FINAL
DECISION DOCUMENT
FOR AREA II OF THE FORMER FRANKFORD ARSENAL
PHILADELPHIA, PENNSYLVANIA
FUDS PROPERTY NO: C03PA0042

U.S. Army Corps of Engineers—Baltimore District
City Crescent Building, Room 10200
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Baltimore, Maryland 21201

September 2016

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/kg	Micrograms per kilogram
amsl	Above mean sea level
AOC	Area of concern
AOI	Area of interest
ARAR	Applicable or relevant and appropriate requirement
bgs	Below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of concern
COPC	Contaminant of potential concern
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
EA	EA Engineering, Science, and Technology, Inc., PBC
FFA	Former Frankford Arsenal
FS	Feasibility study
ft	Foot (feet)
ft^2	Square foot (feet)
FUDS	Formerly Used Defense Sites
GSA	General Services Administration
HHRA	Human health risk assessment
in.	Inch(es)
LTM	Long-term management
mg/kg	Milligram(s) per kilogram
MSC	Medium-specific concentration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
O&M	Operation and maintenance
PADEP	Pennsylvania Department of Environmental Protection
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PRG	Preliminary remediation goal

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

RAO	Remedial action objective
RDC	Residential direct contact
RI	Remedial investigation
RSL	Regional screening level
SARA	Superfund Amendments and Reauthorization Act
SGW	Soil-to-groundwater criteria
SLERA	Screening level ecological risk assessment
SVOC	Semi-volatile organic compound
USACE	United States Army Corps of Engineers
USATHAMA	United States Army Toxic and Hazardous Materials Agency
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile organic compound
XRF	X-ray fluorescence
yd^3	Cubic yard(s)

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1. DECLARATION

1.1 SITE NAME AND LOCATION

The United States Army Corps of Engineers (USACE) prepared this Decision Document for Area II of the Former Frankford Arsenal (FFA), a Formerly Used Defense Site (FUDS) located in Philadelphia, Pennsylvania. The FFA was divided into four areas to facilitate management of investigation and cleanup activities. Three of these areas, Area I, Area II, and Area III, focus on soil. Area I consists of 47.4 acres east of Baird Street that are owned by the Philadelphia Industrial Development Corporation, City of Philadelphia, and Dietz & Watson. Area II, the portion of FFA west of Baird Street, consists of 36.9 acres owned primarily by Arsenal Associates, Inc. A small portion of Area II is owned by Philadelphia Industrial Development Corporation. Area III consists of 22 acres owned by the City of Philadelphia and Dietz & Watson. Additionally, groundwater across the FFA was designated as Area IV. Soil at Area II is addressed by this Decision Document.

1.2 STATEMENT OF BASIS AND PURPOSE

The Decision Document presents the selected remedy for soil at FFA Area II (the site). The remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (Title 40, Code of Federal Regulations [CFR], Part 300). The information supporting determination of the selected remedy presented in this Decision Document is contained in the Administrative Record file, available at the Frankford Branch of the Free Library of Philadelphia (see Section 2.3).

1.3 ASSESSMENT OF THE SITE

The response action selected in this Decision Document is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Specifically, localized areas of elevated concentrations of lead, Aroclor 1260, and/or benzo(a)pyrene are present in soil within six areas of concern (AOCs) in Area II. The elevated concentrations warrant further action based on the unacceptable risk or potential concerns to future human receptors. Additionally, high lead concentrations in exposed surface soil samples in a portion of Area II may represent risk to birds and mammals.

1.4 DESCRIPTION OF THE SELECTED REMEDY

The cleanup strategy addresses soil contaminants at concentrations greater than the risk-based remediation goals through a combination of removal and disposal of soils in some areas and capping of soils in other areas. No principle threats (i.e., source materials considered to be highly toxic or highly mobile that cannot be contained reliably or would pose significant risk to human health or the environment if exposure were to occur) have been identified at Area II. The selected remedy consists of soil removal and disposal at AOCs 1, 6, 10, and 20, and capping at AOCs 13 and 21.

The soil removal and disposal portion of the remedy consists of the following major components:

- Pre-design investigation to determine location of underground utilities
- Pre-design investigation where vertical delineation of contamination is required
- Removal of soils with contaminant concentrations exceeding remediation goals via excavation
- Field screening for lead during excavation in AOCs with lead concentrations exceeding the remediation goal, to confirm the limits of removal
- Offsite disposal of excavated contaminated soil in a facility authorized to accept the waste
- Post-excavation confirmation sampling of soil from the excavation bottoms and sidewalls
- Placement of clean back fill into the excavations
- Restoration of the excavation area to pre-excavation conditions.

