US EPA RECORDS CENTER REGION 5
446987

U.S. Smelter and Lead Refinery, Inc. Superfund Site

Operable Unit 1

East Chicago, Lake County, Indiana

Record of Decision

U.S. Environmental Protection Agency Region 5

77 W Jackson Blvd.
Chicago, IL 60604

November 2012

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Part 1 – Declaration

1.1 – Site Name and Location

U.S. Smelter and Lead Refinery, Inc. Site
Operable Unit 1 (residential area)
CERCLIS ID# IND047030226
East Chicago, Lake County, Indiana

1.2 – Statement of Basis and Purpose

This decision document presents the Selected Remedy for Operable Unit 1 (OU1) at the U.S. Smelter and Lead Refinery, Inc. (USS Lead) Site in East Chicago, Lake County, Indiana. The U.S. Environmental Protection Agency (EPA) chose the Selected Remedy for OU1 in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, and, to the extent practicable, the National Contingency Plan (NCP). The decision is based on the Administrative Record for the USS Lead Site.

The State of Indiana concurs with the Selected Remedy.

1.3 - Assessment of Site

The response action selected in this Record of Decision (ROD) is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

1.4 - Description of Selected Remedy

The USS Lead Site is being addressed as two operable units under the framework set forth in CERCLA. The selected remedy specified in this ROD addresses OU1. OU1 contains residential yards[1] contaminated with lead and arsenic at levels that pose a threat to human health via ingestion, inhalation and direct contact. EPA's selected remedy for OU1 addresses these risks from exposure to contaminated soils through the excavation and off-site disposal of contaminated soils. The remedial action levels (RALs) at OU1 are 400 milligrams per kilogram (mg/kg) for lead at residential properties, 800 mg/kg for lead at industrial/commercial properties, and 26 mg/kg for arsenic at both residential and industrial/commercial properties. EPA's Selected Remedy for OU1 at the USS Lead Site consists of:

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[1] Yards are the risk management unit in OU1. Each individual property consists of one or more yards. Sampling during the remedial investigation demonstrated that contaminant levels in one yard were not reliably correlated with contaminant levels in other yards on the same property. The Human Health Risk Assessment evaluated the risk to human health and the environment by property, not by yard.

- Excavation of soil that contains lead or arsenic in concentrations that exceed the RALs to a maximum excavation depth of 24 inches.

- Disposal of excavated soil at an off-site Subtitle D landfill; some excavated soils may require chemical stabilization prior to off-site disposal to address exceedances of the toxicity characteristic (TC) regulatory threshold. Contaminated soil that exceeds the TC threshold is considered principal threat waste.

- If contaminated soil is identified at a depth greater than 24 inches below ground surface (bgs), a visual barrier, such as orange construction fencing or landscape fabric, will be placed above the contaminated soil before the yard is backfilled with clean soil. Institutional controls will be implemented to protect the visual barrier that separates clean backfill from impacted soils and to ensure that users of the property are not exposed to contaminated soil that remains at depth.

- Excavated soil will be replaced with clean soil to maintain the original grade. The top 6 inches of fill will consist of topsoil. Each yard will be restored as close as practicable to its pre-remedial condition.

This Selected Remedy is the first of two remedial decisions for the USS Lead Site. EPA has not yet begun the remedial investigation (RI) of Operable Unit 2 (OU2). OU2 consists of the former USS Lead property. In the future, EPA will develop a remedial investigation, feasibility study (FS), Proposed Plan, and ROD for OU2.

1.5 - Statutory Determinations

The Selected Remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

This remedy satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment). Soils at OU1 that have lead concentrations exceeding the TC threshold and that are therefore defined under the Resource Conservation and Recovery Act (RCRA) as hazardous waste will be treated prior to disposal. This treatment will reduce the mobility of the lead. The remaining volume of relatively low-level soil contamination that is being addressed in this remedy does not lend itself to any cost-effective treatment.

Because this remedy will likely result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of the remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

1.6 – Data Certification Checklist

The following information is included in the *Decision Summary* section of this ROD. Additional information can be found in the Administrative Record for this site.

Information Item	Location in ROD
Contaminants of concern and their respective concentrations	Section 2.7.2
Baseline risk represented by the contaminants of concern	Section 2.7
Cleanup levels established for contaminants of concern and the basis for these levels	Section 2.8
How source materials that constitute principal threats will be addressed	Sections 2.11 and 2.13
Current and reasonably anticipated future land use assumptions in the baseline risk assessment and the ROD	Section 2.7.1
Estimated capital, annual operation and maintenance, and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected	Section 2.9 and Appendix D
Key factor(s) that led to the selection of the remedy	Sections 2.10 and 2.12

1.7 - Authorizing Signatures

EPA, as the lead agency for the U.S. Smelter and Lead Refinery, Inc. Superfund Site (IND047030226), formally authorizes this Record of Decision.

Richard C. Karl
Richard C. Karl, Director
Superfund Division
EPA Region 5

11-30-12
Date

The State of Indiana Department of Environmental Management (IDEM), as the support agency for the USS Lead Superfund Site, formally concurs with this ROD. IDEM has prepared a separate concurrence letter which is included as Appendix A.

Part 2 – Decision Summary

2.1 - Site Name, Location, and Brief Description

The USS Lead Site is located in the City of East Chicago, Indiana (see Figure 1). East Chicago is located on the shore of Lake Michigan and lies approximately 18 miles southeast of Chicago, Illinois. It has a total area of approximately 16 square miles (mi^2) of which approximately 14 mi^2 are land and 2 mi^2 are water. The USS Lead Site comprises two separate areas each of which is called an operable unit (OU). OU1 is a predominantly residential area located in the southern portion of the City of East Chicago, north of the former USS Lead industrial facility (see Figure 1). The USS Lead facility is referred to as OU2. This ROD sets forth the remedy for OU1. OU1 is a residential soil cleanup site. Lead is the primary contaminant of concern (COC). Accordingly, EPA has followed its 2003 *Superfund Lead-Contaminated Residential Sites Handbook* in the development of the RI, FS, and ROD for OU1.

The residential area that comprises OU1 has been contaminated by aerial deposition of windblown contaminants from the USS Lead facility and other local industrial facilities and by direct deposition of contaminated fill materials. The other industrial sources of contamination in OU1 include operations conducted by the Anaconda Copper Refining Company on property within OU1 and from property located just south of OU1 owned and operated by E.I. duPont deNemours and Company (DuPont) (see Figure 2).

EPA is the lead agency for the USS Lead Site. IDEM serves as the support agency. EPA conducted the RI/FS for OU1 using federal funding. EPA intends to pursue responsible parties to fund or undertake the remedial design and remedial action for OU1.

2.2 - Site History and Enforcement Activities

The USS Lead facility is located at 5300 Kennedy Avenue, East Chicago, Indiana. The facility (OU2) was constructed in the early 1900s by the Delamar Copper Refinery Company to produce copper. In 1920, the property was purchased by U.S. Smelting Refinery and Mining and later by USS Lead. USS Lead operated a primary lead smelter at the facility. An electrolytic process called the "Betts process" was used for refining lead ores into high-purity lead. During production, the Betts process can release fugitive metals like lead.

United States Geological Survey aerial photographs from 1939, 1951, 1959, and 2005 show OU2 and OU1 over time (Figure 3). These photographs indicate the progression of residential development within OU1. For the area located west of Huish Avenue, the photographs show that the majority of the residences were built before 1939. For the area located east of Huish Avenue, approximately half of the homes were built before 1939, approximately 75 to 80 percent of the homes were built between 1939 and 1951, and by 1959 most of the homes were built. These photographs also show that the Anaconda Copper Company was located on the area now occupied by the Gosch Elementary School and a public housing residential complex (the southwest portion of OU1). The Gosch Elementary School and the East Chicago public housing complex were built on the former Anaconda Copper Company site after 1959.

Between 1972 and 1973, the USS Lead facility was converted into a secondary lead smelter which, instead of refining lead ore, recovered lead from scrap metal and automotive batteries. All operations at OU2 were discontinued in 1985. Two primary waste materials were generated as a result of the smelting operations: (1) blast-furnace slag and (2) lead-containing dust from the blast-furnace stack. Blast-furnace slag was stockpiled south of the plant building and once per year spread over an adjoining 21-acre wetland. The blast-furnace baghouse collected approximately 300 tons of baghouse flue dust per month during maximum operating conditions. Some of the flue dust escaped the baghouse capture system and was deposited by the wind within the boundaries of OU1. By the late 1970s, USS Lead stored onsite approximately 8,000 tons of baghouse dust.

The East Chicago area in the vicinity of OU1 has historically supported a variety of industries. In addition to the USS Lead smelting operation, other industrial operations have managed lead and other metals and are sources of contamination in OU1. Immediately east of OU2, across Kennedy Avenue, is the former DuPont site (currently leased and operated by W.R. Grace & Co., Grace Davison). At this location, DuPont manufactured the pesticide lead arsenate. Anaconda Lead Products and International Lead Refining Company, two smelter operations that managed lead and other metals, operated within OU1 at the location currently occupied by an East Chicago public housing facility. Anaconda Lead Products was a manufacturer of white lead and zinc oxide, and the International Lead Refining Company was a metal-refining facility. These facilities included the following: a pulverizing mill, white-lead storage areas, a chemical laboratory, a machine shop, a zinc-oxide experimental unit building and plant, a silver refinery, a lead refinery, a baghouse, and other miscellaneous buildings and processing areas.

Starting in 1993, USS Lead began a cleanup at its facility (OU2) pursuant to an agreement with EPA under the Resource Conservation and Recovery Act. USS Lead addressed the majority of the contamination in OU2 by excavating contaminated soils and consolidating those soils within a corrective action management unit located within OU2. As part of the OU2 RCRA activities, investigations were conducted in the residential area now known as OU1 to investigate the source and identify the extent of lead-contaminated soils. Modeling of air deposition of lead in the residential area was also performed.

Responsibility for the further investigation of conditions at OU1 and OU2 was subsequently transferred from EPA's RCRA program to its Superfund program. During this transition, EPA's Superfund program conducted some limited sampling of the residential area in 2007. The Superfund program subsequently listed the USS Lead Site on the National Priorities List (NPL) in April 2009. As part of the NPL listing process, EPA and IDEM evaluated contaminant concentrations focusing on the southwestern portion of the residential area. This evaluation was later expanded during the RI to cover the entirety of OU1. EPA sampled 7% of the properties during its full-scale remedial investigation. During these investigations, EPA identified properties with lead concentrations in surface soils greater than 1,200 mg/kg. Lead in surface soils in concentrations greater than 1,200 mg/kg poses an imminent and substantial threat to human health. EPA's emergency response program addressed these most highly-contaminated parcels. EPA removed the contaminated soils to a maximum depth of two feet and backfilled the excavated areas with clean soils. A total of 29 properties were remediated by the Superfund emergency response program in 2008 and 2011.

Although some residential properties have been cleaned up, contamination remains at many properties within OU1. This ROD sets forth EPA's approach for addressing the contaminated soils throughout OU1 that still require cleanup.

2.3 – Community Participation

The RI/FS Reports and the Proposed Plan for the USS Lead Site were made available to the public in early July 2012. These documents can be found in the Administrative Record for the site. The Administrative Record is maintained at the EPA Docket Room in Chicago, Illinois, and the East Chicago Public Libraries on Chicago Avenue and Columbus Avenue. After issuing the Proposed Plan, EPA held a public comment period between July 12 and September 12, 2012. In addition, EPA held a public meeting on July 25, 2012, to present the Proposed Plan to a community audience. When the Proposed Plan was issued, EPA mailed a fact sheet to area residents informing them about the Proposed Plan. The fact sheet advised residents that the RI, FS, and Proposed Plan were available for viewing at the public repositories. The fact sheet included the date, time and location of the public meeting. At the public meeting, EPA and IDEM representatives answered questions about the site and the remedial alternatives. EPA's responses to the comments received during the public comment period are included in the *Responsiveness Summary*, which is Part 3 of this ROD.

2.4 - Scope and Role of Operable Unit or Response Action

The USS Lead Superfund Site includes the former USS Lead facility with its surrounding property (OU2) and the residential area north of it (OU1). EPA estimates that approximately 57 percent of the yards (i.e., approximately 723 of the 1,271 properties) in OU1 contain concentrations of lead and/or arsenic that pose a risk to human health. EPA has concluded that USS Lead, DuPont, Anaconda Lead and International Refining were sources of contamination to OU1 through historic aerial deposition and/or direct releases to the ground. These facilities are not ongoing sources of contamination to the residential area.

EPA has organized the USS Lead Superfund Site into two OUs:

- Operable Unit 1 – The residential area north of the former USS Lead facility. OU1 is bounded by Chicago Avenue to the north, Parrish to the east, the Calumet Canal to the west, and 150th/151st Streets to the south. This ROD addresses yards in OU1 that contain lead and/or arsenic concentrations in soil that pose a threat to human health.

- Operable Unit 2 – The former USS Lead facility, its surrounding property, and site-wide groundwater. OU2 will be addressed in a future RI/FS and decision document.

The Selected Remedy for OU1 will address the principal threats by treating contaminated soil that exceeds the toxicity characteristic regulatory threshold for lead before disposing of the soil at an off-site landfill. During the RI, EPA did not test for arsenic exceedances of the TC threshold because very few soil samples had high enough concentrations of arsenic to warrant toxicity characteristic leaching procedure (TCLP) analysis. Although the highest arsenic soil concentration detected at OU1 during the RI was 567 mg/kg, the arsenic concentration in soil was often below 100 mg/kg, the lowest concentration of arsenic in soil that would possibly fail the TCLP test and therefore be considered a hazardous waste. Based on TCLP analysis for lead conducted during the RI, EPA estimates that OU1 soils will exceed the TC threshold for lead when concentrations exceed 2,400 mg/kg. EPA does not expect the highest arsenic concentrations found at OU1 to exceed the TC threshold. Additionally, the highest concentrations of arsenic were found to be co-located with high lead concentrations. Because of this, soils with the highest arsenic concentrations are likely to be subject to treatment because they are frequently co-located with the lead concentrations that require treatment.

2.5 – Site Characteristics

2.5.1 - Conceptual Site Model

The conceptual site model (CSM) for the USS Lead Superfund Site (Figure 4) considers four potentially affected media at the site: air, soil, surface water, and groundwater. The CSM shows that the USS Lead Site comprises within an urban setting historically industrial areas, the residential area (OU1), and a canal. The former smelter plants are the primary source of contamination. During plant operations, the smelters generated airborne emissions from plant stacks. Leaks and spills were also likely. Fill material used to raise the ground level in OU1 is a second potential source of contaminants. Approximately two feet of fill overlie native sands throughout OU1. Metals and polycyclic aromatic hydrocarbons (PAHs) are the main constituents of interest (COIs) associated with these sources. The water table in the vicinity of the site lies approximately 8.5 feet bgs. The groundwater flows south/southwest towards the Grand Calumet River.

Contaminants were deposited at OU1 through airborne emissions from the industrial plants and direct deposition of contaminated fill material. Other possible sources of contaminants at OU1 are fertilizers and pesticides. These chemicals may have been applied to individual properties. Fertilizer can contain measurable levels of heavy metals such as lead, arsenic, and cadmium. The DuPont facility manufactured the pesticide lead arsenate using two ingredients: lead and arsenic. Both are contaminants of concern at the USS Lead Site.

Potential migration routes for COIs were assessed according to the properties of the contaminants and fate-and-transport processes. Potential migration pathways for COIs to be released, deposited, or redistributed in surface soils include:

- particulate erosion and redeposition by wind
- runoff, particulate erosion, and redeposition by surface water
- surface water percolation
- surface soil filling and excavation activities

Contaminants may migrate into the air by two distinct emission mechanisms: entrainment of contaminated particles by the wind and volatilization of chemical compounds. The most likely transport mechanism for the COIs at OU1 is by windborne transport of contaminated dust and soil erosion. The COIs have a strong tendency to adsorb to soil particles. Wind and the concomitant release of wind-borne dust is the primary pathway for site COIs to be released to the atmosphere.

Surface-water runoff is another migration pathway that was considered. Surface-water runoff can erode surface soils and transport particles by overland flow and result in contaminated soil being picked up and redeposited at lower elevations. Because OU1 is flat and is served by a municipal sewer system, redeposition in low-lying areas is not expected to be of major significance at the site.

Excavation and filling activities are also likely migration pathways. EPA has observed these activities at the site. Excavation potentially exposes the subsurface to fugitive dust erosion and deposition. Filling activities result in topsoil that is not as compact as native soils and which may result in faster percolation and/or erosion rates. There is also a possibility that amended fill materials may be contaminated, particularly if obtained from a nearby, contaminated source.

Human and ecological receptors can be exposed to the COIs through direct dermal exposure to soil, inhalation of windborne soils, ingestion of soils, or ingestion of produce grown in affected soils. Based upon the distribution of PAHs, EPA has concluded that their presence in OU1 is not attributable to neighboring industrial activities. Rather, it is consistent with an urban residential setting. Therefore, the Selected Remedy does not address PAHs but does address lead and arsenic in surface and subsurface soils.

2.5.2 - Overview of site

OU1 encompasses approximately 322 acres and is bounded by East Chicago Avenue on the north, East 151st Street on the south, the Indiana Harbor Canal on the west, and Parrish Avenue on the east (see Figure 2). OU1 is a mixed residential and commercial/industrial area north of the former USS Lead industrial facility. The mixed-use area includes the following uses: (1) residences including single and multi-family units some of which, in the southwest corner of the area, are public housing, (2) generally small commercial/industrial operations, (3) municipal and community offices and operations, (4) two schools (the Carrie Gosch Elementary School and the Carmelite School for Girls), (5) four parks, and (6) numerous places of worship. Residences, schools, and public parks constitute the large majority of properties and acreage within OU1.

The average annual precipitation in East Chicago between 1961 and 1990 was 36.82 inches. A five-year wind-rose plot for the years 1987 to 1991 at a site in nearby Hammond, Indiana, indicates that prevailing winds are from the southwest and north at less than 20 miles per hour.

2.5.3 - Geologic and Hydrogeologic Setting

During site investigations, five main soil varieties were identified within OU1, including the following: organic topsoil, fill, fill with construction debris, fill with slag, and native sand. All but the native sand were found from the surface down to depths of as much as 24 inches bgs. Native sand was typically located 18 to 24 inches bgs. Nearby soil borings indicate that the

Equality Formation underlies the top few feet of soils at OU1. The Equality Formation, also known as the Calumet Aquifer, is primarily a sand unit with some silts, clays, and gravel lenses. The Equality Formation is estimated to extend to approximately 25 feet bgs.

EPA did not evaluate groundwater as part of the remedial investigation for OU1. Site-wide groundwater will be investigated as part of the OU2 RI. Residents and businesses in East Chicago are served by a municipal water system.

2.5.4 - Sampling Strategy

EPA's sampling approach at OU1 followed the methodology described in its 2003 *Superfund Lead-Contaminated Residential Sites Handbook*. As part of the RI, EPA collected surface and subsurface soil samples between December 2009 and September 2010. EPA sampled a total of 88 properties, including 74 residential properties and 14 non-residential properties (i.e., schools, parks, and commercial properties). In total, EPA sampled 232 distinct yards (including drip zone samples and quadrants from larger properties such as parks and schools) in order to characterize the nature and extent of COIs in and around OU1. Drip zone samples are soil samples collected from beneath the gutters and downspouts of buildings. The purpose of drip zone sampling is to investigate whether airborne contamination is concentrating or has concentrated along the drip lines of roofs. These 232 separate "yards" included 75 front yards, 76 back yards, 21 quadrants, and 60 drip zones. EPA elected to consider drip zones as separate "yards" because they covered a geographic area that was not confined to a front yard, back yard, or quadrant. EPA used the term "yard" throughout the RI and the FS to represent one unit of remedial area. A single remedial area generally consists of a front yard, back yard, or drip zone of a residential property, or any quadrant of a park, commercial property, easement, or school. A residential property can have up to three yards (front, back, drip zone) and a park, commercial property, easement, or school can be divided into a maximum of four yards (otherwise referred to as quadrants in the RI).

