabilization or fixation	In-situ stabilization w/ phosphate or hydroxide apatite	Effective for reducing leachability at smaller-volume sites but not generally applicable for large smelter sites with wide-spread slag reaching depths of over 9 feet. Long-term reliability is uncertain with possible need to repeat treatment. May be applicable for source materials or soils that are being transported off-Site for disposal at a landfill.	Implementable for source soils that are transported off-Site disposal at a landfill	Very high capitol Low O&M	Yes
		Fly ash/pozzolonic stabilization	Effective in stabilizing wastes but may actually increase transport of some COCs by altering pH - long-term reliability uncertain	Implementable	Moderate capitol Moderate O&M	No
		Pozzolanic stabilization	Effective in stabilizing wastes but may actually increase transport of some COCs by altering pH - long-term reliability uncertain	Implementable	High capitol Moderate O&M	No
Surficial Source Removal	Excavation and Disposal	Excavation and On-Facility Area Consolidation	May be effective and permanent when combined with capping process options for addressing source material and affected media RAOs and all identified risks.	Readily implementable	High capitol Moderate O&M	Yes
		Excavation with Off-Facility Area Disposal	Effective and permanent for addressing source and affected media RAOs and all identified risks	Implementable	Very high capitol Low O&M	Yes
Treatment	Biological Treatment	Organic Matter or Biosolids Addition	May be effective for immobilizing metals in source materials and soils in localized areas (i.e. low-lying area) if used as a component of another remedial option.	Implementable	Moderate capitol Low O&M	Yes
		In-situ Biological remediation	Effective for immobilizing metals in source but is likely not permanent due to natural weathering	Implementable on a small scale but would be difficult to achieve over large area	High capitol High O&M	No

Table 3-5: Results of Final Screening of Surface Water Technologies

Grey shaded cells indicate process option is eliminated from further consideration

General Response Action	Remedial Technology Type	Process Option	Effectiveness	Implementability	Cost	Retained for further analysis
No Action	None	No further action	May be as effective as other options when used with institutional controls to maintain current conditions of no downgradient receptors of shallow groundwater.	Readily implementable	None	Yes
Monitoring	Environmental Monitoring	Surface water monitoring	Effective for continued evaluation of site conditions and risk	Readily implementable	Low capitol Low O&M	Yes
Containment and Stabilization	Refer to Table 3-4 for the final screening of Containment and Stabilization technologies and process options					
Surficial Source Removal	Refer to Table 3-4 for the final screening of Surficial Source Removal technologies and process options					
Drainage and Erosion Controls	Embankment and Channel Stabilization	Berms, check dams, revetments, riprap	Effective in reducing metals loading of COPECs to surface water from surficial source material deposits not addressed as part of meeting source and affected soil RAOs.	Readily implementable	Low capitol Low O&M	Yes
		Channel liners or Channelization	Effective in reducing metals loading of COPECs to surface water from surficial source material deposits not addressed as part of meeting source and affected soil RAOs.	Readily implementable	Moderate capitol Moderate O&M	Yes
		Detention and sedimentation basins	Effective for improving storm water run-off quality by removing suspended sediments that potentially contain COPECs prior to discharge to surface water	Readily implementable but would require routine sediment removal	Moderate capitol High O&M	Yes
	Diversion and Collection Actions	Open Channel Stream Diversions or Ditches	Potentially effective for diverting streams away from source materials and thereby reducing metals loading.	Implementable for Facility Area ditches and segments of creek that run through source materials	Moderate capitol Moderate O&M	Yes
		Runoff impoundments or Retention Basins	Potentially effective in retaining small flows to reduce metals loadings. Would require frequent maintenance.	Implementable for small run-off areas but probably not implementable for streams	High capitol High O&M	No
		Closed Channel Storm Drains	Effective for reducing metals loading of COPECs from source material deposits	Readily implementable	Moderate capitol Moderate O&M	Yes

Table 3-6: Results of Final Screening of Groundwater Technologies

Grey shaded cells indicate process option is eliminated from further consideration