The capping portion of the remedy consists of the following major components:

- Pre-design investigation to determine location of underground utilities
- Installation of a cap of clean fill over soil with contaminant concentrations greater than remediation goals
- Installation of engineering controls to control stormwater flow, as needed
- Execution of an environmental covenant to restrict soil uses, enforceable by Pennsylvania Department of Environmental Protection (PADEP)
- Five-year reviews to assess the protectiveness of the remedy, relative to the soil with contaminant concentrations exceeding remediation goals that will remain onsite.

In addition, to implement the public participation requirements of 40 CFR Section 300.435(c)(3), public notification will be undertaken after completion of the final remedial design and prior to initiation of the remedial action. Public notification will be achieved through issuance of a fact sheet.

1.5 STATUTORY DETERMINATIONS

The selected remedy meets the requirements of CERCLA Section 121 and the NCP. The selected remedy is protective of human health and the environment, is cost-effective, and utilizes permanent solutions to the maximum extent practicable. No federal or state requirements were

identified that are applicable or relevant and appropriate for Area II, and no principal threat wastes have been identified at Area II.

The selected remedy for Area II does not satisfy the statutory preference for treatment as a principal element of the remedy because soil treatment technologies were determined not to be effective and/or implementable at the site. However, the selected remedy is protective of human health and the environment, as it removes contaminated soil from AOCs 1, 6, 10, and 20 and prevents contact with contaminated soil by means of a cap at AOCs 13 and 21. Ecological risks, which were only identified in AOC 1, will be reduced to background levels through the proposed removal of contaminated soil. Capping as part of the selected remedy will result in hazardous substances, pollutants, or contaminants remaining at AOCs 13 and 21 above levels that allow for unlimited use and unrestricted exposure. Therefore, a statutory review will be conducted within 5 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 DECISION DOCUMENT DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of the Decision Document. Additional information can be found in the Administrative Record.

- Contaminants of concern (COCs) and their respective concentrations.
- Baseline risk represented by the COCs.
- Remediation goals established for COCs and the basis for these goals.
- Discussion of source materials constituting principal threats.
- Current and reasonably anticipated future land use assumptions used in the baseline risk assessment and Decision Document.
- Potential land use that will be available at the site as a result of the selected remedy.
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected.
- Key factors that led to selecting the remedy; that is, how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria.

1.7 AUTHORIZING SIGNATURE

NOV 2 3 2018

WILLIAM H. GRAHAM
Brigadier General, USA
Commanding

Date

2. DECISION SUMMARY

The FFA Area II Decision Document was modeled after the United States Environmental Protection Agency (USEPA) format for Records of Decision for CERCLA NPL sites. USEPA's *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents* (USEPA 1999) was used for preparation of this document.

2.1 SITE NAME, LOCATION, AND BRIEF DESCRIPTION

The FFA is a 109.4-acre FUDS located in an urban, mixed-use area of northeast Philadelphia, Pennsylvania (Figure 1-1). This Decision Document addresses Area II of the FFA FUDS, which is bounded to the east by Baird Street, to the west by Bridge Street, to the north by Tacony Street, and to the south by Frankford Creek. Area II encompasses approximately 36.9 acres. The portion of the FUDS identified as Area II currently contains 47 buildings of various sizes, ages, and conditions. An additional 35 buildings that were historically located in Area II have been demolished over the years, creating some open spaces between buildings.

Remediation of environmental contamination associated with Department of Defense (DoD) operations at FFA Area II is led by USACE. PADEP, as the support agency, plays a review and concurrence role. The Defense Environmental Restoration Program (DERP)-FUDS is the source for investigation funds for FFA Area II.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

This section summarizes the history of FFA and previous investigations conducted at FFA, focusing on Area II.

2.2.1 Site History

Prior to military use, the FFA was farm land and undeveloped wetlands. In 1816, the FFA was commissioned for military use. Between 1816 and the decommissioning of the FFA in 1977, the FFA was used for a variety of military activities as its mission was adjusted to fit the military's changing needs. The United States government acquired a total of 109.36 acres that comprise the FFA between 1816 and 1951. The FFA consisted of four component areas: a small arms division, an artillery ammunition division, a stock section area, and an ordnance depot. Activities at the FFA during its years of operation between 1816 and 1977 included military ordnance production, testing and storage, and munitions research. As presented in the remedial investigation (RI) for Area II (EA Engineering, Science, and Technology, Inc., PBC [EA] 2014), potential sources of environmental contamination associated with DoD operations included the following:

- Ordnance manufacturing facilities—metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), explosives, and radionuclides (where historical use of radionuclides is known)

- Laboratories—metals, VOCs, SVOCs, explosives, and radionuclides (where historical use of radionuclides is known)

- Inflammable material storehouses—VOCs, SVOCs, and lead
- Oil storage areas—VOCs, SVOCs, and lead (leaded gasoline)
- Housing garages—VOCs, SVOCs, and lead (leaded gasoline)
- Paint storage—VOCs, SVOCs, and metals
- Machine shops—VOCs, SVOCs, and metals
- Optical shops—VOCs, SVOCs, and metals
- Storage of radioactive materials—radionuclides
- Former greenhouse—Pesticides
- Substations—Polychlorinated biphenyls (PCBs).