Soils from four different horizons (0-6", 6-12", 12-18", and 18-24" bgs) were analyzed from front yards, back yards, and quadrants of larger properties. The purpose of sampling soils from different soil horizons was to evaluate vertical contamination profiles. Aerial deposition of contaminants would be expected to yield contamination profiles with higher concentrations near the surface and lower concentrations at depth.

2.5.5 - Sources of Contamination

As previously discussed, the primary sources of site-related contamination are the industrial facilities that formerly operated in and around OU1, including DuPont, Anaconda Lead, Industrial Refining and the USS Lead facility. None of these facilities are still in operation, and none of them are ongoing sources of contamination to OU1. The placement of fill material and the individual application of materials such as pesticides are other potential sources of contamination in OU1 that may be ongoing.

2.5.6 - Types of Contaminants and Affected Media

Metals are the primary contaminants and soil is the affected media in OU1. All soil samples were analyzed for lead. In addition, a subset of samples was analyzed for various combinations of total metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), PAHs, polychlorinated biphenyls (PCBs), and pesticides to provide a basis for more fully assessing contamination in shallow soils in OU1. Although SVOCs (including PAHs), pesticides, and PCBs were sampled for and discussed in the RI and evaluated in the risk assessment, there is no reasonable basis from which to conclude that there were consistent releases of these compounds into OU1 from the local industrial facilities. Rather, EPA has concluded that the detection of these compounds is associated with other anthropogenic sources typical of a metropolitan industrial area. EPA's RI Report for OU1 includes all available sampling results and a full discussion of those results.

The sampling results were evaluated in the human health risk assessment. The risk assessment determined the contaminants of potential concern (COPCs) and identified which chemicals and affected media drive potential risk at the site. These findings are summarized in Section 2.7.2 of this ROD and discussed in greater detail in the RI Report. The human health risk assessment was completed using site-specific data. EPA has determined that the contaminants of concern (COCs) are lead and arsenic in residential soils.

2.5.7 - Extent of Contamination

Lead is the primary COC at OU1. EPA used the *Superfund Lead-Contaminated Residential Sites Handbook*, EPA remedial screening levels (RSLs), and the State of Indiana's Risk Integrated System of Closure Technical Resource Guidance Document to set the site screening levels (SSLs) for lead at 400 mg/kg for residential areas and 800 mg/kg for industrial areas. Although lead was found to be the most widespread contaminant at OU1, arsenic was also present at locations within the residential area. As detailed in the RI Report, the SSLs for arsenic in surface and subsurface soils are 14.1 mg/kg and 13.2 mg/kg, respectively, at both residential and commercial/industrial properties.

Data analysis indicated that lead and arsenic were generally correlated; arsenic was present in areas with high lead concentrations. Based on the data, OU1 soils typically do not exceed the arsenic SSL unless lead also exceeds the lead SSL. Additionally, lead and PAHs were not correlated; EPA did not discern a correlation between high lead concentrations and high concentrations of PAHs. The lack of correlation between PAHs and lead supports the hypothesis that PAHs are not site-related compounds and are likely associated with other anthropogenic sources.

During the RI sampling events in OU1, EPA analyzed samples from all 232 yards for lead. The surface and/or subsurface soil in 123 yards (53 percent of those tested) exceeded the lead SSL. The potential lateral extent of lead-impacted soil includes all areas within the OU1 boundaries. The area west of Huish Avenue contained a higher frequency of exceedances for lead in both surface and subsurface soil samples than the eastern half of OU1. Lead concentrations in all of the nine properties (20 yards) sampled in the East Chicago Housing Authority complex in the southwest portion of the study area exceeded the SSL for lead.

During the RI sampling events, a total of 136 yards in OU1 were analyzed for arsenic. The surface and/or subsurface soil in 75 yards (55 percent of those tested) exceeded the arsenic SSL. EPA performed an analysis of arsenic concentrations in soils to further understand site conditions and to assess the evidence for aerial deposition of arsenic at OU1. Because arsenic concentrations in the public housing area soils likely resulted from direct deposition of contaminants from the former industrial facility and because operations at the industrial facility and construction of the housing area likely redistributed soils, the vertical profile of arsenic in the public housing area was excluded from the analysis. When the public housing area was excluded from the arsenic data set, it became evident that the arsenic in the remainder of OU1 was primarily dispersed due to aerial deposition because the shallow soil horizons contain higher arsenic concentrations than the deeper soil horizons.

An analysis of front and back yards suggests that there is an approximately 75% chance that if the COIs in one yard are in excess of the SSLs, then the COIs in the other yard at the same property will exceed the SSLs. In addition, based on the observed vertical distributions of lead, arsenic, and PAHs, there is only a 13% chance that sampling only the upper two depth intervals (0-6" and 6-12" bgs) would miss contamination in the lower two depth intervals (12-18" and 18-24" bgs). A comparison of soil type to COI concentration concluded that soil type is not a reliable indicator of the presence or absence of COIs. There is one exception to this rule: the native sands are generally free of contamination.

EPA concluded that the concentration levels of VOCs, SVOCs (including PAHs), PCBs, and pesticides do not require further evaluation. EPA found the highest lead and arsenic concentrations in OU1 in the East Chicago Housing Authority complex. The high concentrations in this area appear to be related to the historical operations at the Anaconda Copper Company facility.

2.6 – Current and Potential Future Site and Resource Uses

The current land use at OU1 is largely residential and recreational (parks and school yards), with a small number of commercial and light industrial properties. The adjacent OU2 includes the RCRA landfill and wetland areas. EPA expects that the land use at OU1 will remain unchanged. The City of East Chicago has shared with EPA its development plans for OU1 and the surrounding area, which confirm that the land use within OU1 is not likely to dramatically change.

Lake Michigan is the municipal water source for East Chicago, and properties within OU1 do not access site-wide groundwater for any use. The surface water in the vicinity of OU1 is the Indiana Harbor Canal (OU1's western boundary) and the Grand Calumet River (south of OU2). The portion of the Indiana Harbor Canal near OU1 is not subject to much industrial use in contrast with much higher industrial activity in the northern part of the canal. The Grand Calumet River in this area is not navigable. Neither water body appears to be used recreationally.

In July 2009, East Chicago had a population of 29,900, of which 51.6% was Hispanic, 40.3% was African-American, and 7.2% was White, non-Hispanic. The density of East Chicago was approximately 2,496 people per square mile, and the average household size was 2.8 people (City-Data 2011). Based on the average household size and the number of homes in OU1, the approximate density within OU1 is 7,000 people per square mile. Based on an inspection of historical aerial photographs, the primary land use in East Chicago is industrial. Residential land use accounts for approximately 20% of the land within the city. OU1 is one of the most densely populated areas in East Chicago.

The East Chicago median household income is $28,289, versus the Indiana median household income of $45,424. The March 2011 unemployment rate for East Chicago was 12.7%, compared to Indiana's March 2011 unemployment rate of 8.8%. EPA considers East Chicago an environmental justice community. An environmental justice community is one characterized by low income and burdened with significant environmental challenges.

2.7 - Summary of Site Risks

A human health risk assessment (HHRA) estimates what risks a site poses to human health if no action is taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the HHRA for the USS Lead site. More detailed information can be found in the RI Report. The HHRA relied on Tier I screening-level evaluations to identify media and exposure pathways that may pose unacceptable risks. More detailed (Tier II) risk assessments were considered if the Tier I screening level evaluations identified potentially significant risks. The HHRA evaluated the potential risks that could result to people from exposure to the contaminants at the site. EPA conducted the HHRA consistent with EPA's Risk Assessment Guidance for Superfund (RAGS) and other supplemental guidance to evaluate human health risks. The HHRA identified possible receptors and potentially complete pathways of exposure. The information used in the HHRA helped define site-specific, risk-based screening levels. The HHRA determined that the COCs for the site are lead and arsenic for residential soils and that cleanup levels of 400 mg/kg for lead and 26 mg/kg for arsenic are protective of human health and the environment for current and future residential use.

The information presented here focuses on the information that is driving the need for a response action at the site and does not necessarily summarize the entire HHRA. Further information is contained in the risk assessment within the RI Report and is included in the Administrative Record.

EPA did not identify any ecological habitats in OU1 so did not conduct an ecological risk assessment.

2.7.1 - Summary of Human Health Risk Assessment

The HHRA for the USS Lead site evaluated risks by individual property rather than by individual yard. Each property consists of one or more yards. The HHRA did not include lead in its carcinogenic risk and non-carcinogenic hazard calculations because EPA's *Superfund Lead-Contaminated Residential Sites Handbook* specifies that lead cleanup levels should be calculated by using the Integrated Exposure Uptake Biokinetic (IEUBK) model. As discussed in the RI Report and explained in more detail in Section 2.7.7 of this ROD, EPA evaluated the available site-specific information (such as lead in drinking water and blood lead levels in children) in relation to the default exposure assumptions in the IEUBK model and concluded that there was no need to modify the default exposure assumptions.

The objectives of the risk evaluation using the HHRA (which includes the results of the IEUBK model) were the following: (1) to investigate whether site-related constituents detected in environmental media pose unacceptable risks to current and future human receptors, and (2) to provide information to support decisions concerning the need for further evaluation or action, based upon current and reasonably anticipated future land use. For the purposes of the risk assessment, future land uses were assumed to be the same as current land uses. Current land uses are primarily residential, commercial/industrial, and recreational. Human receptors at OU1 include the following: child and adult residents; adult utility and construction workers; students; teachers (indoor and outdoor); adult and child recreationalists; and park workers (indoor and outdoor). All the receptors were assumed to be exposed to surface (current and future land use conditions) and subsurface soil (future land use conditions) through incidental ingestion, dermal contact, and inhalation of particulates in ambient air. Subsurface soils were included under the future land use conditions because residents and utility/construction workers may rework soils and expose deeper horizons.

In the HHRA risk characterization, the toxicity factors were integrated with concentrations of COIs and intake assumptions to estimate potential cancer risks and non-carcinogenic hazards. Risks and hazards were calculated using standard risk assessment methodologies. Risks were compared to EPA's acceptable risk range: from $1x10^{-6}$ (one cancer per one million exposed receptors) to $1x10^{-4}$ (one cancer per ten thousand exposed receptors). Risks less than $1x10^{-6}$ are considered insignificant. Risks within the above range are remediated at the discretion of EPA risk managers. Risks greater than $1x10^{-4}$ typically require remediation. Non-carcinogenic hazards are compared to a target hazard index (HI) of 1. Risks posed by lead in soil were evaluated by comparing lead exposure point concentrations (EPCs) in soil at each property to receptor-specific lead preliminary remediation goals (PRGs). Chemicals that have a risk identified through the risk assessment process become COCs.

Risks associated with lead are present throughout the study area. The HHRA found that risks and hazards associated with other compounds exist under both current and future land use conditions for between 30 and 40 percent of residential properties. At these properties, risks above EPA's acceptable risk range ($1x10^{-4}$ to $1x10^{-6}$) and hazard index (greater than 1) from compounds other than lead are driven primarily by exposure to arsenic and PAHs through ingestion of homegrown produce and incidental ingestion of soil. As discussed in the RI Report, the PAHs detected in soil at OU1 are typical of urban soils in the Chicago metropolitan statistical area and are not related to any specific onsite or nearby offsite sources. Therefore, PAHs are not considered site-related COCs and were not addressed in the FS.

In addition, a risk management decision was made to address risk from arsenic concentrations in soil that exceed the upper tolerance limit (UTL) for background arsenic concentrations. Because of the similarity between the bulk soil concentrations for arsenic at OU1 and the background concentrations for arsenic, EPA calculated a UTL for arsenic concentrations in soil to distinguish between soil concentrations that are distributed among the naturally-occurring values at the site and those that may be impacted by activities in and around the USS Lead site. The approach of using the UTL as a value for the RAL has been used at other CERCLA sites, including the Jacobsville Neighborhood Soil Contamination site in Evansville, Indiana. This approach is discussed in greater detail in that site's RI Report. The UTL also corresponds with the soil concentration that is equivalent to a 1×10^{-4} cancer risk level assuming that 25% of the total produce consumed by residents in OU1 is comprised of homegrown produce.

2.7.2 - Identification of Contaminants of Concern

The COCs at OU1 are lead and arsenic, with lead being the primary COC. Based on lead concentrations observed during the RI, lead-contaminated soils at the USS Lead site require remedial action to address unacceptable risks. Data analysis indicates that lead and arsenic are generally co-located. The range of detected concentrations and frequency of detections for lead and arsenic in soil at OU1 are presented in Table 1.

Table 1 – Summary of Contaminants of Concern for OU1

Exposure Point	COC	Concentration Detected (mg/kg)		Frequency of Detection	Exposure Point Concentration (mg/kg)		Statistical Measure
		Min	Max		Min	Max	
Residences	Arsenic	1.6	567	252/252	8.4	169	95 UCL
	Lead	4.7	27,100	848/850	233	5,910	MAX
Parks	Arsenic	0.99	414	40/40	31.8	43.4	95 UCL
	Lead	7	6,770	82/84	276	1,460	MAX
Schools	Arsenic[1]	2.9	11	21/21	N/A	N/A	95 UCL
	Lead	15.6	572	39/40	257	260	MAX

2.7.3 - Data Quality and Usability

Data were evaluated based on completeness, holding times, initial and continuing calibrations, surrogate recoveries, internal standards, compound identification, laboratory and field quality assurance/quality control (QA/QC) procedures and results, reporting limits, documentation practices, and application of validation qualifiers. Analytical data collected as part of Phase I and Phase II RI sampling were considered to be acceptable for use in the HHRA. Data were reduced based on consideration of essential nutrient and duplicate status as described below.

- Calcium, magnesium, potassium, and sodium are classified as essential nutrients and, therefore, were eliminated from further quantitative evaluation.

- Duplicate pairs were reduced to a single value based on an evaluation of the relative percent difference between the paired results.

2.7.4 - Exposure Point Concentrations

EPCs were developed for both modeling and non-modeling scenarios. The same chemical-specific EPCs were used for both reasonable maximum exposure (RME) and central tendancy exposure (CTE) scenarios. The approaches used to calculate EPCs under the two scenarios are presented in the HHRA.

EPCs were calculated only for chemicals with at least eight detected results. Calculations were performed for metals and PAHs in surface soil (0 to 6" bgs) and for all soil depths combined. EPCs were calculated using the 95 percent upper confidence limit of the mean following the decision rules in ProUCL 4.00.05, a statistical analysis software tool. Because EPA uses the IEUBK/Adult Lead Model in its evaluation of lead, the risk assessment used the average concentration under both RME and CTE conditions as the EPC for lead.

EPA used the approach described above to generate EPCs for all receptors except utility and construction workers. Because utility and construction workers may conduct their work within a limited area, the maximum detected concentration was used as the EPC for those receptors under both RME and CTE conditions.

EPCs were calculated following the methods and recommendations provided in EPA's risk assessment guidance. Modeling was used to generate medium-specific EPCs for media not sampled directly. Specifically, modeling was used to estimate EPCs for blood lead, outdoor air (from soil), and homegrown produce, as summarized below.

- EPA used the IEUBK model and the Adult Lead Model (ALM) to estimate soil concentrations that correspond to acceptable blood-lead concentrations for residents and non-residents, respectively. Appendix C of the HHRA presents the methodology based on the IEUBK and ALM models used to calculate acceptable receptor-specific soil lead concentrations (referred to as PRGs). The lead PRGs were compared to the lead EPCs (average lead concentrations) to evaluate whether adverse effects could result from exposure to lead in soil.

- EPA estimated concentrations of non-volatile constituents from soil in ambient air using constituent-specific and site-specific particulate emission factors as presented in the Regional Screening Level User's Guide.

- EPA evaluated the uptake of COPCs from soil into homegrown produce for current and future residents at the site using COPC-specific uptake factors. Uptakes into aboveground and belowground produce were evaluated separately. COPC-specific uptake factors were obtained from or calculated consistent with EPA's "Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities."

Singular EPCs were not calculated for OU1 based on exposure scenarios. Instead, EPCs were calculated on a property-specific basis for the HHRA. EPCs for all COPCs from each of the 88 individual properties evaluated are presented in Appendix A (RAGs Table 7) of the HHRA. A summary of the EPCs for the COCs lead and arsenic is provided in Table 1 above.

2.7.5 - Exposure Assessment

Exposure assessment is the process of measuring or estimating the intensity, frequency, and duration of human exposure to a chemical in the environment. OU1 includes the following land uses: (1) numerous residences, including single and multi-family units, some of which are public housing, (2) various, generally small commercial/industrial operations, (3) various municipal and community offices and operations, (4) two schools (the Carrie Gosch Elementary School and the Carmelite School for Girls), (5) four parks, and (6) numerous places of worship. Residences, schools, and public parks constitute the large majority of properties and acreage within the USS Lead site. These properties are unlikely to soon be redeveloped and replaced by alternate property types. As a conservative approach, places of worship and commercial/municipal properties were treated as residential properties as the likely users of these properties are residents of OU1. Industrial cleanup criteria were applied to industrial properties.

The conceptual site model links contaminant concentrations in various media to potential human exposure. The CSM identified the following exposure scenarios for each of the property types:

- Residential Properties
  - Current and future residents were assumed to be exposed to surface and subsurface soil through incidental ingestion, dermal contact, inhalation of particulates in ambient air, and ingestion of homegrown produce.
  - Current and future utility and construction workers were assumed to be exposed to subsurface soil through incidental ingestion, dermal contact, and inhalation of particulates.

- Schools
  - Current and future students, teachers, and staff were assumed to be exposed to surface and subsurface soil through incidental ingestion, dermal contact, and inhalation of particulates in ambient air.
  - Current and future utility and construction workers were assumed to be exposed to subsurface soil.

- Parks
  - Current and future recreationalists and park staff were assumed to be exposed to surface and subsurface soil through incidental ingestion, dermal contact, and inhalation of particulates in ambient air.
  - Current and future utility and construction workers were assumed to be exposed to subsurface soil.

Assumptions about exposure frequency, duration, and other exposure factors are discussed in the HHRA. Sensitive sub-populations considered in the HHRA included children and adolescents. EPA used the IEUBK model to develop soil-lead PRGs for child and adolescent receptors, including child residents, adolescent school children, and child recreationalists.

2.7.6 - Toxicity Assessment

The toxicity assessment provides a description of the relationship between a dose of a chemical and the potential likelihood of an adverse health effect. The purpose of the toxicity assessment is to provide a quantitative estimate of the inherent toxicity of COCs for use in risk characterization. Potential health risks for COCs are evaluated for both carcinogenic and non-carcinogenic risks.

The risk assessment for the USS Lead site used the default toxicity values presented in the EPA RSL tables. The default values were obtained from the following sources:

- Integrated Risk Information System (IRIS) on-line database;
- Provisional Peer Reviewed Toxicity Values (PPRTV) derived by EPA's Superfund Health Risk Technical Support Center;
- Technical Support Center for the EPA Superfund program;
- The Agency for Toxic Substances and Disease Registry (ATSDR) minimal risk levels;
- The California Environmental Protection Agency/Office of Environmental Health Hazard Assessment's toxicity values;
- Screening toxicity values in appendices to certain PPRTV assessments; and
- The EPA Superfund program's Health Effects Assessment Summary Tables (HEAST).