General Response Action	Remedial Technology Type	Process Option	Effectiveness	Implementability	Cost	Retained for further analysis
No Action	None	No further action	May be as effective as other options when used with institutional controls to maintain current conditions of no downgradient receptors of shallow groundwater.	Readily implementable	None	Yes
Monitoring	Environmental Monitoring	Groundwater monitoring	Groundwater monitoring will provide a means of determining the effectiveness of the overall Site remedy in limiting migration of COC from source materials	Readily implementable	Low capitol Low O&M	Yes
Institutional Controls	Deed Restrictions	Groundwater use restrictions prohibiting well installation and use of shallow groundwater for potable purposes.	Effective in preventing exposure to COCs in groundwater through ingestion.	Readily Implementable	Low capitol Low O&M	Yes
Containment & Stablization of Source	Refer to Table 3-4 for the final screening of Surficial Source Removal technologies and process options					
Source removal	Refer to Table 3-4 for the final screening of Surficial Source Removal technologies and process options					
Alternative Water Supplies	Public water Supply System	Connect to existing system	Effective in preventing exposure to affected shallow groundwater if there would be a future residential development on or downgradient of Facility Area	Implementable as there is an existing piped system in close proximity to the off-Facility Area affected groundwater modeled plume.	Low capitol Low O&M	Yes
Extraction/ Removal/ Collection/ Discharge	Subsurface Drains	Trench/Gallery Drains	Depth of affected groundwater horizons likely to render this alternative less effective than interceptor trenches. Upgradient off-Site metal loading likely to impact effectiveness, removal rates and require long-term operation.	May not be implementable due to depth of affected groundwater	Moderate capitol Moderate O&M	No
		Interceptor Trenches	While depth of some affected groundwater horizons (> 30 feet) may render this alternative ineffective for capturing all affected groundwater for subsequent treatment and discharge, this technology is generally superior to other capture technologies for low-permeability materials and heterogeneous aquifers as found at the Site. Upgradient off-Site metal loading likely to impact effectiveness, removal rates and require long-term operation.	Implementable but the expenditure of natural resources in implementation, associated treatment and maintenance of system greater than other less energy-consumptive GRAs or process options that are equally effective in meeting groundwater RAOs.	Low capitol Moderate O&M	Yes
	Injection	Reinjection wells	Effectiveness of this option likely to be impacted by low permeability of unconsolidated deposits underlying Site.	May not be technically feasible	Moderate capitol Moderate O&M	No
	Discharge	POTW	Potentially effective but not considered a green alternative in that captured treated water would then have to be transported from the Facility Area to the nearest POTW	Difficult to implement	High capitol High O&M	No
		Surface Water Discharge	Potentially effective for receiving treated captured water but would require treatment meet PRGs for both human health and ecological receptors since Facility Area ditches and Rose Creek discharges through outfalls to Old Cahokia Watershed	Technically feasible more energy-consumptive than other GRAs or process options that are equally effective in meeting groundwater RAOs.	Moderate capitol Moderate O&M	Yes
Groundwater Treatment	In-situ GW Treatment	In-situ chemical oxidation	Not as effective for metal contamination as for other contaminants. Potential adverse oxidation-induced effects include mobilization of redox sensitive and exchangeable metals which is a concern at this Site, and possible formation of toxic by-products. Also requires handling large quantities of hazardous oxidizing chemicals.	Implementable but other less expensive and equally effective options exist	High capitol High O&M	No
		Permeable Reactive Barriers (PRB)	Considered an innovative technology but works best in loose sandy soil with a steady flow of groundwater which are not the conditions found at the Site. Low groundwater velocity directly affects time required to meet cleanup goals. Effectiveness also dependent upon source removal which is uncontrolled at this Site based on off-Site upgradient metal	Implementable up to depths of 50 feet. There are no moving parts, equipment or noise. Very little waste needs to landfilled.	Moderate Capitol Low O&M	Yes
	Ex-situ GW Treatment	Precipitation/Coagulation/Flocculation	Effective as treatment method in conversion of soluble heavy metals salts to insoluble slats that will precipitate and can then be removed by physical means (settling or filtration). Treated water will often require pH adjustment particularly if there is a discharge to surface water or groundwater.	Implementable for capture process options prior to discharge options. For more stringent discharge standards, further treatment may be required. Generates toxic sludge requiring disposal.	Low Capitol Moderate O&M	Yes
	Point-of-Use Treatment	Water Softeners with NaCl or KCl	An effective means of removing metals from groundwater at point of use but based on the unlikelihood that shallow affected groundwater can be used as a viable water supply and the readily-available public water supply serving all of Fairmont City, this option is eliminated from further consideration.	Implementable but other less expensive and equally effective options exist	Low Capitol Moderate O&M	No
		Reverse Osmosis Systems	An effective means of removing metals from groundwater at point of use but based on the unlikelihood that shallow affected groundwater can be used as a viable water supply and the readily-available public water supply serving all of Fairmont City, this option is eliminated from further consideration.	Implementable but other less expensive and equally effective options exist	Moderate capitol Low O&M	No

Table 4-1: Candidate Remedial Alternative Summary

Source Material or Affected Media Category	Remedial Action Objective	Alternative 1 No Further Action	Alternative 2 Monitoring with Institutional Controls, surface water and groundwater monitoring.	Alternative 3 In-place covering through placement of soil/vegetative cap, removal of soils outside Facility Area, institutional controls, drainage and erosion controls, and groundwater monitoring.	Alternative 4 In-place covering through placement of mixed engineered barriers (concrete/ asphalt and soil/vegetative cap), drainage and erosion controls, institutional controls, and groundwater monitoring.	Alternative 5 Partial source excavation of Facility Area ground slag/affected soils for on-Facility Area consolidation with stockpiled slag, capping with soil / geocomposite cover system, institutional controls, drainage and erosion controls and groundwater monitoring.	Alternative 6 Excavation and off-Site disposal, groundwater treatment, and institutional controls
Stockpiled Slag	Source RAOs	No action does not meet source RAOs but is required under the NCP.	Use of existing perimeter fencing around Facility Area with deed restrictions prohibiting future residential land use will control access to Facility Area stockpiled slag. Alternative 2 does not address direct contact risks for site workers/utility workers to COCs in source material nor does it minimize transport of COCs from stockpiled slag to other media.	Stockpiled slag will be graded and capped in place with soil and vegetative cover that will prevent direct contact to site workers or utility workers and prevent transport of COCs from stockpiled slag to other media. Institutional controls will maintain nonresidential land use in the future and prohibit intrusive activities in capped areas to protect remedy	Same as Alternative 3	Stockpiled slag consolidated with other excavated materials then graded and capped with a soil and geocomposite cover system will prevents direct contact to site workers or utility workers and prevent transport of COCs from stockpiled slag to other media.. Drainage and erosion controls may be required to control drainage and protect cover system. Institutional controls will maintain nonresidential land use in the future and prohibit intrusive activities in capped areas to protect remedy	Stockpiled slag excavated, treated as necessary with phosphate- or similar based additive proven effective for immobilizing metals, for off-Site disposal at designated landfill will prevents direct contact for residential or nonresidential receptors, and eliminate potential for transport of COCs from stockpiled slag to other media.
Re-distributed Slag (on-Facility Area ground slag and affected off-Facility Area Alleyways)	Source RAO	No action does not meet source RAOs but is required under the NCP.	Use of existing perimeter fencing around Facility Area with deed restrictions prohibiting future residential land use will control access to, and future use of, Facility Area and off-Facility Areas with re-distributed slag. Alternative 2 does not address direct contact risks for site workers/utility workers to COCs in source material nor does it minimize transport of COCs from source materials to other media.	Re-distributed slag capped in place with soil and vegetative cover will address direct contact risks to site workers/utility workers and minimize transport of COCs from source material to other media. Institutional controls will maintain nonresidential land use in the future and prohibit intrusive activities in capped areas to protect remedy.	Re-distributed slag capped with mixed engineered barriers. Areas of re-distributed slag currently covered with asphalt or concrete barriers in good condition will be refurbished and left in place. Areas of re-distributed slag outside these areas capped in place with soil and vegetative cover to address direct contact risks to site workers/utility workers or minimize transport of COCs from re-distributed slag to other media. Institutional controls used to maintain nonresidential land use and to prohibit intrusive activities in capped areas.	Excavation of re-distributed slag for consolidation with stockpiled slag then capped with soil and geocomposite cover system described above will prevent direct contact to site workers or utility workers and prevent transport of COCs from stockpiled slag to other media. Institutional controls will maintain nonresidential land use in the future and prohibit intrusive activities in capped areas to protect remedy	Re-distributed slag excavated, treated as necessary with phosphate- or similar based additive proven effective for immobilizing metals, for off-Site disposal at designated landfill will prevents direct contact for residential or nonresidential receptors, and eliminate potential for transport of COCs from stockpiled slag to other media.
Affected Soils/ Ephemeral Sediments (On-Facility Area soil beneath or adjacent to source material , soils below source materials in off-Facility Area alleyways, and soils and sediments in ephemeral channels)	Soils RAO	No Action does not meet affected soil/ephemeral sediments RAOs but is required to be evaluated under the NCP	Does not reduce direct contact risk to affected exposed soils or ephemeral sediments for applicable receptors or minimize transport of COCs from affected soils to other media or to the Old Cahokia Watershed through bulk transport.	Affected soils under source materials effectively addressed by soil and vegetative cover on re-distributed source material prevents direct contact. Affected soils outside Facility Area and soils and sediments in ephemeral channels removed for placement with stockpiled slag prior to capping as described above under Stockpiled Slag. Drainage and erosion controls used to entrain sediments and prevent bulk transport to Old Cahokia Watershed. Institutional controls used to prevent future residential development on smelter-affected soils outside slag boundary.	Affected soils underlying source materials (including off-Facility Area alleyways) effectively addressed by soil and vegetative cap on re-distributed source material prevents direct contact. Affected soils outside Facility Area and soils and sediments in ephemeral channels removed for placement with stockpiled slag prior to capping as described above under Stockpiled Slag. Drainage and erosion controls used to entrain sediments and prevent bulk transport to Old Cahokia Watershed Institutional controls used to prevent future residential development on smelter-affected soils outside slag boundary.	Excavation of affected soils and ephemeral sediments for consolidation with stockpiled and re-distributed slag source materials and capped with soil and composite cover described above will prevents direct contact to site workers or utility workers and prevent transport of COCs from stockpiled slag to other media. Institutional controls will maintain nonresidential land use in the future and prohibit intrusive activities in capped areas to protect remedy.	General affected soils/ephemeral sediments excavated, treated as necessary with phosphate- or similar based additive proven effective for immobilizing metals, for off-Site disposal at designated landfill will prevent direct contact for residential or nonresidential receptors (depending on cleanup criteria used) and eliminate potential for transport of COCs from stockpiled slag to other media. Institutional controls would be required to prohibit well installation or use of shallow groundwater on long as off-Site upgradient metals loading is not controlled.