Toxicity values used in the HHRA for all COPCs are presented in Tables A5.1 and A5.2 (non-cancer toxicity values) and Tables A6.1 and A6.2 (cancer toxicity values) of Appendix A of the HHRA. For the COCs lead and arsenic, the cancer toxicity data are summarized in Table 2 below and the non-cancer toxicity data are summarized in Table 3.

2.7.7 - Risk Characterization

For carcinogens, such as arsenic, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

Risk = CDI x SF

Where:

risk = a unitless probability (e.g., $2x10^{-5}$) of an individual's developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor, expressed as $(mg/kg\text{-}day)^{-1}$

These risks are probabilities that are expressed typically in scientific notation (e.g., $1x10^{-6}$). An excess lifetime risk of $1x10^{-6}$ indicates that an individual experiencing the RME estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as excess lifetime cancer risk because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an

Table 2
Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

COC	Oral Cancer Slope Factor	Dermal Cancer Slope factor	Slope Factor Units	Weight of Evidence/ Cancer Guideline Description	Source	Date
Arsenic	1.5	1.5	$(mg/kg\text{-}day)^{-1}$	A	IRIS	Nov-2010
Lead	NA	NA	NA	NA	IRIS	Nov-2010

Pathway: Inhalation

COC	Unit Risk	Units	Inhalation Cancer Slope factor	Slope Factor Units	Weight of Evidence/ Cancer Guideline Description	Source	Date
Arsenic	0.0043	$(\mu g/m^3)^{-1}$	15	$(mg/kg\text{-}day)^{-1}$	A	IRIS	Nov-2010
Lead	NA	NA	NA	NA	NA	IRIS	Nov-2010

Notes:
COC: Contaminant of concern
NA: Not available
IRIS: Integrated Risk Information System, EPA

A - Known Human Carcinogen
B1- Probable human carcinogen - indicates that limited human data are available
B2- Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C- Possible human carcinogen
D- Not classifiable as a human carcinogen
E- Evidence of non-carcinogenicity

This table provides carcinogenic risk information which is relevant to the contaminants of concern in soil. At this time, slope factors are not available for lead for oral, dermal, or inhalation routes of exposures. An adjustment factor is sometimes applied, and is dependent upon how well the chemical is absorbed via the oral route. An adjustment factor of 95% was used for arsenic. Therefore, a slightly lower value than is presented above was used as the dermal carcinogenic slope factor for arsenic.

Table 3
Non-Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

COC	Chronic/ Subchronic	Oral RfD value[1]	Oral RfD Units	Dermal RfD Value[2]	Dermal RfD Units	Primary Target Organ[3]	Combined UF/MF[4]	Sources of RfD Target Organ[5]	Date
Arsenic	Chronic	0.0003	mg/kg-day	0.0003	mg/kg-day	Cardiovascular Dermal	3	IRIS	Nov-2010
Lead	NA	NA	NA	NA	NA	NA	NA	IRIS	Nov-2010

Pathway: Inhalation

COC	Chronic/ Subchronic	Inhalation RfC value	Inhalation RfC Units	Inhalation RfD Value	Inhalation RfD Units	Primary Target Organ[6]	Combined UF/MF	Sources of RfC Target Organ	Date
Arsenic	Chronic	1.5×10^{-5}	mg/m^3	NA	NA	Development Cardiovascular CNS	NA	CalEPA	Nov-2010
Lead	NA	NA	NA	NA	NA	NA	NA	IRIS	Nov-2010

Notes:

COC: Contaminant of concern
NA: Value not available/not calculated
1) Oral RfD = Oral reference dose (EPA, 2010)
2) Dermal RfD = Dermal reference dose calculated as: RfDd = RfDo x GIABS (Gastrointestinal absorption efficiency EPA, 2010).
3) Primary target organ/system based on information from the Agency for Toxic Substances and Disease Registry "ToxFAQs" (ATSDR, 2010).
4) UF/MF = Uncertainty factor/modifying factor (EPA-IRIS, 2010)
5) Primary source of RfDo as cited in the RSL Tables (EPA, 2010) and date of RSL Table update. Primary sources include: 1) IRIS - Integrated Risk Information System; 2) PPRTV - Provisional Peer Reviewed Toxicity Values; 3) ATSDR = Agency for Toxic Substances and Disease Registry; 4) CalEPA - California Environmental Protection Agency; 5) HEAST - Health Effects Assessment Summary Table; 6) NJ - New Jersey Department of Environmental Quality.
6) Primary source of RfC as cited in the RSL Tables (EPA, 2010) and date of RSL Table update. Primary sources include: 1) IRIS - Integrated Risk Information System; 2) PPRTV - Provisional Peer Reviewed Toxicity Values; 3) ATSDR = Agency for Toxic Substances and Disease Registry; 4) CalEPA – California Environmental Protection Agency; 5) HEAST - Health Effects Assessment Summary Table; 6) NJ - New Jersey Department of Environmental Quality; 7) X-PPRTV = PPRTV Appendix; 8) ECAO = Environmental Criteria and Assessment Office.

This table provides non-carcinogenic risk information which is relevant to the contaminants of concern in soil. At this time, RfDs are not available for lead for oral, dermal, or inhalation routes of exposure. An adjustment factor is sometimes applied, and is dependent upon how well the chemical is absorbed vial the oral route. An adjustment factor of 95% was used for arsenic. Therefore, a slightly lower value than was presented above is used as the dermal non-carcinogenic slope factor for arsenic.

individual developing cancer from all other causes has been estimated to be as high as one in three. EPA's generally-acceptable risk range for site-related exposures is $1x10^{-4}$ to $1x10^{-6}$.

The potential for non-carcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with a reference dose (RfD) derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any adverse effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ less than 1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic non-carcinogenic effects from that chemical are unlikely. The hazard index is generated by adding the HQs for all COCs to which a given individual may reasonably be exposed that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media. An HI less than 1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic non-carcinogenic effects from all contaminants are unlikely. An HI greater than 1 indicates that site-related exposures may present a risk to human health.

The HQ is calculated as follows:

Non-cancer HQ = CDI/RfD

Where:

CDI = chronic daily intake
RfD = reference dose

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

Because lead does not pose a cancer risk and does not have a nationally-approved reference dose, slope factor, or other accepted toxicological factor which can be used to assess risk, standard risk assessment methods cannot be used to evaluate the health risks associated with lead contamination. EPA has developed the Integrated Exposure Uptake Biokinetic Model for Lead in Children to predict blood lead levels (BLLs) in children exposed to lead. The IEUBK model calculates the probability that a child will have a BLL greater than 10 micrograms of lead per deciliter of blood (µg/dL). BLLs above 10 µg/dL have been directly related to adverse health effects in adults and children. EPA developed the IEUBK model to assist in establishing lead cleanup levels at Superfund sites.

The IEUBK model for lead in children was used to evaluate the non-carcinogenic risks posed to young children as a result of the lead contamination at OU1. EPA ran the IEUBK model using the available site-specific data to predict a lead soil level that will be protective of children and other residents. Site-specific soil concentrations for lead were used in place of model default values. Drip zone samples were included in the IEUBK model calculations.

A blood-lead-level study was not conducted at OU1. EPA used the IEUBK model to develop soil-lead PRGs for child and adolescent receptors, including child residents, adolescent school children, and child recreationalists. For the remaining receptors considered in the OU1 HHRA, EPA used the ALM to develop soil-lead PRGs. For residential child receptors, the average lead concentration in soil at each property was compared to the EPA residential soil RSL of 400 mg/kg. The 400 mg/kg RSL was calculated using EPA's IEUBK model and default exposure assumptions.

Available site-specific information was below regulatory levels and did not appear to be significantly different from the default parameters of the IEUBK model. This information included the municipal lead result for drinking water (3.6 micrograms per liter (µg/l)), low reported blood lead concentrations in school children, and low bioavailability of lead in soil at the site based on leachability studies. For other site-specific factors, insufficient information was available (for example, localized concentrations of lead in air, water, and foodstuffs) to warrant calculation of a site-specific residential soil PRG. For these reasons, EPA determined it was the best practice to use the default parameters in the model rather than to use site-specific data for only certain inputs. The output from the IEUBK model identified residential properties with average lead concentrations in soil greater than 400 mg/kg as presenting potential lead risks to residential receptors.

PRGs for lead in soil for both adolescent school children and child recreationalists were calculated in accordance with EPA's "Assessing Intermittent or Variable Exposures at Lead Sites" (EPA-540-R-03-008). In performing the calculations, EPA assumed that the overall average concentration of lead in soil to which these receptors could be safely exposed was the residential soil PRG of 400 mg/kg. For each receptor, three inputs were identified: (1) the average concentration to which the receptor would be exposed at home, (2) the fraction of time the receptor would spend at home, and (3) the fraction of time the receptor would spend at the alternate exposure point (for an adolescent school child, this would be the school; for a child recreationalist, this would be a park). Using these inputs and the target acceptable overall average lead concentration of 400 mg/kg, EPA calculated receptor-specific soil-lead PRGs (the acceptable concentration of lead in soil at the alternate location) for schools and parks. The calculated soil-lead PRG for an adolescent school child is 583 mg/kg, and for a child recreationalist the soil-lead PRG is 693 mg/kg.

After evaluating all COPCs for the appropriate exposure scenarios, EPA retained only lead and arsenic as COCs. Non-carcinogenic effects attributable to COPCs other than lead at OU1 were found to be negligible for all exposure scenarios.

Tables 4, 5, and 6 summarize the total carcinogenic risks from all COPCs to residents, utility workers, and construction workers, respectively. Tables 7, 8, and 9 summarize the total non-carcinogenic risks from all COPCs to residents, utility workers, and construction workers, respectively. Because the HHRA evaluated risks on an individual, property-by-property basis, Tables 4 through 9 show the range of the property-specific risk results for each exposure route.

Table 4
Risk Characterization Summary for Residents - Carcinogens

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Adult/Child

Medium	Exposure Location	Exposure Point	Carcinogenic Risk									
			Ingestion		Inhalation		Dermal		Home Grown Produce Ingestion		Exposure Routes Total	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Surface/Subsurface Soil	Schools	Soil On-Site Adult/Child RME	3.9×10^{-8}	6.2×10^{-6}	7.5×10^{-9}	4.7×10^{-6}	4.9×10^{-17}	8.1×10^{-9}	1.2×10^{-5}	6.4×10^{-5}	1.2×10^{-5}	7.5×10^{-5}
	Parks	Soil On-Site Adult/Child RME	4.7×10^{-8}	7.9×10^{-5}	4.9×10^{-9}	1.8×10^{-5}	3.7×10^{-16}	6.4×10^{-9}	N/A	N/A	5.2×10^{-8}	9.7×10^{-5}
	Residential	Soil On-Site Adult/Child RME	0.0	1.3×10^{-3}	0.0	2.4×10^{-4}	0.0	1.9×10^{-3}	0.0	4.5×10^{-3}	0.0	7.9×10^{-3}

Table 5
Risk Characterization Summary for Utility Workers - Carcinogens

Scenario Timeframe: Current/Future
Receptor Population: Utility Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Carcinogenic Risk									
			Ingestion		Inhalation		Dermal		Home Grown Produce Ingestion		Exposure Routes Total	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Surface/Subsurface Soil	Schools	Soil On-Site Adult RME	0.0	6.0×10^{-6}	0.0	3.1×10^{-11}	0.0	2.3×10^{-6}	N/A	N/A	0.0	8.3×10^{-6}
	Parks	Soil On-Site Adult RME	5.2×10^{-6}	5.8×10^{-5}	5.7×10^{-10}	6.4×10^{-9}	4.9×10^{-7}	5.6×10^{-6}	N/A	N/A	5.7×10^{-6}	6.4×10^{-5}
	Residential	Soil On-Site Adult RME	6.5×10^{-8}	7.8×10^{-5}	2.7×10^{-13}	6.0×10^{-9}	2.5×10^{-8}	7.1×10^{-6}	N/A	N/A	1.8×10^{-7}	8.5×10^{-5}

Table 6
Risk Characterization Summary for Construction Workers - Carcinogens

Scenario Timeframe: Current/Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Carcinogenic Risk									
			Ingestion		Inhalation		Dermal		Home Grown Produce Ingestion		Exposure Routes Total	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Surface/Subsurface Soil	Schools	Soil On-Site Adult RME	0.0	3.6×10^{-7}	0.0	3.7×10^{-12}	0.0	1.4×10^{-7}	N/A	N/A	0.0	5.0×10^{-7}
	Parks	Soil On-Site Adult RME	3.1×10^{-7}	3.5×10^{-6}	6.9×10^{-11}	7.7×10^{-10}	7.0×10^{-11}	3.4×10^{-7}	N/A	N/A	3.1×10^{-7}	3.8×10^{-6}
	Residential	Soil On-Site Adult RME	3.9×10^{-9}	4.7×10^{-6}	3.3×10^{-14}	1.8×10^{-7}	5.7×10^{-11}	1.6×10^{-1}	N/A	N/A	7.9×10^{-9}	1.6×10^{-1}

Table 7
Risk Characterization Summary for Residents - Non-Carcinogens

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Adult/Child

Medium	Exposure Medium	Exposure Point	Non-Carcinogenic Risk (Hazard Index)									
			Ingestion		Inhalation		Dermal		Home Grown Produce Ingestion		Exposure Routes Total	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Surface/Subsurface Soil	Schools	Soil On-Site Adult/Child RME	0.0	$2.7x10^{-1}$	0.0	$2.7x10^{-3}$	0.0	$2.2x10^{-2}$	0.0	$2.5x10^{-1}$	0.0	$5.4x10^{-1}$
	Parks	Soil On-Site Adult/Child RME	$4.6x10^{-3}$	6.4	$1.2 x10^{-4}$	$5.9x10^{-1}$	$4.8x10^{-4}$	$4.2x10^{-1}$	N/A	N/A	$5.2x10^{-3}$	7.4
	Residential	Soil On-Site Adult/Child RME	0.0	$1.6x10^{+2}$	0.0	$3.0x10^{+1}$	0.0	2.1	0.0	$5.3x10^{+2}$	0.0	$7.2x10^{+2}$

Table 8
Risk Characterization Summary for Utility Workers - Non-Carcinogens

Scenario Timeframe: Current/Future
Receptor Population: Utility Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Non-Carcinogenic Risk (Hazard Index)									
			Ingestion		Inhalation		Dermal		Home Grown Produce Ingestion		Exposure Routes Total	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Surface/Subsurface Soil	Schools	Soil On-Site Adult RME	0.0	6.0×10^{-6}	0.0	3.1×10^{-11}	0.0	2.3×10^{-6}	N/A	N/A	0.0	8.3×10^{-6}
	Parks	Soil On-Site Adult RME	4.5×10^{-2}	4.9×10^{-1}	2.3×10^{-4}	4.2×10^{-4}	2.9×10^{-3}	3.2×10^{-2}	N/A	N/A	4.8×10^{-2}	5.2×10^{-1}
	Residential	Soil On-Site Adult RME	2.1×10^{-6}	1.2	3.3×10^{-10}	1.1×10^{-3}	3.0×10^{-4}	4.5×10^{-2}	N/A	N/A	3.0×10^{-4}	1.2

Table 9
Risk Characterization Summary for Construction Workers - Non-Carcinogens

Scenario Timeframe: Current/Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Non-Carcinogenic Risk (Hazard Index)									
			Ingestion		Inhalation		Dermal		Home Grown Produce Ingestion		Exposure Routes Total	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Surface/Subsurface Soil	Schools	Soil On-Site Adult RME	0.0	1.9×10^{-1}	0.0	2.7×10^{-3}	0.0	0.0	N/A	N/A	0.0	1.9×10^{-1}
	Parks	Soil On-Site Adult RME	5.8×10^{-1}	6.4	6.0×10^{-3}	1.1×10^{-2}	7.8×10^{-3}	4.2×10^{-1}	N/A	N/A	6.0×10^{-3}	6.8
	Residential	Soil On-Site Adult RME	2.6×10^{-7}	15	1.6×10^{-4}	2.4×10^{-1}	2.8×10^{-3}	5.8×10^{-1}	N/A	N/A	3.0×10^{-3}	16

Risk characterization results are discussed by property and receptor type in the following order: residential, school, and recreational properties. For each, there is a discussion of the likely exposure of the primary receptor, followed by the likely exposure to utility and construction workers (which are assumed to be potentially exposed at all properties). (See Section 2.7.5 for a discussion of the various exposure scenarios that were evaluated.)

Residential Properties

The majority of OU1 is made up of residential properties. Risk was evaluated discretely at each of the 74 residential properties that were tested during the RI. Exposure routes at residential properties to lead- and arsenic-contaminated surface and subsurface soils include incidental ingestion, dermal contact, inhalation of particulates in ambient air, and ingestion of homegrown produce. For lead, these were integrated together in the IEUBK model. For other COPCs, risks were quantified individually for each exposure route at each property. The HHRA evaluated risks associated with both current and future land uses. For current land use, the HHRA considered the upper 12 inches of soil in yards and 24 inches where gardens are currently located. Future land use assumes that gardens can be relocated anywhere in the yard and the HHRA considered the top 24 inches of soil throughout the yard. Individual risks for each property can be found in the HHRA, which is included in the RI Report. The sensitive subpopulation for lead is children.

The primary non-lead drivers of risk are arsenic and carcinogenic PAHs. EPA has determined that the PAHs at OU1 are not site-related. The primary hazard drivers are arsenic, antimony, manganese, and mercury, as well as a series of other metals at a small number of properties. Risks and hazards are driven by ingestion of homegrown produce and incidental ingestion of soil. No carcinogenic COPCs were identified at 35 of the 74 residential properties tested.

<u>Residents</u>

As shown in Table 4, the total carcinogenic risk for residents under both current and future land uses from all COPCs at the residential properties tested ranges from zero to 7.9×10^{-3}. Table 7 shows that the non-carcinogenic hazard index from all COPCs at the residential properties tested ranges from zero to 720. However, some of the COPCs were determined not to be site-related. The risks to residents when considering only the site-related COCs are summarized as follows:

- For residents under current land uses (exposed to the upper 12 inches of soil), 27 of the 74 residential properties tested have total current risks greater than 1×10^{-4}, the upper end of EPA's acceptable risk range. The total risks at these properties range from 2×10^{-4} to 5×10^{-3}.

- For residents under future land uses (potentially exposed to the upper 24 inches of soil), 36 of the 74 properties tested have total future risks greater than 1×10^{-4}, the upper end of EPA's acceptable risk range. The total risks at these properties range from 2×10^{-4} to 5×10^{-3}.

- Lead poses a risk to residents at 47 of the 74 residential properties that were tested.

Utility Worker

The HHRA evaluated potential exposure of utility workers at the residential properties. As shown in Table 5, the total carcinogenic risk for utility workers from all COPCs ranges from 1.8×10^{-7} (below EPA's acceptable risk range) to 8.5×10^{-5} (within EPA's acceptable risk range). Table 8 shows that the non-carcinogenic hazard index from all COPCs ranges from 0.0003 (insignificant) to 1.2. However, when considering risks to utility workers only due to site-related COCs, non-carcinogenic hazards are less than 1 and insignificant at all properties. Lead poses a risk to utility workers at three of the 74 residential properties that were tested.

Construction Worker

The HHRA evaluated potential exposure of construction workers at the residential properties. As shown in Table 6, the total carcinogenic risk for construction workers from all COPCs ranges from 7.9×10^{-9} (below EPA's acceptable risk range) to 1.6×10^{-1} (above EPA's acceptable risk range). Table 9 shows that the non-carcinogenic hazard index from all COPCs ranges from 0.003 to 16. However, when considering risks to construction workers only due to site-related COCs, carcinogenic risks were either less than 1×10^{-6} and considered insignificant or were within EPA's acceptable risk range. Non-carcinogenic hazards for construction workers due to the COCs exceed an HI of 1 at 11 of the residential properties that were tested. Lead poses a risk to construction workers at 16 of the 74 residential properties that were tested. The majority of the 16 properties are clustered in the public housing area at the southwest corner of OU1.

Schools

There are two schools within the study area, the Carmelite School for Girls and Carrie Gosch Elementary School. The Carmelite School contains some residents. Therefore, the exposure assumptions were different for the two schools. Human health risks for students and teachers are summarized as follows:

Carmelite School for Girls

Under both current (C) and future (F) land use conditions, total risks from all COPCs for adolescent students (5×10^{-5} [C] and 7×10^{-5} [F]) and adult teachers and staff (4×10^{-5} [C] and 1×10^{-4} [F]) are within EPA's acceptable risk range. Non-carcinogenic hazards for both receptor groups are less than an HI of 1 and considered insignificant. At Carmelite School for Girls, lead does not pose a risk to either adolescent students or adult teachers and staff.

Carrie Gosch Elementary School

At Carrie Gosch Elementary School, under both current and future land use conditions, total risks from all COPCs for adolescent students, indoor teachers and staff, and outdoor teachers and staff are less than or equal to 1×10^{-5} and within EPA's acceptable risk range. Non-carcinogenic hazards are less than an HI of 1 and considered insignificant for all receptors. At Carrie Gosch Elementary School, lead does not pose a risk to any receptors.

Construction and Utility Workers

There were no unacceptable risks for construction or utility workers at either school under current or future land use conditions.

Parks

Under current land use conditions, total carcinogenic risks to the following groups are within EPA's acceptable risk range: (1) child, adolescent, and adult recreationalists; (2) indoor park workers; and (3) outdoor park workers at Riley Park, Goodman Park, and Kennedy Gardens Park. The maximum risk is $3x10^{-5}$ (within EPA's acceptable risk range) for an outdoor park worker at Goodman Park. Total non-carcinogenic hazards at all three parks are less than an HI of 1 and considered insignificant for all receptors.

Lead poses the following types of risk at each park:

- Riley Park – lead does not pose a risk to any receptors.
- Goodman Park – lead poses a risk to child recreationalists, indoor park workers, and outdoor park workers.
- Kennedy Gardens Park – lead poses a risk to all recreational receptors.

Under future land use conditions, the carcinogenic risks increase slightly for all receptors but remain within EPA's acceptable risk range, and non-carcinogenic hazards at the three parks also remain insignificant. The risks from lead remain similar to those described under current land use conditions.

Construction and Utility Workers

There are no unacceptable risks for utility workers at the three parks under current or future land use conditions. For construction workers, the non-carcinogenic hazard index from all COPCs ranges from 0.006 to 6.8 (see Table 9), with the values exceeding 1 driven by concentrations of arsenic at or below background levels. When taking such non-site-related concentrations out of the evaluation, there are no unacceptable risks to construction workers at the three parks.

2.7.8 - Uncertainties

Uncertainties are inherent in the process of quantitative risk assessment because of the use of environmental sampling results, assumptions regarding exposure, and the quantitative representation of chemical toxicity. Potentially significant sources of uncertainty for this assessment are discussed in the HHRA and include analytical data, exposure estimates, toxicity estimates, and background conditions. The uncertainties associated with analytical data are summarized below.

At OU1 of the USS Lead Site, there are four primary sources of uncertainty with regard to the analytical data used in the HHRA: (1) the depth of surface soil samples, (2) the use of x-ray fluorescence (XRF) data, (3) the limited number of soil samples analyzed for constituents other than lead, and (4) a limited number of samples at each property. Each of these sources of uncertainty is summarized below.

- Surface soil samples were collected from 0 to 6 inches bgs. However, EPA guidance suggests that concentrations of some constituents, particularly lead, may be highest in the uppermost few centimeters (1 inch). Therefore, collection of surface soil samples from 0 to 6 inches bgs may result in a dilution of lead concentrations in surface soil samples. At OU1, EPA evaluated the concentration of lead in soil samples collected during the limited investigation in 2007. EPA concluded that concentrations of lead measured in soil samples collected from 0 to 1 inch bgs did not differ from measured lead concentrations in samples collected from 1 to 6 inches bgs at the same location.

- Field-based analytical methods have been found acceptable for use in investigating hazardous waste sites if a particular method (in this case XRF) is generally accepted and performed in accordance with QA/QC protocols and procedures. The XRF technique, well established and routinely used in site investigations, was performed using an established analytical method (Method 6200). Therefore, EPA concluded that XRF data (obtained by EPA) are acceptable for use in the RI and HHRA for the USS Lead Site. Furthermore, all XRF data used in the HHRA were first adjusted based on a correlation developed between samples analyzed using both XRF and laboratory analysis.

- All soil samples collected during the RI were analyzed for lead, either by XRF (and later adjusted as described above) or by an off-site laboratory. However, only 20 percent of the Phase I soil samples were sent to an off-site laboratory for total metals analysis. (Note: All Phase II soil samples were sent offsite for total metals analysis). Also, only eight Phase I soil samples were sent offsite for VOC, SVOC (including PAHs), PCB, and pesticide analyses. VOCs, non-PAH SVOCs, PCBs, and pesticides were not detected in any of those eight samples; therefore, VOCs, non-PAH SVOCs, PCBs, and pesticides were not analytes in Phase II sampling. Consequently, the EPCs (and in turn risks and hazards) for non-lead COPCs, particularly arsenic and PAHs, are subject to a moderate to large amount of uncertainty.

- As noted above, samples analyzed for COCs other than lead were collected less frequently than samples analyzed for lead. As a result, EPCs for COCs other than lead at individual properties are based on fewer samples than EPCs for lead. This means that EPCs for some analytes could not be calculated at some properties. At other properties, the EPCs are subject to at least a moderate amount of uncertainty because they are based on a limited number of samples. In such instances, the maximum detected concentration was used as the EPC. This may result in an overestimation of the EPC.

2.7.9 - Risk Assessment Conclusions

The risk to human health from lead and arsenic in residential soils drives the need for remedial action at OU1 of the USS Lead Site. The response action selected in this ROD is therefore necessary to protect public health or welfare or the environment from actual or threatened releases of pollutants or contaminants that may present an imminent and substantial endangerment.

2.8 – Remedial Action Objectives

Remedial action objectives (RAOs) are goals specific to media or operable units for protecting human health and the environment. Risk can be associated with current or potential future exposures. RAOs should be as specific as possible, but not so specific that the range of alternatives to be developed is unduly limited. Objectives aimed at protecting human health and the environment should specify: (1) COCs; (2) exposure routes and receptors; and (3) an acceptable contaminant level or range of levels for each exposure route.

As discussed in Section 2.7, the OU1 HHRA recognized the following receptors for current and future land-use scenarios: child, adolescent, and adult residents; child, adolescent, and adult recreationalists; and adult indoor and outdoor workers. Section 2.7 also details the exposure routes for each receptor. Current land uses within OU1 include residential, recreational, school, and industrial/commercial properties. For the purposes of the HHRA and the development of RAOs, EPA assumed that future land uses of all properties would be the same as current land uses. As land use and the potential for exposure to contaminated material is not likely to change, the RAO must reduce the risks posed by soils in yards at OU1.

EPA has identified the following RAO for OU1 of the USS Lead Site:

- Reduce to acceptable levels human health risk from exposure to COCs (lead and arsenic) in impacted surface and subsurface soils, through ingestion, direct contact, or inhalation exposure pathways, assuming reasonably anticipated future land-use scenarios.

Portions of OU1 are currently paved or covered with buildings, which limits potential exposure. However, significant portions of OU1, including yards, parks, and lawns, are unpaved. The intent of the RAO above is to address open areas to protect residents, recreationalists, and workers. A cleanup that achieves this RAO will be protective of human health and the environment as it will ensure that the soil to which residents are exposed, now and in the future, does not pose a health risk.

Remedial Action Levels

<u>Lead</u>

As discussed in Section 2.7.7, the HHRA evaluated lead by using the IEUBK model and default exposure assumptions to calculate a screening level very similar to the 400 mg/kg RSL. Available site-specific information was not significantly different than the standard parameters of the IEUBK model, and insufficient information was available for other site-specific factors. EPA therefore used the default parameters for the IEUBK model and the ALM in its calculation of site-specific residential soil PRGs for lead, and identified average lead concentrations in soil greater than 400 mg/kg as presenting potential lead risks to residential receptors. EPA is therefore selecting 400 mg/kg as the RAL for lead in residential yards.

At schools and parks, where the calculated soil PRG is above 400 mg/kg, EPA has conservatively chosen to use the residential RSL of 400 mg/kg as the RAL since it is likely that the children potentially exposed at schools and/or parks are also exposed at residences within OU1. Given the small size of the yards at many residences within OU1, it is possible that some children spend more time outside at schools and parks than they do at home. Selecting 400 mg/kg as the lead RAL for all property types therefore takes into account cumulative risk from exposure of children at schools and parks as well as at residential properties.

At industrial/commercial properties, EPA used the ALM to identify a RAL of 800 mg/kg for lead in soil.

Arsenic

As discussed in Section 2.7.1, the RAL for arsenic is based upon the upper tolerance limit of naturally-occurring concentrations of arsenic at OU1. Arsenic concentrations in soil samples collected within OU1 are distributed around both the site-specific background concentration of 14.1 mg/kg and the Illinois metropolitan background concentration of 13.0 mg/kg. Because of the similarity between the bulk soil concentrations for arsenic at OU1 and the naturally-occurring background concentrations, EPA made a risk-management decision to use the UTL to distinguish between arsenic soil concentrations that are distributed among the naturally-occurring values at OU1 and those that may have been impacted by activities in and around the site. The 95% UTL for arsenic in soil at OU1 is 26 mg/kg, which corresponds to the upper bound of the naturally-occurring (i.e. background) concentrations. The 26 mg/kg RAL for arsenic will be applied to residential, recreational, and commercial/industrial properties. The approach of using the UTL as a RAL has been used at other CERCLA sites, including the Jacobsville Neighborhood Soil Contamination Site in Evansville, Indiana, and is discussed more fully in the RI Report for OU1 of the USS Lead Site.

EPA notes that an arsenic soil concentration of 26 mg/kg also corresponds with a risk level of $1x10^{-4}$ for residential land use if one assumes that 25 percent of the produce consumed by residents of OU1 is comprised of homegrown produce (grown within OU1).

RAL Summary

Table 10 summarizes the remedial action levels for soils at OU1.

Table 10 Soil Remedial Action Levels for OU1 of the USS Lead Site		
Analyte Group	**Analyte Name**	**OU1 Soil RAL**
Metals	Arsenic	26 mg/kg
	Lead	400 mg/kg (Residential) 800 mg/kg (Industrial/Commercial)

2.9 – Description of Alternatives

This section presents the remedial alternatives for OU1, which are numbered to correspond with the numbering system used in the FS Report. The alternatives are described more fully in Section 2.9.2. The alternatives listed in bold font are those that EPA carried forward for detailed analysis in the FS.

- **Alternative 1 – No Action**
- Alternative 2 – Institutional Controls
- **Alternative 3 – On-site Soil Cover + Institutional Controls**
- **Alternative 4A – Excavation of Soil Exceeding RALs + Off-site Disposal + *Ex-situ* Treatment Option**
- **Alternative 4B – Excavation to Native Sand + Off-site Disposal + *Ex-situ* Treatment Option**
- Alternative 5 – *In-situ* Treatment by Chemical Stabilization

In accordance with EPA guidance, the potential remedial alternatives identified in the FS and listed above were screened against three broad criteria: (1) effectiveness (both short-term and long-term), (2) implementability (including technical and administrative feasibility), and (3) relative cost (capital and operation and maintenance [O&M]). The purpose of the screening evaluation was to reduce the number of alternatives chosen for a more thorough analysis. EPA eliminated Alternative 2 (exclusive reliance on institutional controls to prevent exposure) and Alternative 5 (in-place treatment by chemical stabilization) from further consideration because EPA did not consider them to be effective for OU1. Alternative 2 does not reduce human health risk from exposure to COCs because the impacted soils would remain in place without protective barriers. Alternative 5, chemical stabilization through the introduction of ground fish bones to achieve phosphate immobilization, was eliminated because it is not proven for long-term effectiveness; there are few case studies available for review.

2.9.1 - Common Element of Alternatives

Pre-Remedial Sampling

Prior to remedy implementation, pre-remedial sampling must be conducted at the remainder of the properties in OU1 (i.e., those that have not yet been tested) to determine which yards require remediation. The pre-remedial sampling will take place during the remedial design phase. All field activities will be conducted in accordance with an EPA-approved, site-specific quality assurance project plan. The sampling methodologies employed will be the same as those used during the RI field work. Because EPA has secured access to fewer than 25% of the properties in OU1, additional access agreements for the remaining properties will be obtained before initiating the pre-remedial field investigation. The pre-remedial sampling results will be used in the remedial design to identify the yards that require remediation. For Alternative 4A, the pre-remedial sampling will also identify the depth of RAL exceedances in each yard. The cost of the pre-remedial sampling is included in each retained alternative, with the exception of Alternative 1, No Action.

Assumed Number of Properties Requiring Remediation

Based on the representative sampling conducted during the RI, of the 1,271 properties in OU1, 53 percent or 672 properties are likely to require remedial action to address risks associated with lead. An additional four percent or 51 properties are likely to require remediation to address risks associated only with arsenic. In total, 723 properties are likely to require remediation.

2.9.2 – Summary of Remedial Alternatives

Alternative 1 – No Action
Estimated Capital Cost: $0
Estimated Total O&M Cost: $0
Cost Estimate Contingency: $0
Estimated Present Worth Cost: $0
Estimated Construction Timeframe: None

Regulations governing the Superfund program generally require that the "no action" alternative be evaluated to establish a baseline against which EPA and the public can compare the costs and benefits of other alternatives. Under this alternative, EPA would take no action at OU1 to prevent exposure to the soil contamination, and statutory five-year reviews would not be required.

Alternative 3 – On-site Soil Cover + Institutional Controls
Estimated Capital Cost: $16,705,000
Estimated Total O&M Cost: $735,000
Cost Estimate Contingency: $3,500,000
Estimated Present Worth Cost: $20,900,000
Estimated Construction Timeframe: 18 months

Alternative 3 would achieve the RAO of preventing exposure to contaminated soil by installing a soil cover that limits direct contact with impacted soil. A visible barrier, such as orange construction fencing or landscaping fabric, would be placed over the contaminated soil and then the contaminated soil and visible barrier would be covered with clean soil. Contamination would be left in place and capped with a 12-inch-thick soil cover as specified in EPA's *Superfund Lead-Contaminated Residential Sites Handbook*. The soil cover would be composed of 6 inches of imported select borrow material topped with 6 inches of top soil, and is meant to prevent direct contact with contaminated soil. The soil cover would be placed directly on top of the existing grade. After installation of the soil cover, each yard would be restored to its pre-remedial condition. As part of the O&M cost calculations, EPA assumed that the soil cover would be inspected and repaired as needed on a semi-annual basis for the first 5 years, followed by an annual inspection for years 6 through 30. Annual repairs would include re-grading portions of the soil cover, placing additional soil to maintain the 12-inch cover, and seeding or sodding the yards as needed. Institutional controls would be implemented to maintain the integrity of the soil cover so that users of the impacted yards would not be exposed to COCs in soil. Institutional controls may include property restrictions, such as the following:

- limiting gardening to raised beds;
- requiring that all subsurface work (utility maintenance, foundation work, etc.) be done in accordance with the remedial design in order to protect workers and residents;
- requiring that sufficient coverage of impacted soils be maintained.

In accordance with CERCLA requirements, EPA would perform five-year reviews of this remedy since impacted soil would be left in place above levels that allow for unlimited use and unrestricted exposure. After remediation work is complete, this alternative would allow for the continued residential use of impacted yards.

<u>Alternative 4A</u> - Excavation of Soil Exceeding RALs + Off-site Disposal + *Ex-situ* Treatment Option
Estimated Capital Cost: $24,795,000
Estimated Total O&M Cost: $67,000
Cost Estimate Contingency: $4,980,000
Estimated Present Worth Cost: $29,900,000
Estimated Construction Timeframe: 26 months

Alternative 4A would achieve the RAO of preventing exposure to contaminated soil by removing impacted soil that exceeds RALs, to a maximum excavation depth of 24 inches, while leaving in place soils that do not exceed the RALs. This alternative requires excavation of soil exceeding RALs, disposal of excavated soil at an off-site Subtitle D landfill, and, as necessary, chemical stabilization of some excavated soil to address lead concentrations that exceed the toxicity characteristic regulatory threshold. Based upon testing conducted during the RI, EPA estimates that soil with lead concentrations above 2,400 mg/kg (an estimated 7% of the excavated yards at OU1) will exceed the TC regulatory threshold. EPA considers the soils that exceed the TC regulatory threshold to be principal threat waste, and under Alternative 4A, the principal threat wastes would be treated.

Pre-remedial sampling would be conducted at impacted properties to determine the approximate excavation depth required in each yard. The maximum excavation depth would be 24 inches, but may be less than 24 inches at many properties. Confirmation samples would be collected as needed during the excavation work to determine the final excavation depth (up to 24 inches) and to confirm that all soils exceeding RALs within the top 24 inches were excavated. If contaminated soil is identified at a depth greater than 24 inches bgs, a visual barrier such as orange construction fencing or landscape fabric would be placed above the contaminated soil and beneath the clean backfill soil. In such instances, institutional controls would be implemented, in the same way as described in Alternative 3, to ensure that users of the property are not exposed to COCs in soil. Unlike the ICs for Alternative 3, however, the ICs for Alternative 4A would not limit gardening to raised beds.

Based on the results of the RI, the native sand/soil horizon is estimated to be no more than 24 inches bgs and is clean. During the RI, native sand was encountered at most sample locations between 0 and 24 inches bgs. For this reason, EPA expects that excavating to a maximum depth of 24 inches under Alternative 4A would remove all of the soil exceeding RALs at the majority of the impacted yards within OU1.

Since no local stockpile area has been identified, EPA assumes that soil would be loaded directly into roll-off containers and transported to the landfill. If a stockpiling location is identified that is acceptable to the community, then excavated soils could be stockpiled prior to being transported off-site for disposal.

Excavated soil would be replaced with clean soil, including 6 inches of top soil, to maintain the original grade. Each yard would be restored as close as practicable to its pre-remedial condition. Once the properties are sodded or seeded, O&M of the sod or seed, including watering, fertilizing, and cutting, would be conducted for 30 days. After the initial 30-day period, property owners would be responsible for the maintenance of their own yards. Because some soil exceeding RALs would likely be left in place at OU1 (e.g., within some yards deeper than 24 inches bgs), a five-year review would be required in accordance with CERCLA. After remediation is complete, this alternative would allow for the continued residential use of impacted yards.