Table 4-1 continued: Candidate Remedial Alternative Summary

Source Material or Affected Media Category	Remedial Action Objective	Alternative 1 No Further Action	Alternative 2 Monitoring with Institutional Controls and surface water and groundwater monitoring.	Alternative 3 In-place covering through placement of soil/vegetative cap, removal of soils outside Facility Area, institutional controls, drainage and erosion controls, and groundwater monitoring.	Alternative 4 In-place covering through placement of mixed engineered barriers (concrete/ asphalt and soil/vegetative cap), drainage and erosion controls, institutional controls, and groundwater monitoring.	Alternative 5 Partial source excavation of Facility Area ground slag/affected soils for on-Facility Area consolidation with stockpiled slag, capping with soil / geocomposite cover system, institutional controls, drainage and erosion controls and groundwater monitoring.	Alternative 6 Excavation and off-Site disposal, groundwater treatment, and institutional controls
Residential yards, commercial properties and, vacant lots Soils	Soils RAO	No Action does not meet Residential yards, commercial properties and, vacant lots soil RAOs but is required under the NCP	Does not meet Residential yards, commercial properties and, vacant lots soil RAOs	Soils from residential yards, commercial properties and, vacant lots that exceed cleanup goals for excavation and consolidation with stockpiled slag on the Facility Area, then capped with soil and vegetative cover.	Same as Alternative 3	Same as Alternative 3	Soils from residential yards, commercial properties and, vacant lots that exceed cleanup goal would be excavated for off-Site disposal at a designated landfill
Surface Water	Surface Water RAO	No Action does not address continued metals loading to surface water that comes into contact with source materials or affected soils and does not meet surface water RAOs but is required under the NCP	Does not meet surface water RAOs	Source materials and affected soils would be covered and drainage channels and embankments would be stabilized using riprap and/or channel liners to meet all surface water RAOs. Surface water and would ensure effectiveness of remedy.	Same as Alternative 3	Same as Alternative 3	Surface water RAOs met by removal of all source materials. No drainage control or surface water monitoring required.
Shallow Groundwater	Groundwater RAO	No Action does not affect current receptors as there are no on-Facility Area or downgradient receptors of shallow groundwater. Does not address potential for future well installation or use of affected shallow groundwater since there are no local ordinances in place banning use of water below 10 feet, though low permeability make practical use of shallow groundwater for potable purposes unlikely. Alternative 1 does so does not meet groundwater RAOs but is required under the NCP	Institutional controls banning well installation on and downgradient of Facility Area prevents potential for future ingestion of shallow drinking water within affected plume boundary.	Institutional controls banning well installation on and downgradient of Facility Area to prevent potential for future ingestion of shallow drinking water. Capping of source materials and affected soils further minimizes potential (along with native clay layers between source materials and water table) for metals loading from Facility Area source materials via infiltrating precipitation. Groundwater monitoring will ensure effectiveness of remedy. Readily-available existing public supply for any future development water needs.	Same as Alternative 3	Same as Alternative 3	Groundwater treatment using either an in-situ permeable reactive barrier or interceptor trenches for ex-situ treatment and surface water discharge will address migration of affected groundwater off the Facility Area but uncontrolled metals loading from off-Site upgradient sources will require continued operation of system and institutional controls to prevent well installation or groundwater use.