<u>Alternative 4B</u> - Excavation to Native Sand + Off-site Disposal + *Ex-situ* Treatment Option
Estimated Capital Cost: $37,760,000
Estimated Total O&M Cost: $0
Cost Estimate Contingency: $7,560,000
Estimated Present Worth Cost: $45,400,000
Estimated Construction Timeframe: 40 months

Alternative 4B would achieve the RAO of preventing exposure to contaminated soil by removing all of the soil at impacted yards to the native sand, even if some of the excavated soils do not exceed RALs. EPA has observed that lead is not found in the native sand layer. Under this alternative, EPA would not collect confirmation samples during the excavation work. Instead, EPA would assume that, for yards that have soils exceeding the RALs, complete removal of all soils above the native sand layer would achieve the RAO. The goal of this alternative is the total removal of soil at identified yards down to the native sand, disposal of excavated soil at an off-site Subtitle D landfill, and, as necessary, chemical stabilization of some excavated soil to address lead concentrations that exceed the TC regulatory threshold. EPA considers the soils that exceed the TC regulatory threshold to be principal threat waste, and under Alternative 4B, the principal threat wastes would be treated.

Soil in those yards that have RAL exceedances would be excavated from the surface grade down to the native sand/soil horizon without pre-remedial testing to determine the depth of contamination. Based on the results of the RI, the native sand/soil horizon is estimated to be no more than 24 inches bgs. During the RI, native sand was encountered at most sample locations between 0 and 24 inches bgs. RI results indicated that the native sand beneath the fill soils is both clean and by sight very easily distinguished from soil and fill material. The cost estimate for this alternative assumes that all soil above the native sand would be excavated and disposed offsite with no post-excavation confirmation samples.

Since no local stockpile area has been identified, EPA assumes that soil would be loaded directly into roll-off containers and transported to the landfill. If a stockpiling location is identified that is acceptable to the community, then excavated soils could be stockpiled prior to being transported off-site for disposal.

Excavated soil would be replaced with clean soil, including 6 inches of top soil, to maintain the original grade. Each yard would be restored as close as practicable to its pre-remedial condition. Once the properties are sodded or seeded, O&M of the sod or seed, including watering, fertilizing, and cutting, would be conducted for 30 days. After the initial 30-day period, property owners would be responsible for the maintenance of their own yards. This alternative would result in the removal of all impacted soils (since excavations would go down to the native sand, and the native sand layer is clean). No institutional controls would be needed, and CERCLA would not require five-year reviews because waste would not be left in place above levels that allow for unlimited use and unrestricted exposure. After remediation is complete, this alternative would allow for the continued residential use of impacted yards.

2.10 – Comparative Analysis of Alternatives

As required by CERCLA, nine criteria were used to evaluate the different remediation alternatives individually and against each other in order to select a remedy. This section of the *Record of Decision* summarizes the performance of each alternative against the nine criteria and notes how they compare to the other options under consideration.

The nine evaluation criteria fall into three groups: threshold criteria, primary balancing criteria, and modifying criteria. Threshold criteria, which include overall protection of human health and the environment and compliance with ARARs, are requirements that each alternative must meet in order to be eligible for selection. Primary balancing criteria, which include long-term effectiveness and permanence, reduction of toxicity, mobility, or volume of contaminants through treatment, short-term effectiveness, implementability, and cost, are used to weigh major trade-offs among alternatives. Modifying criteria, which include state/support agency acceptance and community acceptance, can be fully considered only after public comment is received on the Proposed Plan, so were not evaluated in the FS. In the final balancing of trade-offs between alternatives, upon which the final remedy selection is based, modifying criteria are of equal importance to the balancing criteria. The nine evaluation criteria are discussed below.

2.10.1 - Overall Protection of Human Health and the Environment

This criterion assesses how well the alternatives achieve and maintain protection of human health and the environment.

Alternative 1 (No Action) would provide no improvement over current conditions, would provide no risk reduction, and would not be protective of human health or the environment.

Alternatives 3, 4A, and 4B are each expected to be effective remedies for OU1 that would be protective of human health and the environment. Protection of human health and the environment would be achieved by addressing potential pathways of exposure to contaminated soils. Alternative 3 relies on a soil cover and compliance with institutional controls, such as restricting gardens to raised beds, to achieve protectiveness. Alternatives 4A and 4B would achieve protectiveness through removal of contaminated soils. As discussed in Section 2.5.1, the exposure pathways through which people can be exposed to the lead- and arsenic-contaminated surface and subsurface soils at OU1 are ingestion, direct contact, and inhalation.

Ingestion of contaminated soils in yards is the primary exposure route at OU1. Residents may be exposed to contaminants adhering to soils through ingestion of homegrown produce or through direct ingestion of contaminated soil. Alternatives 3, 4A, and 4B are all considered effective at preventing ingestion of contaminants.

Exposure to contaminated soils through direct contact may result from recreational activities, gardening, landscaping, or excavation activities. Each of the active alternatives would prevent most direct contact by covering or removing the contaminated soils. However, direct contact may be more likely to result from unauthorized excavation activities under Alternative 3 because the contaminated soils would remain in place under a soil cover that is only 12 inches thick.

Exposure through inhalation would most likely occur through windborne transport of contaminated dust and soil due to the COCs' low volatility and strong tendency to adsorb to soil particles. Each of the active alternatives would prevent exposure to contaminated dust over the long term by removing or covering the contaminated soils. However, the remedial activities may generate dust and cause short-term exposure, particularly under Alternatives 4A and 4B, which would excavate contaminated soils.[2]

Alternatives 3, 4A, and 4B address potential exposure to contaminants by covering or removing the contaminated soil. Alternative 4B would eliminate all potential exposure pathways because

[2] Any dust generated under Alternative 3 would be created by the placement of clean soils as cover material, since excavation of contaminated soils is not part of that alternative.

all of the soil at yards that exceed the RALs would be removed down to native sand. Alternatives 3 and 4A would reduce or eliminate potential exposure pathways. Alternative 3 would leave contaminated soil behind at all properties under a 12-inch soil cover, and EPA would rely on institutional controls (such as prohibiting excavation work deeper than 12 inches and limiting gardening to raised beds) to prevent exposure. Alternative 4A would leave contaminated soil in place at some properties at depths greater than 24 inches. At those properties where contaminated soil remains at depth, EPA would rely on institutional controls (such as prohibiting excavation of contaminated soils) to prevent exposure.

Each active remedial alternative is expected to be protective of human health and the environment, provided that the cover is properly maintained under Alternative 3 and institutional controls are effective under Alternatives 3 and 4A. Active Alternatives 3 and 4A could allow exposure to contaminated soils through unauthorized excavation, if institutional controls are not effective. The potential for such exposure is highest for Alternative 3 where the greatest volume of contaminated soils would remain in place.

2.10.2 - Compliance with Applicable or Relevant and Appropriate Requirements

This criterion assesses how the alternatives comply with regulatory requirements. Federal and state regulatory requirements that are either applicable or relevant and appropriate are known as ARARs. Only state requirements that are more stringent than federal requirements are ARARs. There are three different categories of ARARs: chemical-specific, action-specific, and location-specific ARARs. Potential ARARs were identified during the FS and were included in Table 1 of EPA's July 2012 Proposed Plan.

Alternatives 3, 4A and 4B would all comply with ARARs. Alternative 1 would not comply with ARARs.

The ARARs that have been identified for the Selected Remedy are included in this ROD as Appendix B.

2.10.3 - Long-term Effectiveness and Permanence

This criterion evaluates the effectiveness of the alternatives in protecting human health and the environment in the long term, after the cleanup is complete.

Alternative 1 would not provide any degree of long-term effectiveness or permanence because no action would be taken. Each of the remaining, active alternatives would meet the RAO and provide long-term effectiveness and permanence once the RAO is met. The active alternatives are combinations of proven and reliable remedial processes, and the potential for failure of any individual component is low. The evaluation of the active alternatives against this criterion resulted in the following findings:

- Alternative 3 would achieve long-term effectiveness through covering the metals-contaminated soil onsite as the primary component of the remedy, with O&M and institutional controls to ensure and verify the ongoing effectiveness and permanence of the remedy. Implementation of Alternative 3 would introduce topographic changes to the properties that would need to be maintained to ensure protectiveness. Therefore, the long-term effectiveness of this alternative is completely dependent on (1) O&M to prevent erosion and potential exposure to contaminated soils that remain in place, and (2) institutional controls to prevent unauthorized activities that could result in exposure to contaminated soils that remain in place.

- Alternative 4A would achieve long-term effectiveness by removing soil that exceeds RALs and disposing of it at an off-site disposal facility. Alternative 4A would likely leave some contaminated material in place deeper than 24 inches bgs if the contamination exceeding RALs extends deeper than 24 inches. (Native sand was encountered above 24 inches bgs at all but a few locations in OU1 where borings were advanced.) Any material exceeding RALs that is left in place would require O&M and institutional controls to maintain the effectiveness and permanence of the remedy.
- Alternative 4B would achieve long-term effectiveness by removing all non-native soils down to native sand (estimated to be no more than 24 inches bgs at most properties) from yards that exceed RALs and disposing of those soils at an off-site disposal facility.

Alternatives 3, 4A, and 4B are all proven methodologies that meet the requirements for long-term effectiveness and permanence. Compared to Alternative 3, Alternatives 4A and 4B would provide an additional level of protectiveness because wastes above RALs would be removed and sent off-site for disposal. Alternative 4B would provide the greatest degree of long-term effectiveness and permanence because all soil exceeding RALs would be removed from impacted yards.

2.10.4 - Reduction of Toxicity, Mobility, or Volume through Treatment

This criterion addresses the preference for selecting remedial actions that use treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of the hazardous substances. This preference is satisfied when treatment is used to reduce the principal threats at a site through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible encapsulation, or reduction of total volume of contaminated media.

EPA has estimated that approximately 7% of the soils at OU1 have lead concentrations that exceed the TC threshold and that would therefore be considered hazardous waste. These soils are considered principal threat wastes due to their toxicity and potential to leach to groundwater.

Alternatives 1 and 3 would not reduce the toxicity, mobility, or volume of contaminated materials since no treatment would be applied. Alternatives 4A and 4B would reduce the toxicity and mobility of those soils with lead levels that exceed the TC threshold through the use of ex-situ treatment prior to disposal. The amount of material requiring treatment is expected to be the same for Alternatives 4A and 4B. The treatment used under Alternatives 4A and 4B would not reduce the volume of contaminated materials.

2.10.5 - Short-term Effectiveness

This criterion examines the effectiveness of the alternatives in protecting human health and the environment during implementation of the cleanup until the cleanup is complete. It considers protection of the community, workers, and the environment during the cleanup. For OU1, the short-term effectiveness criterion is primarily related to the volume of contaminated soils addressed in each alternative, the time necessary to implement the remedy, potential risks to workers, and potential impacts to the community during implementation of the remedy.

Each of the active alternatives would have short-term impacts that include increased potential for exposure to lead-contaminated soils and construction-related risks. Potential for exposure to lead-contaminated soils would increase in the short term through creation of dust during excavation activities and increased potential for workers to come in contact with lead-contaminated soils above RALs. Construction-related risks include the potential for vehicle accidents, traffic and noise from construction vehicles, increased wear on local roads, and other risks associated with construction work. These impacts can be mitigated by implementing a project-specific health and safety plan, keeping excavation areas properly wetted to reduce dust generation, planning truck routes to minimize disturbances to the surrounding community, and using other best management practices.

There are no short-term impacts associated with Alternative 1 since no action would be taken. Of the action alternatives, Alternative 3 requires the least disturbance of lead-contaminated soils and the shortest duration of construction. Compared to Alternative 3, Alternatives 4A and 4B present greater short-term impacts because they require a greater amount of material to be moved to and from the site. Construction of these alternatives would also take longer than Alternative 3. The duration of construction work for the action alternatives progresses from an estimated 18 months for Alternative 3, to 26 months for Alternative 4A, to 40 months for Alternative 4B. Increasing the duration of construction means increased truck traffic, potential for vehicle accidents, construction-related and exposure risks to workers, as well as extending the time during which the local community would be subjected to increased dust and noise.

2.10.6 - Implementability

This criterion assesses the technical and administrative feasibility of an alternative and the availability of required goods and services. Technical feasibility considers the ability to construct and operate a technology and its reliability, the ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of a remedy. Administrative feasibility considers the ability to obtain approvals from other parties or agencies and the extent of required coordination with other parties or agencies.

Alternative 1 could easily be implemented as no action would be taken. Alternatives 3, 4A, and 4B are proven, could be readily implemented, and have been used successfully for other environmental cleanup projects. In addition, Alternatives 3, 4A, and 4B could all be completed using readily available conventional earth-moving equipment. EPA expects that most of the necessary services and construction materials are readily available. Qualified commercial contractors with experience are available locally to perform the work.

Alternative 3 would be more difficult to implement than Alternatives 4A and 4B since it requires a more detailed remedial design plan to maintain safe grading for each of the contaminated yards. Raising the grade of each impacted yard by 12 inches under Alternative 3 would pose technical and administrative challenges. The areas where the soil cover must be tied into the existing grade (such as at streets) would require excavation and would likely erode more rapidly than the surrounding areas. This could pose physical safety concerns for the elderly and young. Each yard would need to undergo a custom remedial design to achieve proper storm water drainage.

All of the alternatives are administratively feasible. Although no permits would be required, a similar level of coordination would be needed with state and local parties during design and construction activities for the action alternatives. However, Alternative 3 would likely be more difficult to implement because property owners may not want the grade of their properties raised by 12 inches; access may therefore be difficult to obtain.

2.10.7 - Cost

This criterion evaluates the capital and operation and maintenance costs of each alternative. Present-worth costs are presented to help compare costs among alternatives with different implementation times.

The present worth costs for the alternatives are presented within the descriptions of alternatives in Section 2.9.2 of this ROD. The detailed cost estimates and associated assumptions for all alternatives are in the FS and other documents within the administrative record. The cost estimates are consistent with the level of estimation required in the FS phase. The estimate is within a range of accuracy of +50 to -30 percent. A final cost estimate will be developed and refined during the remedial design process.

Alternative 1 has no associated capital or O&M costs since no action would be taken. The remaining three alternatives are progressively more expensive. Alternative 3 is the least costly action alternative ($20.9 million) and Alternative 4A is the next most costly option ($29.9 million). Alternative 4B is the most costly alternative ($45.4 million), costing more than twice as much as Alternative 3. The cost savings anticipated to be realized in Alternative 4B by not collecting and analyzing post-excavation confirmation samples are more than offset by the increased cost of handling and transporting for off-site disposal a greater volume of soil, since the process of removing all soils down to the native sand would include soils that do not exceed the RALs.

2.10.8 - State/Support Agency Acceptance and Community Acceptance

State/support agency acceptance considers the state's preferences among or concerns about the alternatives, including comments on regulatory criteria or proposed use of waivers. Community acceptance considers the community's preferences or concerns about the alternatives.

The State of Indiana supports the selection of Alternative 4A as the Selected Remedy. The State's concurrence letter is included as Appendix A.

During the public comment period, the community expressed general support for Alternative 4A, although some citizens and the City of East Chicago supported Alternative 4B. All attendees who expressed their opinion at the proposed plan public meeting strongly disliked Alternative 3. A complete list of the public comments and EPA's response to the comments is contained in the *Responsiveness Summary*, which is Part 3 of this ROD. In addition, the transcript from the proposed plan public meeting is included in the administrative record.

2.10.9 – Comparative Analysis Summary

Appendix C provides a summary, in table form, of the comparative analysis of the alternatives described in Sections 2.10.1 through 2.10.8 above.

2.11 – Principal Threat Waste

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP §300.430(a)(1)(iii)(A)). Identifying principal threat wastes combines concepts of both hazard and risk. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or will present a significant risk to human health or the environment should exposure occur. Conversely, low-level threat wastes are those source materials that generally can be reliably contained and that will present only a low risk in the event of exposure. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied.

Wastes that generally will be considered to constitute principal threats include but are not limited to the following:

- **Liquid source material** - wastes contained in drums, lagoons or tanks, or free product in the subsurface (i.e., non-aqueous phase liquids) containing contaminants of concern (generally excluding groundwater).

- **Mobile source material** - surface soil or subsurface soil containing high concentrations of chemicals of concern that are (or potentially are) mobile due to wind entrainment, volatilization (e.g., volatile organic compounds), surface runoff, or subsurface transport.

- **Highly toxic source material** – buried, drummed non-liquid wastes; buried tanks containing non-liquid wastes; or soils containing significant concentrations of highly toxic materials.

Wastes that generally will not constitute principal threats include but are not limited to the following:

- **Non-mobile contaminated source material of low to moderate toxicity** - surface soil containing chemicals of concern that generally are relatively immobile in air or groundwater (i.e., non-liquid, low volatility, low leachability contaminants such as high molecular weight compounds) in the specific environmental setting.

• **Low toxicity source material** - soil and subsurface soil concentrations not greatly above reference dose levels or that present an excess cancer risk near the acceptable risk range if exposure were to occur.

At OU1 of the USS Lead site, EPA considers soils with lead concentrations exceeding the TC threshold to be principal threat waste that requires chemical stabilization prior to disposal. Without treatment, lead from such soils could potentially leach to groundwater.

Cleanup Alternatives 4A and 4B will best address the principal threat wastes at OU1 by chemically stabilizing those soils with lead concentrations above the TC threshold prior to disposal.

2.12 – Selected Remedy

The Selected Remedy for OU1 of the USS Lead Site is Remedial Alternative 4A: Excavation of Soil Exceeding RALs + Off-site Disposal + *Ex-situ* Treatment Option.

Summary of the Rationale for the Selected Remedy

EPA chose Alternative 4A as the Selected Remedy because it represents the best balance of the evaluation criteria among all the alternatives. Alternative 4A meets the RAO of reducing exposure of residents to contaminated soils that pose a health risk through the removal and off-site disposal of those soils, and allows for the continued residential use of impacted residential properties within OU1. Alternative 4A is more easily implemented and requires fewer restrictions on property use than Alternative 3, which involves placing a soil cover on the contaminated soil. Alternative 4A also reduces risk within a more reasonable time frame and at a lower cost than the other excavation alternative (Alternative 4B), and provides for long-term reliability of the remedy.

Based on the information available at this time, EPA and the State of Indiana believe that the Selected Remedy will (1) be protective of human health and the environment, (2) comply with ARARs, (3) be cost-effective, and (4) utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. Because it will treat those soils constituting principal threats, the remedy also will meet the statutory preference for the selection of a remedy that involves treatment as a principal element.

Description of the Selected Remedy

The Selected Remedy achieves protectiveness by removing impacted soil that exceeds RALs, to a maximum excavation depth of 24 inches, while leaving in place soils with concentrations below the RALs. The RALs for lead are 400 mg/kg at residential properties and 800 mg/kg for commercial/industrial properties. The RAL for arsenic is 26 mg/kg. Under the Selected Remedy, soil exceeding RALs will be excavated from impacted yards within OU1 to a maximum depth of 24 inches bgs and transported off-site for disposal at a Subtitle D landfill.

Excavated soil that exceeds the TC regulatory threshold will be chemically stabilized prior to disposal. EPA estimates that soil with lead concentrations above 2,400 mg/kg (an estimated 7% of the excavated yards at OU1) exceeds the TC regulatory threshold and considers these soils to be principal threat waste.

Pre-remedial sampling will be conducted at impacted properties to determine the approximate excavation depth required in each yard, and confirmation samples will be collected as needed during the excavation work to confirm that all soils exceeding RALs within the top 24 inches were excavated. If contaminated soil is identified at a depth greater than 24 inches bgs, a visual barrier such as orange construction fencing or landscape fabric will be placed above the contaminated soil and beneath the clean backfill soil. In such instances, institutional controls will be implemented to ensure that users of the property are not exposed to COCs in soil. The institutional controls will be deed restrictions that will require the use of the proper procedures for handling contaminated material in the event that any future excavation work must intrude into the underlying contamination.

EPA assumes that soil will be loaded directly into roll-off containers and transported to the landfill for disposal. If a stockpiling location that is acceptable to the community is identified, then excavated soils could be stockpiled prior to being transported to the landfill.

Excavated soil will be replaced with clean soil, including 6 inches of top soil, to maintain the original grade. Each yard will be restored as close as practicable to its pre-remedial condition. Once the properties are sodded or seeded, O&M of the sod or seed, including watering, fertilizing, and cutting, will be conducted for 30 days. After the initial 30-day period, property owners will be responsible for the maintenance of their own yards. Since some soil exceeding RALs will likely be left in place at OU1 (e.g. within some yards deeper than 24 inches bgs), statutory five-year reviews of the remedy will be required in accordance with CERCLA.

Summary of the Estimated Remedy Costs

The estimated cost of implementing the Selected Remedy at OU1 is $29.9 million. A detailed cost estimate for the Selected Remedy, Alternative 4A, is included as Appendix D. The cost estimate is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data that will be collected during the remedial design phase. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

Expected Outcome of the Selected Remedy

The expected outcome of the Selected Remedy is that residents in OU1 will no longer be exposed to soil that poses a threat to human health. The land use of the properties will remain unchanged, and the Selected Remedy will allow for the continued residential use of impacted yards. As noted above, some properties may require institutional controls, for those situations where contamination remains in place at depths greater than 24 inches bgs.

2.13 – Statutory Determinations

Under CERCLA §121 and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the Selected Remedy meets these statutory requirements.

Protection of Human Health and the Environment

The current and potential future risks at OU1 are due to the presence of lead and arsenic in residential soils. Implementation of the Selected Remedy, Alternative 4A, will be protective of human health and the environment through the removal of soils with lead concentrations above 400 mg/kg at residential properties, schools and parks, 800 mg/kg at commercial or industrial properties, and/or arsenic concentrations above 26 mg/kg. The site-specific RAO was developed to protect current and future receptors that are potentially at risk from exposure to the contaminants at OU1. The Selected Remedy will achieve the RAO. Institutional controls will be employed at those properties where contamination is left in place at depths greater than 24 inches bgs in order to ensure that the remedy remains protective.

Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA requires that Superfund remedial actions meet ARARs. Appendix B provides all ARARs that have been identified for the remedial action. The Selected Remedy will comply with the identified ARARs.

Cost-Effectiveness

EPA has concluded that the Selected Remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness" (NCP §300.430(f)(1)(ii)(D)). For OU1, this determination was made by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). Overall effectiveness was then compared to costs to determine cost-effectiveness. The relationship of the overall effectiveness of the Selected Remedy was determined to be proportional to its costs. The Selected Remedy therefore represents a reasonable value for the money to be spent.

Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

EPA has determined that the Selected Remedy for OU1 represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the Selected Remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and bias against off-site disposal, and considering state and community acceptance. The Selected Remedy removes the contaminated soils at OU1 from the top 24 inches of impacted yards, and treats those materials constituting principal threats. The Selected Remedy therefore provides a permanent solution for both the low-level and principal threat wastes at OU1 that is effective in the long term, and achieves significant reductions in leachability to groundwater. The short-term risks associated with the Selected Remedy are greater than those presented by Alternative 3 and less than those presented by Alternative 4B, but those risks are offset by implementability and cost considerations.

Preference for Treatment as a Principal Element

By treating those soils that exceed the TC threshold prior to disposal, the Selected Remedy addresses the principal threats posed at OU1 through the use of chemical stabilization treatment technologies. By utilizing treatment as a portion of the remedy, the Selected Remedy satisfies to the maximum extent practicable the statutory preference for remedies that employ treatment as a principal element.

Five-Year Review Requirements

Because this remedy will likely result in hazardous substances, pollutants, or contaminants remaining on-site, at depth but above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of the remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

2.14 – Documentation of Significant Changes

The Proposed Plan for OU1 was released for public comment on July 12, 2012. The Proposed Plan identified as the preferred alternative Remedial Alternative 4A, Excavation of Soil Exceeding RALs + Off-site Disposal + *Ex-situ* Treatment Option. After carefully reviewing all written and verbal comments submitted during the public comment period, EPA has determined that no significant changes to the remedy as originally identified in the Proposed Plan are necessary or appropriate. While not considered a significant change, EPA notes that the cost estimates and estimated construction timeframes for Alternatives 3, 4A and 4B are slightly different in the ROD than in the Proposed Plan. After release of the Proposed Plan, the cost and time estimates were revised as a result of refined estimates of the volume of contamination that would need to be addressed under each of the alternatives. The revised cost and time estimates neither impact the outcome of the comparison of alternatives nor alter EPA's selection of Alternative 4A as the Selected Remedy.

Part 3 – Responsiveness Summary

The Proposed Plan for the USS Lead Site was released for public comment on July 12, 2012. At the request of the City of East Chicago, Indiana, EPA extended the public comment period for thirty days until September 12, 2012. EPA held a public meeting in East Chicago, Indiana, on July 25, 2012, to describe the Proposed Plan and answer questions about the different cleanup alternatives. The public meeting also provided the community with an opportunity to comment on the proposed cleanup alternative and the other alternatives evaluated. EPA received several general comments and a few technical comments at the public meeting. Additional comments were provided to EPA in writing during the comment period. These comments and responses are divided into two parts in this *Responsiveness Summary*. Part 1 includes general stakeholder issues and lead agency responses. Part 2 includes specific technical comments related to the alternatives evaluated in the Proposed Plan.

3.1 – Stakeholder Comments and Lead Agency Responses

Comment: A resident expressed support for EPA's preferred remedy (Alternative 4A).

> **Response:** EPA has noted the support.

Comment: Two persons stated that EPA should select Alternative 4B.

> **Response:** EPA carefully considered Alternative 4B during its comparative analysis of the various cleanup alternatives. Under Alternative 4B, impacted yards would be excavated down to native sand without confirmation sampling, which means that clean soils that do not exceed RALs would also be excavated and transported off-site for disposal along with contaminated soils. EPA selected Alternative 4A, which excavates contaminated soils to a maximum depth of 24 inches and includes confirmation sampling, because it represents the best balance of the evaluation criteria. EPA determined that Alternative 4B is not significantly more protective in the long term than Alternative 4A. It is, however, much more expensive, would take longer to implement, and would pose higher short-term risks to the community than Alternative 4A. Because Alternative 4B is estimated to cost about $15 million more than Alternative 4A while providing only an insignificant increase in long-term effectiveness, it is much less cost effective than Alternative 4A. Both alternatives remove all of the soils above RALs that pose a risk to residents – namely the contamination within the top two feet of impacted yards.

Comment: Several persons commented that EPA should conduct medical testing of residents in the area, particularly lifelong residents. One commenter stated that she is a life-long resident of the area and suffer from illnesses.

> **Response:** EPA does not intend to conduct medical testing as a part of the remedy. EPA is confident that the remedy, once implemented, will reduce to an acceptable level the risk to human health and the environment posed by lead- and arsenic-contaminated soils. Section 104 of CERCLA (the Superfund law) authorized the creation of the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR has the primary

responsibility at the federal level for performing health assessments. The Indiana Department of Health and the Lake County, Indiana, Department of Health may also be better positioned to address these concerns.

Comment: A commenter requested that EPA conduct health studies on residents in conjunction with implementation of the remedy. The commenter stated that they are a life-long resident of the area and suffer from illnesses.

Response: EPA conducts cleanups based upon the current or future risk of human or environmental exposure to contaminated material. This approach is conservative in that there does not need to be actual current exposure – or evidence of adverse impacts to human health or the environment – for EPA to require a cleanup. Health studies are based upon current conditions and at USS Lead would reflect how current residents are using their yards. As future residents may use yards differently than current residents, health studies done on current residents may not reflect future health risks posed to future residents. For these reasons, EPA does not conduct health studies as a part of the remedy selection process.

Comment: EPA should not dispose of contaminated soil removed from the USS Lead Site at the new East Chicago Landfill.

Response: EPA does not yet know where the contaminated soil excavated from OU1 will be sent for disposal. EPA does not always select the disposal location during the remedy selection process, but does require that the disposal location be permitted to accept the waste materials from the site and be in compliance with federal and state regulations. EPA will decide where to dispose of the contaminated soil from OU1 during the remedial design phase.

Comment: One commenter stated that he did not believe the soil at his property is contaminated and for that reason does not want his property excavated.

Response: EPA will respect the wishes of individual homeowners if they refuse access to their property, though it strongly encourages homeowners to allow their yards to be tested and remediated if appropriate. All testing and cleanup work will be conducted at no cost to the property owner.

Comment: The City of East Chicago commented that EPA should consider area restoration and reuse and partner with the city throughout the cleanup process.

Response: The area that makes up OU1 of the USS Lead Site is predominantly residential. EPA's Selected Remedy will maintain current land uses within OU1. Further, the Selected Remedy does not prevent construction or redevelopment at any property within OU1, although if any properties have contamination left behind deeper than 24 inches bgs, institutional controls would require that all subsurface work at those properties be done in accordance with approved procedures. Additionally, EPA will communicate and coordinate closely with the city during the OU1 cleanup process.

3.2 – Technical and Legal Issues

Comment: EPA should evaluate use of the USS Lead property as a disposal facility.

> **Response:** EPA does not intend to dispose of contaminated material at the USS Lead facility (OU2) for the following reasons: (1) The residential portion of the USS Lead Site is located within an environmental justice community that is already home to several disposal facilities. Further disposal at the USS Lead property, immediately adjacent to the southern edge of OU1, would increase the environmental burden already borne by the residents of OU1; (2) contamination still remains at the USS Lead property that requires further evaluation; and, (3) some of the material that will be excavated and require disposal will be a hazardous waste; the corrective action management unit located within the USS Lead facility is not a hazardous waste landfill and cannot accept such wastes.

Comment: The ATSDR's January 27, 2011, report does not support EPA's determination that the USS Lead Site requires a cleanup.

> **Response:** ATSDR's statement that, "Breathing the air, drinking tap water or playing in soil in neighborhoods near the USS Lead Site is not expected to harm people's health," is based upon low blood lead levels in children within East Chicago. In determining whether to perform response actions, EPA evaluates the current and potential threats to human health and the environment posed by exposure to hazardous substances. EPA estimates these threats by using risk calculations that are based upon the physical characteristics of the site and the general characteristics of the hazardous substances. Present day blood lead levels reflect neither current nor future risk of exposure. EPA has analyzed the current and potential threats posed by contaminated soil within the residential portion of the USS Lead Site and concluded that soils with lead levels exceeding 400 mg/kg and arsenic levels exceeding 26 mg/kg pose a risk to the health of residents living within OU1. EPA has concluded that these conditions require it to undertake response actions.

Comment: Several persons commented that a RAL for lead of 400 mg/kg is too conservative. They recommended that EPA calculate a site-specific Preliminary Remediation Goal for lead and noted that the RAL of 400 mg/kg (the standard output from the IEUBK model) is not site-specific. They also stated that EPA should perform a bioavailability study for the site, and argued that a bioavailability study would likely conclude that lead in the residential portion of the USS Lead Site poses a low risk because it is not readily bioavailable.

> **Response:** EPA did evaluate the use of site-specific inputs for the IEUBK model but decided to use the IEUBK model set to the general default parameters. EPA compared the available site-specific data with the default parameters and concluded that the site-specific information was not significantly different from the default inputs. For example, EPA looked at lead uptake through drinking water at the USS Lead site. The source drinking water lead data is from samples collected annually by the City of East Chicago at 30 residential taps within East Chicago. In 2011, the lead in drinking water in East Chicago was reported as 3.6 ppb (or 4 ppb if you round up to the nearest integer). The

default drinking water input for the IEUBK model is 4 ppb. As these concentrations are not significantly different, EPA deemed it appropriate to use the base input parameter.

Comment: EPA should not select cleanup Alternative 4A (excavation with confirmation sampling to a maximum depth of 24 inches) as it is not cost effective. The commenter added that Alternative 3 (installation of a 12-inch soil cap) is cost effective and should be the selected remedy.

Response: EPA determines cost effectiveness by comparing the cost of an alternative with its long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, and short-term effectiveness. Alternative 3 would leave all contaminated materials in place and would introduce topographic changes to the properties. These changes would need to be maintained to ensure the remedy's permanence and long-term effectiveness. Alternative 4A removes the soil contamination within the top two feet bgs and restores yards to their existing topography, so erosion of soil barriers is not a concern with Alternative 4A. Alternative 4A therefore offers greater long-term effectiveness and permanence than Alternative 3. Alternative 4A represents the best combination of all the balancing criteria. Alternative 4A will also treat those soils considered to be principal threat waste, while the principal threat waste would go untreated in Alternative 3. For these reasons, Alternative 4A is more cost-effective than Alternative 3, despite its higher absolute cost.

Comment: One commenter stated that it is inappropriate for EPA to require the excavation of all soils at yards down to 24 inches if EPA collects a single sample with a concentration of lead above 400 mg/kg.

Response: The commenter's statement is not accurate. Under Alternative 4A, the decision to clean up any given yard will typically be made based on the results of composite soil samples collected from discrete 6-inch horizons. A composite soil sample combines the soil collected from several different areas within the yard, and therefore represents the average concentration in that yard. The only exception to this is that single, discrete soil samples will be considered when evaluating the contamination levels in gardens and play areas. Additionally, contaminated yards will not automatically be excavated to the depth of 24 inches. The maximum excavation depth is 24 inches, but could be less based on the amount of contamination present in a particular yard.

Comment: Alternative 3 would be preferable to the community as it is less intrusive in the community.

Response: During the public meeting on July 25, 2012, the community expressed general disapproval of Alternative 3.

Comment: USS Lead Refinery, Inc. is bankrupt and unable to fund a cleanup.

Response: EPA's remedy selection process is independent of available funding. EPA intends to pursue other potentially responsible parties to design and conduct the Selected Remedy.

Comment: It is unclear if EPA followed the *Superfund Lead-Contaminated Residential Sites Handbook* in consideration of future land use or sampling techniques.

> **Response:** EPA followed the Residential Lead Sites Handbook throughout the RI and FS processes, including sampling techniques and consideration of future land use.

Comment: The *Superfund Lead-Contaminated Residential Sites Handbook* is not straightforward.

> **Response:** EPA disagrees with this comment and is confident in its ability to follow and interpret the cited document.

Comment: Several persons commented that EPA should consider alternative remediation techniques.

> **Response:** EPA did consider alternative remediation techniques during the Feasibility Study. In-situ treatment technologies for soils contaminated with metals largely consist of encapsulation or the introduction of soil amendments to make the metals less bioavailable. These technologies show promise but the duration of their effectiveness is not yet known. It is possible that following treatment, metals over time may again become bioavailable. For these reasons, EPA decided that an alternative treatment technology remedy for OU1 of the USS Lead Site would not be protective of human health and the environment. EPA elected not to carry an alternative remediation technique remedy forward into the final array of cleanup alternatives.

Comment: The City of East Chicago stated its support for Alternative 4B (excavation down to native sand without confirmation sampling) over Alternative 4A (excavation to a maximum depth of 24 inches with confirmation sampling) because the former is more protective than Alternative 4A.

> **Response:** EPA has determined that at OU1 of the USS Lead Site, soils that exceed RALs in the top 24 inches of residential yards pose a threat to current and future residents. Alternative 4A may leave some contaminated soil deeper than 24 inches bgs at a limited number of yards, but EPA has concluded that soil deeper than 24 inches does not pose a risk to residents, and institutional controls will be implemented in situations where contamination remains at depth. Alternative 4B is not significantly more protective in the long term than Alternative 4A. It is, however, much more expensive, would take longer to implement, and would pose higher short-term risks to the community than Alternative 4A. Because Alternative 4B is estimated to cost about $15 million more than Alternative 4A while providing only an insignificant increase in long-term effectiveness, it is much less cost effective than Alternative 4A. Both alternatives remove all of the soils above RALs that pose a risk to residents – namely the contamination within the top two feet of impacted yards.

Comment: The City of East Chicago supports Alternative 4B over Alternative 4A because excavation to native sand would not leave in place any contaminated soil. If contaminated soil is left in place, the remedy requires the installation of subsurface barriers, maintenance of a soil cover, and the recording of deed restrictions or other requirements for construction activities at some properties located within the site. Alternative 4B is consistent with EPA's *Superfund Lead-Contaminated Residential Sites Handbook* that sets forth EPA's preference for permanent remedies that allow for remediated yards to be returned to unrestricted use. Furthermore, leaving contaminated material below 24 inches will make it more difficult or costly for the city or others to redevelop properties.

> **Response:** EPA recognizes that leaving some contaminated soils in place imposes burdens on the city and affected property owners. EPA has concluded, however, that these burdens do not warrant the expenditure of an additional $15 million when the expenditure will not yield any greater protection of human health or the environment.

Comment: A reader cannot determine which properties are to be remediated.

> **Response:** EPA intentionally removed references to individual addresses out of concern for the privacy of the property owners.

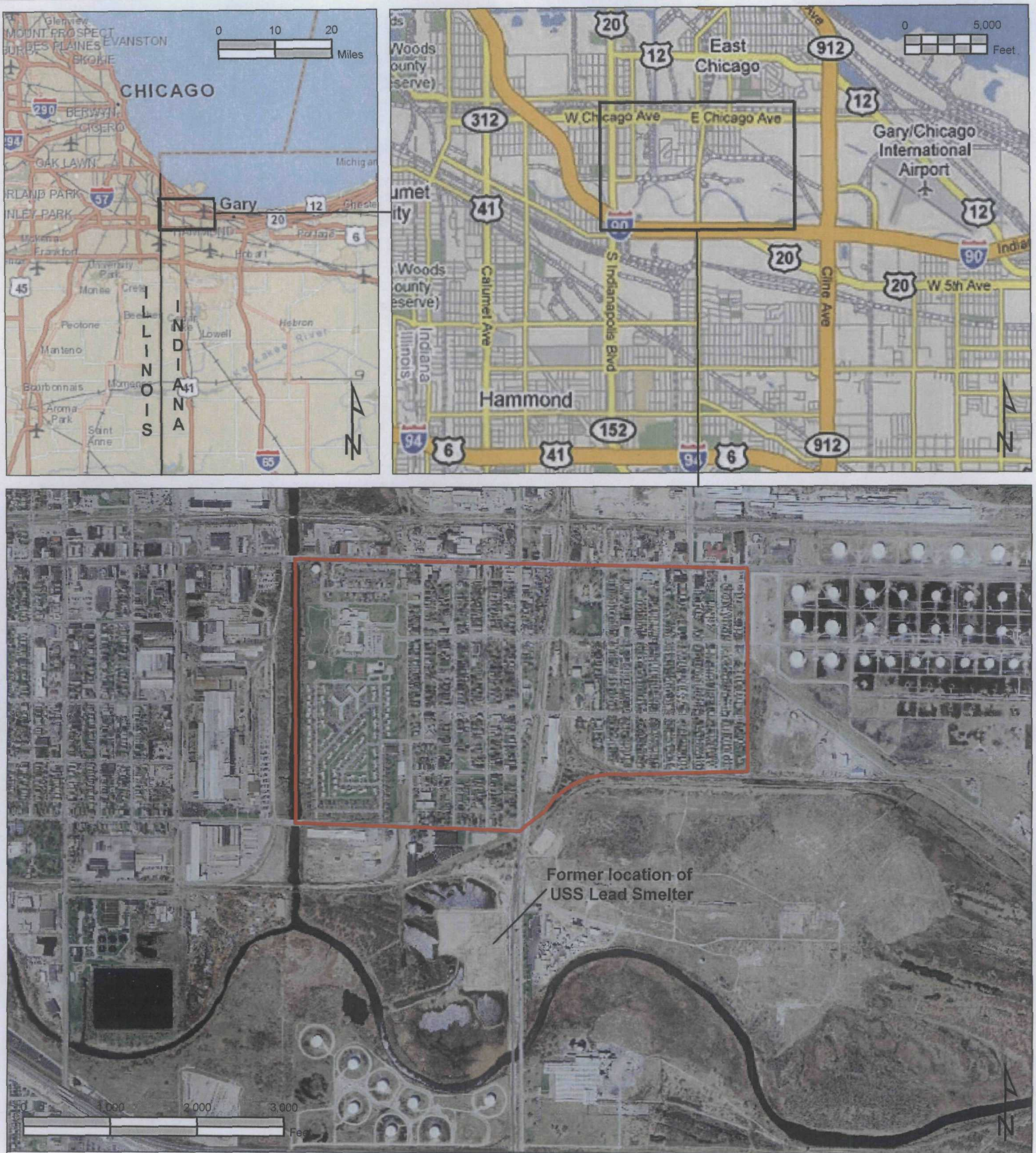
Comment: There are areas of the RI/FS in which EPA's data analysis is not transparent. Also, the text and tables present conflicting information. Finally, steps could be taken to increase the clarity of EPA's data analysis.