Table 4-2: Candidate Remedial Alternatives – Initial Screening Summary

Alternative Description	Effectiveness	Implementability	Cost	Retained – Yes/No
Alternative 1 **No Action**	Human health risks from COCs on-Facility Area currently minimized by fencing and lack of any operations on or adjacent to Facility Area but this alternative does not provide any long-term protection for future receptors. Potential off-Facility Area human health risks from residential soils, affected soils or sediments. Continued potential transport of COCs to surrounding environment through leaching or surface water run-off. No restrictions on developing shallow wells on or downgradient of Facility Area, but there is a low probability that new wells would be developed.	Reflects current conditions - No additional implementation is necessary	Capitol Costs: Low O&M Costs: Low	Yes – NCP requires detailed analysis of no action alternative
Alternative 2 **Monitoring with Institutional Controls, surface water and groundwater monitoring.**	As in Alternative 1, human health risks from COCs on-Facility Area currently minimized by lack of any operations on or adjacent to Facility Area and use of institutional controls to maintain nonresidential land use, but this alternative does not provide any long-term protection for future workers. Not effective in addressing potential off-Facility Area human health risks from residential soils, affected soils or sediments. Not effective in preventing continued potential transport of COCs to surrounding environment through leaching or surface water run-off. Institutional controls effectively meet groundwater RAOs by prohibiting well installation or use of shallow groundwater on or downgradient of Facility Area within the affected plume boundary, and with groundwater monitoring to monitor plume boundary to ensure there is no further migration of plume.	Reflects current conditions - No additional implementation is necessary except periodic monitoring. Similar institutional controls have been successfully implemented in Illinois.	Capitol Costs: Low O&M Costs: Low	No – Alternative 2 is not effective in meeting RAOs for either source materials or affected media with the exception of groundwater.

Table 4-2 continued: Candidate Remedial Alternatives – Initial Screening Summary

Alternative Description	Effectiveness	Implementability	Cost	Retained – Yes/No
Alternative 3 **In-place covering through placement of soil/vegetative cap, removal of soils outside Facility Area, institutional controls, drainage and erosion controls, and surface water and groundwater monitoring**	Soil/vegetative cover system over source materials and underlying soils reduces potential human health risk on the Facility Area under both current and intended future nonresidential land use. Soil/vegetative cap reduces COC transport via infiltration or surface water run-off. Source containment and removal also addresses surface water and groundwater RAOs Removal of affected soils (both on-Facility and in alleyways), ephemeral sediments and residential yard, commercial properties and vacant lot soils for placement and capping with stockpiled slag reduces direct contact risk to both on-Facility and off-Facility Areas to meet affected soil/sediment and residential yard, commercial properties and vacant lots RAOs. Storm water drainage and erosion controls on drainage channels leaving the Facility Area entrain sediments and prevent the potential bulk transport of metals via storm water run-off to metals loading to surface water draining the Site Groundwater monitoring will monitor effectiveness of containing source materials in meeting these RAOs. Though there are no current receptors of shallow groundwater on or downgradient of the Facility Area, institutional controls prohibiting use of the shallow groundwater for potable purposes will ensure protection over the long term. There is a readily available public drinking water supply for any future development water needs within the affected plume boundary. Institutional controls ensure Facility Area land use remains nonresidential, and prohibits intrusive activities within capped areas to protect the remedy and ensure there are no future residential receptors of shallow groundwater.	Material and equipment readily available. Cited as a presumptive remedy for metal-in-soil sits under EPA guidance and has been successfully implemented in numerous similar smelter sites. Similar institutional controls have been successfully implemented in Illinois. Short-term impacts associated with implementation of remedy managed through dust controls and monitoring at work area perimeter. Additional truck traffic associated with bringing in clean soils may be temporarily disruptive to community but routes will be planned to minimize impact to extent possible.	Capitol Costs: Moderate O&M Costs: Initially high but moderate after remedial vegetation matures cover	Yes – Alternative 2 offers a potentially effective mid-range remedy