> **Response:** EPA is not aware of places within the RI/FS where statements in the text conflict with information presented in the tables. EPA has provided tables to indicate which data were included in statistics and how they were evaluated. The Human Health Risk Assessment Appendix to the RI contains close to 1700 pages of detailed tables that provide the data EPA considered for its evaluation of risks to human health. Section 5.2 of the RI contains a detailed description of the data upon which the RI is based. Section 5.3 of the RI contains a detailed description of the statistical treatment of data and data used for each contaminant of concern.

Comment: It is difficult to follow EPA's calculations for the purpose of estimating remedial volume.

> **Response:** Volume estimates are based on a number of factors, including the number of yards within each sub-area of the site, the average yard size for different types of properties, the proportion of those yards estimated to require cleanup, and the anticipated depths of excavation for the various different remedial alternatives. EPA calculated these volumes based on the information it collected during the RI so that it could conduct a comparison of relative costs of cleanup alternatives. During the remedial design phase, EPA will calculate more precise remedial volumes based upon data from many, if not all, of the properties in OU1.

FIGURES



OU1 boundary

Imagery sources (clockwise from upper left):
ESRI Resource Center
Google Maps
ISDP (Indiana Spatial Data Portal)

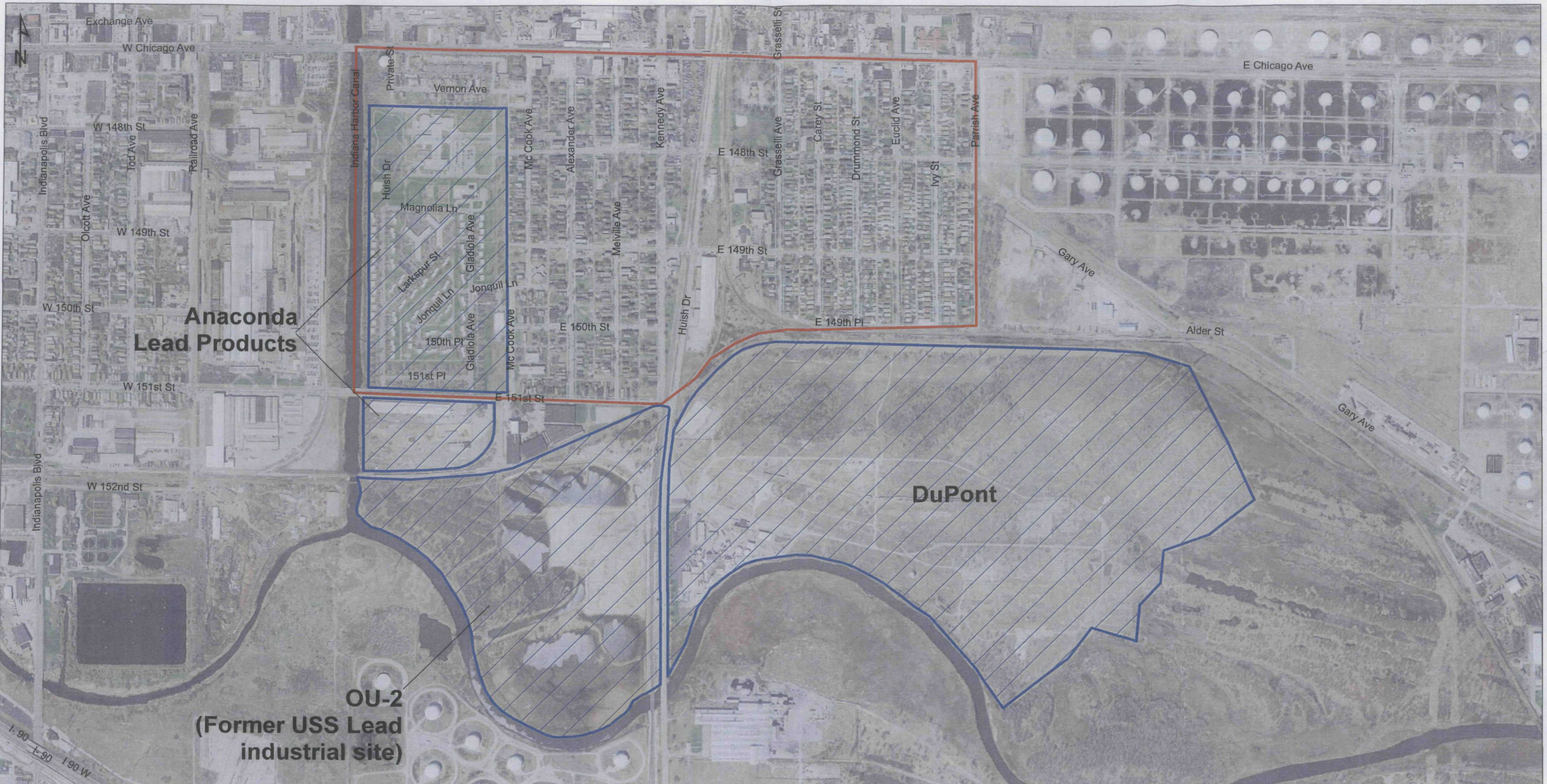
US SMELTER & LEAD REFINERY
LAKE COUNTY, EAST CHICAGO, INDIANA

RECORD OF DECISION

FIGURE 1
USS LEAD RESIDENTIAL AREA SITE LOCATION MAP

EPA REGION 5 RAC 2 | REVISION 0 | AUGUST 2012

ST SulTRAC



OU-1 boundary

Industrial sites

0 0.5 1 mile

1 inch = 800 feet

Imagery source:
ISDP (Indiana Spatial Data Portal)

US SMELTER & LEAD REFINERY
LAKE COUNTY, EAST CHICAGO, INDIANA

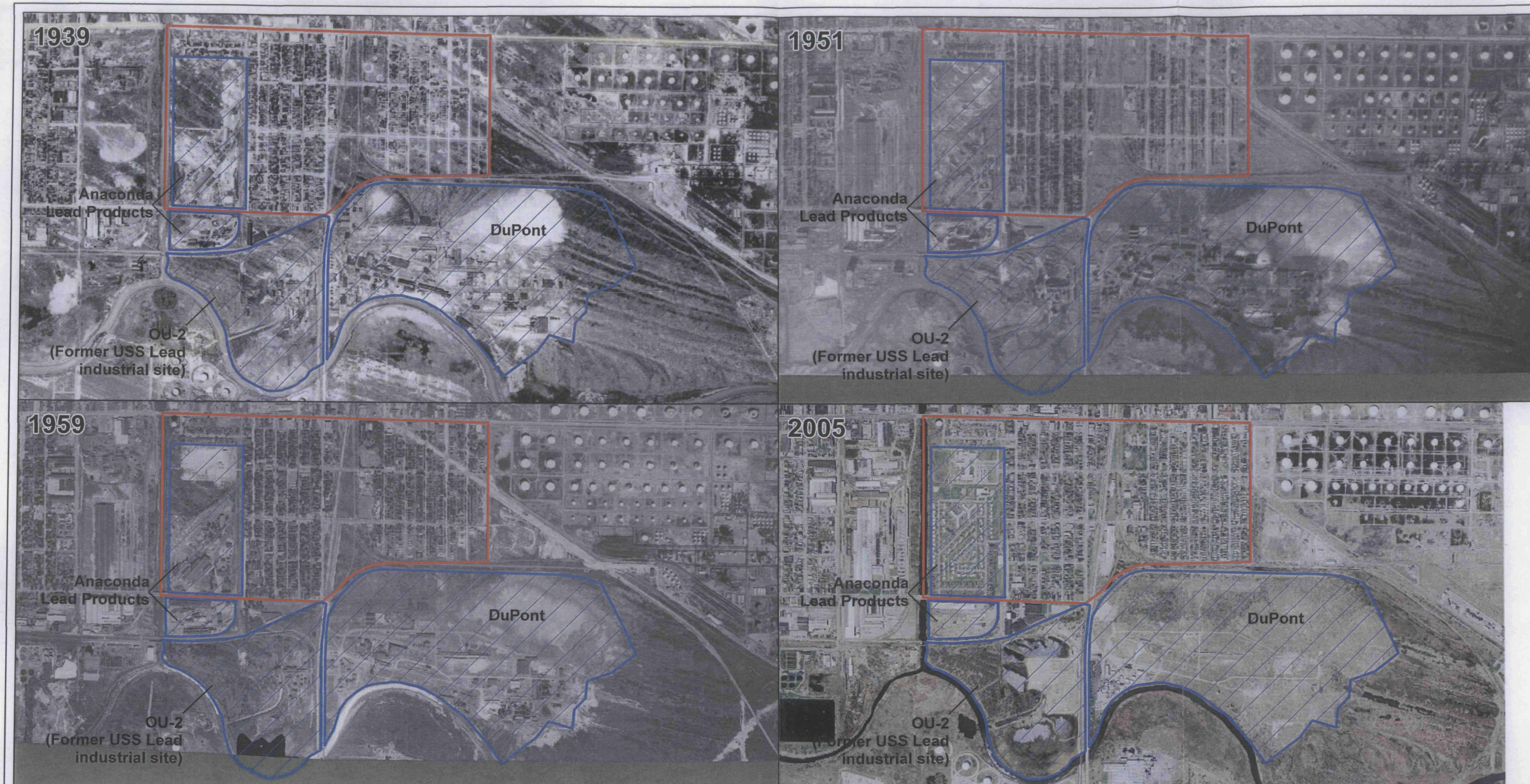
RECORD OF DECISION

FIGURE 2

HISTORICAL OVERVIEW OF STUDY AREA

EPA REGION 5 RAC 2 | REVISION 0 | AUGUST 2012

ST SulTRAC



OU-1 boundary

Industrial sites

Imagery sources (clockwise from upper left):
Indiana State Archives,
USGS EarthExplorer,
ISDP (Indiana Spatial Data Portal),
USGS EarthExplorer

Note: Graphic scale is approximate for the 1939, 1951 & 1959 imagery

0 1,000 2,000 3,000 4,000 5,000 approximate feet

1 inch approximately = 1,500 feet

N

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FIGURE 3

HISTORICAL IMAGERY

EPA REGION 5 RAC 2 | REVISION 0 | AUGUST 2012

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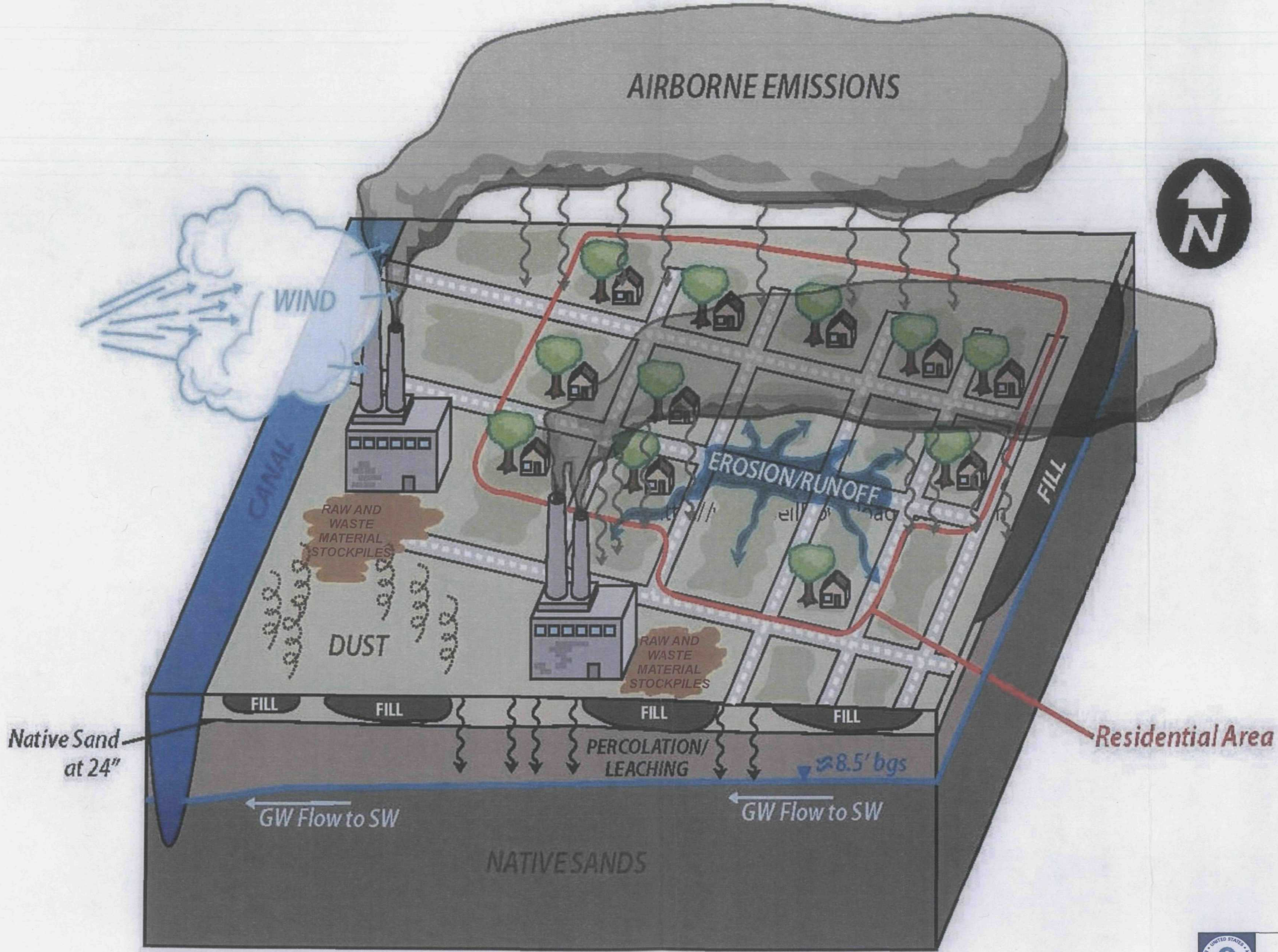

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RECORD OF DECISION

FIGURE 4

CONCEPTUAL SITE MODEL

EPA REGION 5 RAC 2 | REVISION 0 | AUGUST 2012

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APPENDIX A

State Concurrence Letter

IDEM INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
We Protect Hoosiers and Our Environment.

Mitchell E. Daniels, Jr.
Governor

Thomas W. Easterly
Commissioner

100 North Senate Avenue
Indianapolis, Indiana 46204
(317) 232-8603
Toll Free (800) 451-6027
www.idem.IN.gov

September 25, 2012

Ms. Susan Hedman
Regional Administrator
U.S. EPA, Region V
77 West Jackson St.
Chicago, Illinois 60604-3507
Mail Code: SRF-6J

Dear Ms. Hedman:

Re: Draft Record of Decision (*ROD*)
USS Lead Superfund Site
East Chicago, Indiana

The Indiana Department of Environmental Management (*IDEM*) has reviewed the U.S. Environmental Protection Agency's draft Record of Decision (*ROD*) document for the USS Lead Superfund site in East Chicago, Indiana. IDEM is in full concurrence with the major components of the selected remedy outlined in the document which include the following:

- Excavation of impacted soils that exceed Remedial Action Levels (*RALs*) to a maximum depth of two feet below the ground surface (*bgs*) and replacement with clean soil.

- Chemical stabilization of excavated soils, as necessary prior to disposal, to address soils exceeding the toxicity characteristic (*TC*) regulatory threshold.

- Disposal of excavated soils at an off-site Subtitle D landfill.

- Placement of a buried visual barrier, such as orange construction fencing, above soils exceeding the RALs if such soils are identified at a depth greater than two feet bgs, and the placement of Environmental Restrictive Covenants (*ERCs*) to protect the barrier.

IDEM staff agree that the selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost effective. IDEM staff have been working closely with Region V staff in the selection of an appropriate remedy and are satisfied with the selected alternative.

Please be assured that IDEM is committed to accomplish cleanup at all Indiana sites on the National Priorities List and intends to fulfill all obligations required by law to achieve that goal. We look forward to beginning remediation work on this project.

Sincerely,

Bruce H Palin

Bruce H Palin
Assistant Commissioner
Office of Land Quality

BP:DP:bl
cc: Peggy Dorsey, IDEM
Bruce Oertel, IDEM
Rex Osborn, IDEM
Michael Berkoff, EPA

APPENDIX B

List of Applicable or Relevant and Appropriate Requirements

APPENDIX B
List of Applicable or Relevant and Appropriate Requirements
USS Lead Site, OU1
East Chicago, Indiana

Applicable/ Relevant and Appropriate Requirements	Description	Type of ARAR	Applicable/ Relevant and Appropriate	Comment
CLEAN AIR ACT (CAA) of 1974				
42 USC Section 7401-7671	The Act is intended to protect the quality of air and promote public health. Title I of the Act directed the U.S. Environmental Protection Agency (EPA) to publish national ambient air quality standards for "criteria pollutants." In addition, EPA has provided national emission standards for hazardous air pollutants under Title III of the Act. Hazardous air pollutants are also designated hazardous substances under CERCLA. The Clean Air Act amendments of 1990 greatly expanded the role of National Emission Standards for Hazardous Air Pollutants by designating 179 new hazardous air pollutants and directed EPA to attain maximum achievable control technology standards for emission sources. Such emission standards are potential ARARs if selected remedial technologies produce air emissions of regulated hazardous air pollutants.	Action-specific	Applicable	The Act is considered an ARAR for remedies that involve creation of air emissions, such as excavation activities that might create dust. Also includes emissions rules that apply to equipment working on the project (based on date of manufacture and/or rebuild and/or overhaul).
FLOODPLAIN MANAGEMENT EXECUTIVE ORDER No. 11988				
40 CFR Part 6, Appendix A	Requires federal agencies to evaluate the potential adverse effects associated with direct and indirect development of a floodplain. Alternatives that involve modification/ construction within a floodplain may not be	Location-specific	Applicable	The Act is considered an ARAR as some properties within OU1 are adjacent to the Calumet Canal which feeds into the Grand Calumet River.

Applicable/ Relevant and Appropriate Requirements	Description	Type of ARAR	Applicable/ Relevant and Appropriate	Comment
	selected unless a determination is made that no practicable alternative exists. If no practicable alternative exists, potential harm must be minimized and action taken to restore and preserve the natural and beneficial values of the floodplain.			
CLEAN WATER ACT (CWA) OF 1977				
Protection of Wetlands Executive Order 11990 [40 CFR Part 6, Appendix A]	Under this Order, federal agencies are required to minimize the destruction, loss, or degradation of wetlands, and preserve and enhance natural and beneficial values of wetlands. If remediation is required within wetland areas and no practical alternative exists, potential harm must be minimized and action taken to restore natural and beneficial values.	Location-specific	Applicable	Applicability will be determined by location of wetlands, if any, along Grand Calumet River
Federal Water Pollution Control Act Section 401: Water Quality Certification	Establishes a permit program to regulate a discharge into the navigable waters of the U.S., including wetlands.	Action-specific	Relevant and Appropriate	

APPENDIX B
List of Applicable or Relevant and Appropriate Requirements
USS Lead Site, OU1
East Chicago, Indiana

Applicable/ Relevant and Appropriate Requirements	Description	Type of ARAR	Applicable/ Relevant and Appropriate	Comment
National Pollutant Discharge Elimination System 33 U.S.C. §§1251-1387 Clean Water Act NPDES Permit Program (40 CFR 122)	Regulates discharges of pollutants to navigable waters.	Action-specific and may be Chemical-specific	Relevant and Appropriate	Applies to disturbances of one acre or more of total land area and disturbances of less than one acre of land that are part of a larger common plan of development or sale if the larger common plan will ultimately disturb one or more acres of land.
FISH AND WILDLIFE COORDINATION ACT				
Fish and Wildlife Coordination Act; 16 U.S.C. §§661 et seq. 16 USC 742a 16 USC 2901 40 CFR 6.302 50 CFR 402	Actions that affect species/habitat require consultation with U.S. Department of Interior, U.S. Fish and Wildlife Service, and National Marine Fisheries Service, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. The effects of water-related projects on fish and wildlife resources must be considered. Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. Consultation with the responsible agency is also strongly recommended for on-site actions. Under 40 CFR Part 300.38, these requirements apply to all response activities under the National Contingency Plan.	Location-specific	Applicable	

APPENDIX B
List of Applicable or Relevant and Appropriate Requirements
USS Lead Site, OU1
East Chicago, Indiana

Applicable/ Relevant and Appropriate Requirements	Description	Type of ARAR	Applicable/ Relevant and Appropriate	Comment
RESOURCE CONSERVATION AND RECOVERY ACT OF 1976				
Off-Site Land Disposal Subtitle C [40 CFR 260-268]	Soil and/or sediment that is excavated for off-site disposal and constitutes a hazardous waste must be managed in accordance with the requirements of RCRA.	Action-specific	Applicable	Applicable for management of soils that are characteristic hazardous wastes.
Land Disposal Restrictions [40 CFR 268.2]	The land disposal restrictions (LDR) provide a second measure of protection from threats posed by hazardous waste disposal by ensuring that hazardous waste cannot be placed on the land until the waste meets specific treatment standards to reduce the mobility or toxicity of its hazardous constituents. Hazardous waste destined for land disposal must meet the applicable Land Disposal Regulations of 40 CFR 268.	Action-specific	Relevant and Appropriate	Relevant for treatment of soils that are characteristic hazardous wastes.
Land Treatment [40 CFR 264.270 to 264.283 Subpart M]	Establishes standards applicable for owners and operators of facilities that treat or dispose of hazardous waste in land treatment units to ensure that hazardous constituents placed in or on the treatment zone are degraded, transformed, or immobilized within the treatment zone.	Action-specific	Relevant and Appropriate	Applicable if treatment of residue piles to render them non-hazardous occurs in a land treatment unit.
Special Provisions for Cleanup [40 CFR 264.550 to 264.555 Subpart S]	Establishes standards for corrective action management units, temporary units, and staging piles.	Action-specific	Applicable	Staging piles or temporary units may be needed for residue that may be a characteristic hazardous waste.

APPENDIX B
List of Applicable or Relevant and Appropriate Requirements
USS Lead Site, OU1
East Chicago, Indiana

Applicable/ Relevant and Appropriate Requirements	Description	Type of ARAR	Applicable/ Relevant and Appropriate	Comment
Miscellaneous Units [40 CFR 264.600 to 264.603 Subpart X]	Establishes design and operating requirements, detection and monitoring requirements, and requirements for responses to releases of hazardous waste or hazardous constituents from the unit.	Action-specific	Applicable/Relevant and Appropriate	ARAR if treatment or storage of the TCLP hazardous materials is in miscellaneous units.
Definition of a hazardous waste [40 CFR 261.3(d) and 329 IAC 3.1]	Applies to contaminated containment components, contaminated soils, and structures and equipment contaminated with waste.	Action-specific	Relevant and Appropriate	Substantive requirements are ARARs for identifying and managing characteristic hazardous waste.
Hazardous waste determination [40 CFR 262.11 and 329 IAC 3.1-6]	Requires that a proper hazardous waste determination must be made on all wastes generated from remedial actions.	Action-specific	Relevant and Appropriate	Substantive requirements are ARARs for identifying and managing characteristic hazardous waste.
Pre-Transportation Requirements [40 CFR 262.30, 262.31, 262.32, and 262.33 and 329 IAC 3.1-7 and 329 IAC 3.1-8]	All hazardous waste must be properly packaged, with labels, markings, and placards, prior to transport.	Action-specific	Relevant and Appropriate	
Standards applicable to the generators of hazardous waste - The manifest [40 CFR 262, Subpart B and 329 IAC 3.1-7 and 329 IAC 3.1-8]	Hazardous waste stored on-site in containers for greater than 90 days shall be managed in accordance with 40 CFR 262, Subpart B (329 IAC 3.1-7 and 329 IAC 3.1-8).	Action-specific	Applicable	

APPENDIX B
List of Applicable or Relevant and Appropriate Requirements
USS Lead Site, OU1
East Chicago, Indiana

Applicable/ Relevant and Appropriate Requirements	Description	Type of ARAR	Applicable/ Relevant and Appropriate	Comment
Standards applicable to the generators of hazardous waste - The manifest [40 CFR 262, Subpart B and 329 IAC 3.1-7 and 329 IAC 3.1-8]	Hazardous waste must be manifested as such for transport to a permitted treatment, storage, or disposal facility (TSDF)	Action-specific	Relevant and Appropriate	
Standards for owners and operators of hazardous waste treatment, storage, and disposal facilities - Waste piles [40 CFR 264, Subpart L]	Any excavated contaminated soils must not be placed back on the ground so as to create a waste pile. Covered rolloff containers may be used.	Action-specific	Relevant and Appropriate	
Use and management of containers [40 CFR 265, Subpart I and 329 IAC 3.1-10]	Hazardous waste stored on-site in containers for 90 days or less shall be managed in accordance with the standards of 40 CFR 265, Subpart I (329 IAC 3.1-10).	Action-specific	Relevant and Appropriate	
SOLID WASTE DISPOSAL ACT				
Identification and Listing of Hazardous Waste (40 CFR 261) Subpart B	Sets criteria for identifying a hazardous waste.	Action-specific	Relevant and Appropriate	

APPENDIX B
List of Applicable or Relevant and Appropriate Requirements
USS Lead Site, OU1
East Chicago, Indiana

Applicable/ Relevant and Appropriate Requirements	Description	Type of ARAR	Applicable/ Relevant and Appropriate	Comment
Identification and Listing of Hazardous Waste (40 CFR 261) Subpart C	Identifies the characteristics of a hazardous waste.	Action-specific	Relevant and Appropriate	
Identification and Listing of Hazardous Waste (40 CFR 261) Subpart D, List of Hazardous Waste	Lists hazardous waste from sources	Action-specific	Relevant and Appropriate	
Standards for Hazardous Waste Generators (40 CFR 263)	General requirements for packaging, labeling, marking, and manifesting hazardous wastes for temporary storage and transportation off-site	Action-specific	Applicable	
Solid Wastes (40 CFR 264), Subpart D	Hazardous waste and debris may be placed in units known as containment buildings for the purpose of interim storage or treatment.	Action-specific	Applicable	
ENDANGERED SPECIES ACT				
Endangered Species Act [16 USC 1531]; 50 CFR 200	Requires that federal agencies ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any threatened or endangered species or adversely modify critical habitat.	Location-specific	Applicable	No endangered species are known to be present on the site that would be affected by remedial actions.

APPENDIX B
List of Applicable or Relevant and Appropriate Requirements
USS Lead Site, OU1
East Chicago, Indiana

Applicable/ Relevant and Appropriate Requirements	Description	Type of ARAR	Applicable/ Relevant and Appropriate	Comment
NATURAL HISTORIC PRESERVATION ACT				
National Historic Preservation Act [16 USC 661 et seq.] 36 CFR Part 65	Establishes procedures to provide for preservation of scientific, historical, and archaeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program. If scientific, historical, or archaeological artifacts are discovered at the site, work in the area of the site affected by such discovery will be halted pending a completion of any data recovery and preservation activities required pursuant to the act and any implementing regulations.	Location-specific	Applicable	No part of the USS Lead Residential Area is listed on the national register of historic places. Would be applicable during remedial activities if scientific, historic, or archaeological artifacts are identified during implementation of the remedy.
DEPARTMENT OF TRANSPORTATION				
Requirements for the Transport of Hazardous Materials [40 CFR 172]	Transportation of hazardous materials on public roadways must comply with the requirements.	Action-specific	Applicable	
OTHER FEDERAL GUIDELINES TO BE CONSIDERED				
Integrated Risk Information System (IRIS)	Risk reference doses (RfD) are estimates of daily exposure levels that are unlikely to cause adverse non-carcinogenic health effects over a lifetime. Cancer Slope Factors (CSF) are used to compute the incremental cancer risk from exposure to site	Chemical-specific	To Be Considered	Levels may be considered for use as cleanup goals.

APPENDIX B
List of Applicable or Relevant and Appropriate Requirements
USS Lead Site, OU1
East Chicago, Indiana

Applicable/ Relevant and Appropriate Requirements	Description	Type of ARAR	Applicable/ Relevant and Appropriate	Comment
	contaminants and represent the most up-to-date information on cancer risk from EPA's Carcinogen Assessment Group.			
EPA Regional Screening Levels	EPA Regional Screening Levels (RSLs and associated guidance necessary to calculate them) are risk-based screening levels developed using risk assessment guidance from the USEPA Superfund program. These are risk-based concentrations derived from standardized equations combining exposure information assumptions with USEPA toxicity data. Screening levels are considered to be protective for humans over a lifetime; however, screening levels do not address non-human health endpoints, such as ecological impacts.	Chemical-specific	To Be Considered	Levels may be considered for use as cleanup goals.
EPA Area of Contamination Policy under RCRA	Allows wastes within an Area of Contamination to be consolidated and treated in-situ without triggering RCRA LDRs or minimum technology requirements. This policy does not have the effect of law.	Action-specific	To Be Considered	Applicable to on-site consolidation, treatment and covering/capping of soils and sediments.
EPA's Contained-in Policy under RCRA	Deals with management of remediation waste. This policy does not have the effect of law.	Action-specific	To Be Considered	
Occupational Safety and Health Act [29 CFR 61]	The Act was passed in 1970 to ensure worker safety on the job. Worker safety at hazardous waste sites is addressed under 29 CFR 1910.120:	Action-specific	Applicable	The Act is considered an ARAR for construction activities performed during the implementation of remedies.

APPENDIX B
List of Applicable or Relevant and Appropriate Requirements
USS Lead Site, OU1
East Chicago, Indiana

Applicable/ Relevant and Appropriate Requirements	Description	Type of ARAR	Applicable/ Relevant and Appropriate	Comment
	Hazardous Waste Operations and Emergency Response. General worker safety is covered elsewhere within the law.			
INDIANA ADMINISTRATIVE CODE				
Indiana Solid Waste Rules (IAC Title 329)	This law applies to remedies that involve off-site disposal of materials typically involved with excavations. Contaminated soils or wastes that are excavated for off-site disposal would be tested for hazardous waste characteristics and requirements of the Rules would be followed if hazardous waste is found.	Action-specific	Relevant and Appropriate	
Generator Responsibilities for Waste Information (329 IAC 10-7.2-1)	Requires all wastes undergo a waste determination, and if found to be nonhazardous, be disposed of in a permitted solid waste disposal facility.	Action-specific	Relevant and Appropriate	
Indiana Air Pollution Control Regulations (IAC Title 326)	This law applies to the regulation of air emissions, for activities such as excavation, that have the potential to create dust and sets emissions limits for particulates.	Action-specific and may be Chemical-specific	Relevant and Appropriate	
Rule 4. Fugitive Dust Emission (326 IAC 6-4-1[4])	Rule 4 establishes that visible fugitive dust must not escape beyond the property line or boundaries of the property, right-of-way, or easement on which the source is located.	Location/Action-specific	Relevant and Appropriate	

APPENDIX B
List of Applicable or Relevant and Appropriate Requirements
USS Lead Site, OU1
East Chicago, Indiana

Applicable/ Relevant and Appropriate Requirements	Description	Type of ARAR	Applicable/ Relevant and Appropriate	Comment
Motor vehicle fugitive dust sources (326 IAC 6-4-4)	No vehicle driven on any public right of way may allow its contents to escape and form fugitive dust.	Action-specific	Relevant and Appropriate	
Storm Water Run-off Associated with Construction Activity (327 IAC 15-5)	Sets requirements for managing storm water during construction activities, including sediment and erosion control.	Action-specific	Relevant and Appropriate	Will be required if remedial activities generate storm water runoff.
Voluntary Remediation of Hazardous Substances and Petroleum (Indiana Code [IC] 13-25-5)	IC 13-25-5 established the Voluntary Remediation Program in 1993 and gave the IDEM the authority to establish guidelines for voluntary site closure. Under this authority IDEM developed a non-rule policy document, the Risk Integrated System of Closure (RISC), to guide site closures within the authority of IDEM's remediation programs. This guidance document does not have the effect of law.	Chemical-specific	To Be Considered	The RISC document provides a methodology for establishing remedial goals and determining that remediation has been achieved. The RISC policy does not apply to Superfund sites, but does apply to remedial sites under several state programs, including the state version of RCRA, the state Leaking Underground Storage Tank program, the State Cleanup Program (state equivalent of the Federal Superfund Program) and the Voluntary Remediation Program.

APPENDIX C

Remedial Alternatives Evaluation Summary

APPENDIX C
Remedial Alternatives Evaluation Summary
USS Lead Site, OU-1
East Chicago, Indiana

Evaluation Criteria	**Alternative 1** No Action	**Alternative 3** On-Site Soil Cover + Institutional Controls	**Alternative 4A** Excavation of Soil Exceeding RALs + Off-Site Disposal + *Ex Situ* Treatment Option	**Alternative 4B** Excavation to Native Sand + Off-Site Disposal + *Ex Situ* Treatment Option
Overall Protection to Human Health and the Environment				
Protection of human health and the environment	Not protective	Protective	Protective	Protective
Compliance with ARARs				
Location-specific ARARs	Not in compliance	In compliance	In compliance	In compliance
Action-specific ARARs	Not in compliance	In compliance	In compliance	In compliance
Chemical-specific ARARs	Not in compliance	In compliance	In compliance	In compliance
Long-Term Effectiveness and Permanence				
Magnitude of residual risk	Residual risk remains	Some residual risk	Minimal residual risk	No residual risk
Adequacy and reliability of controls	No controls	Somewhat reliable	Reliable to very reliable	Very reliable
Need for 5-year review	Required	Required	May be required	Not required
Reduction of Toxicity, Mobility, or Volume through Treatment				
Treatment processes used and materials treated	None	None	Some treatment utilized	Some treatment utilized
Amount of hazardous material destroyed or treated	None	None	~7% treatment	~7% treatment
Expected reduction in toxicity, mobility, or volume of the waste	None	None	Toxicity and mobility reduced	Toxicity and mobility reduced
Irreversibility of treatment	Not applicable	Not applicable	Not likely reversible	Not likely reversible
Type and quantity of residuals that will remain following treatment	Not applicable	Not applicable	Metals less than TC threshold	Metals less than TC threshold
Statutory preference for treatment	Does not satisfy	Does not satisfy	Partially satisfies	Partially satisfies
Short-Term Effectiveness				
Protection of workers during remedial action	Not applicable	High	Moderate-High	Moderate-High
Protection of the community during remedial action	Not applicable	High	Moderate-High	Moderate-High
Potential environmental impacts of remedial action	Not applicable	Low	Low	Low
Time until protection is achieved	Protection not achieved	Immediate	Immediate	Immediate
Implementability				
Technical feasibility	Not applicable	Moderate	Easy	Easy
Reliability of technology	Not applicable	Somewhat reliable	Very reliable	Very reliable
Administrative feasibility	Not applicable	Difficult	Feasible	Feasible
Availability of services, equipment, and materials	Not applicable	Readily available	Readily available	Readily available
Cost				
Total construction cost	$0	$13,905,000	$21,600,000	$32,800,000
Total engineering and construction management cost	$0	$2,800,000	$3,195,000	$4,960,000
Total present worth O&M	$0	$735,000	$67,000	$0
Period of analysis (yrs)	NA	30	30	NA
Total cost (including 20% contingency)	$0	$20,900,000	$29,900,000	$45,400,000

APPENDIX D

Feasibility Study Cost Estimate for Alternative 4A

APPENDIX D
FEASIBILITY STUDY COST ESTIMATE
ALTERNATIVE 4A: EXCAVATION OF SOIL EXCEEDING RALS + OFF-SITE DISPOSAL + EX SITU TREATMENT OPTION
USS Lead Site, OU-1
East Chicago, Indiana

Estimate Category	**Cost**			
	Eastern Area	**Southwestern Area**	**Northwestern Area**	**TOTAL**
PRE-REMEDIAL DESIGN SAMPLING				
Sample Labor	$583,000	$408,000	$451,000	$1,442,000
ODCs	$84,000	$60,000	$66,000	$210,000
REMEDY CONSTRUCTION				
Preconstruction Activities	$180,000	$186,000	$173,000	$539,000
Site Preparation and Access	$460,000	$685,000	$268,000	$1,413,000
Institutional Controls	$5,000	$5,000	$5,000	$15,000
Contaminated Soil Excavation and Backfilling	$2,203,000	$3,793,000	$1,548,000	$7,544,000
Contaminated Soil Transportation and Disposal	$1,509,000	$2,411,000	$943,000	$4,863,000
Soil Cover	$1,000	$2,000	$1,000	$4,000
Property Restoration	$1,407,000	$2,278,000	$927,000	$4,612,000
Contractor's Oversight, Health & Safety, Quality Control	$280,000	$455,000	$175,000	$910,000
Construction Subtotal	**$6,700,000**	**$10,300,000**	**$4,600,000**	**$21,600,000**
ENGINEERING & CONSTRUCTION MANAGEMENT	**$991,000**	**$1,548,000**	**$656,000**	**$3,195,000**
OPERATIONS AND MAINTENANCE	**$27,068**	**$18,961**	**$20,971**	**$67,000**
Project Subtotal	**$7,700,000**	**$11,900,000**	**$5,300,000**	**$24,900,000**
20% Contingency	$1,540,000	$2,380,000	$1,060,000	$4,980,000
Project Total	**$9,200,000**	**$14,300,000**	**$6,400,000**	**$29,900,000**