Table 4-2 continued: Candidate Remedial Alternatives – Initial Screening Summary

Alternative Description	Effectiveness	Implementability	Cost	Retained – Yes/No
Alternative 4 **In-place covering through placement of mixed engineered barriers (concrete/ asphalt and soil/vegetative cap), drainage and erosion controls, institutional controls, and groundwater monitoring.**	Same effectiveness as Alternative 3 but cover systems to be used for the re-distributed slag will consist of mixed soil/vegetative caps and asphalt/concrete caps in existing paved areas that are underlain by source material for potential future industrial or commercial land use. Same as Alternative 3 for addressing off-Facility Area affected soil, alleyways and ephemeral sediments RAOs, residential yards, commercial properties and vacant lot soil RAOs, surface water RAOs and the groundwater RAO. Institutional controls ensure Facility Area land use remains nonresidential, and prohibits intrusive activities within capped areas to protect the remedy and ensure there are no future residential receptors of shallow groundwater.	Material and equipment readily available Technically and administratively feasible. Similar institutional controls have been successfully implemented in Illinois.	Capitol Cost: High O&M Costs: High for the long-term maintenance of the asphalt and concrete covers. Initially high for the soil/vegetative cover but moderate as remedial vegetated cover establishes and matures	Yes – This alternative warrants more detailed evaluation
Alternative 5 **Partial source excavation of ground slag/affected soils for on-Facility Area consolidation with stockpiled slag, capping with soil or geocomposite cover system, drainage and erosion controls, institutional controls, surface water and groundwater monitoring.**	Excavation of re-distributed slag, all affected soils (including residential yards and commercial and vacant lots) and ephemeral sediments for consolidation with stockpiled slag reduces footprint of area requiring cap, but is not more protective to human health or the environment than other less costly alternatives (Alternative 3 and 4).. Estimated volume of material to be excavated for consolidation is over 500,000 cubic yards with depths of re-distributed source material averaging 3 feet but for some materials reaches a maximum depth of 9 feet that limits practicality of this alternative. More consumptive of both energy and natural resources, though the footprint of capped source material at the Site is reduced. Requires a more rigorous engineered cover design due to anticipated height and expanse of consolidation area. Same as Alternative 3 for addressing off-Facility affected soil, alleyways and ephemeral sediments RAOs, residential yards, commercial properties and vacant lot soil RAOs, surface water RAOs and the groundwater RAOs and required institutional controls.	Material and equipment readily available Technically and administratively feasible. Short-term impacts associated with excavating and consolidating over 500,000 cubic yards of ground slag are less easily controlled such as such a noise and dust. Additional truck traffic associated with bringing in anticipated volume of clean soils will be disruptive to community for duration of construction activities but routes will be planned to minimize impact to extent possible.	Capitol Cost: Very High O&M Costs: High costs associated with maintaining the engineered soil and geocomposite cover system over long term	Yes – The additional costs will be weighed with possible benefits associated with reducing footprint of consolidated material – will retain for a more detailed evaluation

Table 4-2 continued: Candidate Remedial Alternatives – Initial Screening Summary

Alternative Description	Effectiveness	Implementability	Cost	Retained – Yes/No
Alternative 6 **Excavation and off-Site disposal, groundwater treatment, and institutional controls.**	Meets all source, soils and sediment RAOs through the complete removal and off-Site disposal of source and affected soils (including alleyways)/sediments, residential yards, commercial properties and vacant lot soils but results in greatest expenditure of natural resources and energy in implementation . Meets surface water RAOs through complete removal of source materials and eliminates the need for surface water monitoring over the long term. Use of groundwater treatment to address affected shallow groundwater but does not address metal-loading to groundwater from upgradient sources so institutional controls prohibiting shallow groundwater use of shallow affected groundwater on and downgradient of the Facility Area will still be necessary . Short-term impacts during the implementation of this remedy are likely to be considerably greater to the surrounding community than any of the other alternatives due to the excavation and hauling of source materials and affected soils/sediments from the Site to a designated landfill or landfills capable of receiving this volume of material.. Large carbon footprint in implementation through the moving, managing and disposing >550,000 cubic yards of metal-impacted materials to a designated landfill.	Material and equipment readily available and can be implemented though the time required to implement this remedy will span several years and be disruptive for community. Requires finding a Subtitle D landfill(s) capable and willing of accepting this large volume of material within a reasonable distance from the Facility Area. Short-term impacts during the implementation of this remedy are likely to be considerably greater to the surrounding community than any of the other alternatives due to the excavation and hauling of source materials and affected soils/sediments from the Site to a designated landfill or landfills capable of receiving this volume of material..	Capitol Costs: Very High O&M: Low Cost for completing the remedy will be the highest of all alternatives without providing significant additional benefits	Yes – Though there are other equally effective remedial alternatives that will minimize risk to human health or to the environment at a much lower cost this alternative is retained for further evaluation as it meets all RAOs and the current Village officials have expressed interest in this option.

APPENDIX A

Appendix A

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Appendix A

USEPA April 17, 2009 RI Report Approval Letter with Modifications

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF

SR-6J

April 17, 2009

Mr. Gary D. Uphoff
Principal
Environmental Management Services Company
5934 Nicklaus Drive
Fort Collins, CO 80528

Subject: United States Environmental Protection Agency (U.S. EPA) Approval with Modifications of the March 13, 2009 ENTACT Final Remedial Investigation Report; Old American Zinc Plant Site; Fairmont City, Illinois

Dear Mr. Uphoff:

This letter serves as the U.S. EPA approval with modifications of the March 13, 2009 Remedial Investigation Report for the Old American Zinc Plant Site. The enclosure describes the modifications.

Please contact me at 312-886-2940, if you want to discuss this letter.

Sincerely yours,

Ronald W. Murawski

Ronald W. Murawski
Remedial Project Manager

Enclosure

cc: Tom Turner, Office of Regional Counsel
Terrance Gileo Faye; Babst, Calland, Clements, and Zomnir P.C.
Doyle Wilson, Illinois EPA
Tiffany Swoveland Chapman, CH2M Hill
Pat Thomson, P.G., ENTACT

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U.S. EPA Modifications to the March 13, 2009 ENTACT
Final Remedial Investigation Report;
Old American Zinc Plant Site; Fairmont City, Illinois

Note: Response to comment numbers refer to those in the March 13, 2009 ENTACT response to comments letter.

1. Response to General Comment 7

   Footnote 2 of Figure 3-1 of the Baseline Human Health Risk Assessment (BHHRA) is modified as follows: "Use of groundwater as a source of potable water is hypothetical as Facility Area and Off-Facility properties are supplied by a public water distribution system, and no private, potable wells currently exist within one mile downgradient of the Facility Area."

   Also, this general response states the following: "This information was added to the RI and to the BHHRA stating that in the unlikely event that if a well potentially used as a source of potable water were to be developed within 250 feet downgradient of the Facility Area, the potential risks associated with the consumption of groundwater from this hypothetical well would be similar to or less than that estimated for a hypothetical future resident drinking groundwater from the Facility Area." Similar text was added to the Executive Summary of the RI Report, but none was added to the BHHRA. Therefore, the following text is added to Section 3.1.2 of the BHHRA, as it was to the Executive Summary: "In the unlikely event that a water supply well would be developed within 250 feet downgradient of the Facility Area, the potential exposures associated with the consumption of groundwater from this hypothetical well would be similar to or less than that calculated for a hypothetical future resident drinking groundwater from the Facility Area."

2. Response to Specific Comment 14

   In the Executive Summary, the last sentence on page xiv that continues onto page xv is reworded as follows: "However, as there is no municipal ordinance expressly preventing installation of shallow wells or requiring wells to be cased beyond 10 feet, the lateral and vertical extent of metals found in groundwater have been delineated to Illinois Class I screening levels using analytical data and modeled predictions, and the shallow groundwater exposure pathway has been evaluated as part of the human health risk assessment."

3. Response to BHHRA Specific Comment 16

   In Table 5-11 of the BHHRA, the phrase "Sludge Material" in the header of the second column is changed to "Tar-Like Material."