In 1976, the FFA was reported excess to the General Services Administration (GSA), and in 1981 the GSA assigned 21.36 acres to the State of Pennsylvania Fish and Boat Commission. In 1983, the GSA assigned the remaining 87.37 acres to the Philadelphia Authority for Industrial Development, who sold the property to Arsenal Associates, Inc. later in 1983. The Arsenal Associates property, now identified as Arsenal Business Center, is operated by Hankin Management Company. During the past 24 years, Hankin Management Company has leased buildings on behalf of Arsenal Associates, Inc. to various tenants. An approximately 1-acre portion in the southeast corner of Area II was transferred to the Philadelphia Industrial Development Corporation in Spring 2014 as part of a larger land transfer associated with Area I.

No federal or state enforcement activities have been undertaken at the FFA Area II.

2.2.2 Previous Investigations and Removal Actions

Several investigations and historical removal actions have been conducted at the FFA by the United States Army Toxic and Hazardous Materials Agency (USATHAMA), USACE, the current property owner, and by USEPA. No removal or remedial actions have been conducted in Area II under CERCLA or other environmental authorities to date. A thorough review of previous investigations performed at the FFA, and specifically relating to Area II, is presented in the RI (EA 2014). Relevant documents reviewed included the following:

- Installation Assessment, USATHAMA, 1977
- Detailed Survey and Alternatives Assessment for FFA, Battelle, 1978
- Historical and Archeological Survey, John Milner Associates, Inc., 1979
- Preliminary Assessment of Frankford Arsenal, Ecology and Environment, 1981

- Frankford Arsenal Decontamination/Cleanup Report, Rockwell, 1981
- Remedial Action Decision Document, USATHAMA, 1988
- Radiological Historical Site Assessment, Cabrera Services, 2001
- Radiological Scoping Survey, Cabrera Services, July 2003
- Final Closeout Report for the Underground Storage Tank Removal, Battery Disposal, and Well Abandonment Container/Hazardous, Toxic, and Radioactive Waste Project, EA, 2008.

2.2.2.1 Remedial Investigation, EA, 2014

The purpose of the RI was to assess potential environmental impacts to FFA Area II resulting from former DoD use of the property. Area II had not been investigated in depth since its transfer from DoD ownership. As such, the primary goals of the RI, as they relate to Area II soils, were to (1) assess whether or not environmental contaminants from past DoD use are present in soil, (2) determine the nature and extent of those contaminants in soils, and (3) determine whether or not there are risks to human health and the environment from any contaminants in Area II soils that require further action by USACE. In order to accomplish these goals, surface soil samples, subsurface soil samples, and groundwater samples were collected from areas of historical DoD use. The samples were analyzed to determine the concentrations of analytes present and whether or not these concentrations present a risk to human health or the environment.

As part of the RI process, Area II was divided into three exposure units (termed zones; see Figure 2-1):

- Zone 1 (12.2 acres)—a mostly residential area that occupies the northwest corner of Area II
- Zone 2 (10.1 acres)—a mostly industrial area located in the northeast corner of Area II that housed research and support operations
- Zone 3 (14.6 acres)—a mostly industrial area that housed former ammunition production operations in the southern portion of Area II adjacent to Frankford Creek.

During the RI, 445 surface and subsurface soil samples (biased and unbiased locations) were collected in 2011 and 2012 to delineate contamination in soil in Area II Zones 1, 2, and 3. Unbiased sample locations were identified using Visual Sample Plan (Version 6.1b), which indicated that a triangular grid spacing of 96.60 ft would yield a 95 percent probability of detecting a hot spot 100 ft in diameter. Biased sample locations were identified based on a review of site history and the conceptual site model. Soil samples were analyzed for Target Compound List VOCs, Target Compound List SVOCs, and metals. A subset of samples were

submitted for the analysis of explosives, radionuclides, and pesticides. Samples collected near substations were evaluated for PCBs.

Contaminants of potential concern (COPCs) in soil were identified through comparison of RI data to PADEP medium-specific concentrations (MSCs) for soil (residential direct contact [RDC] values and soil-to-groundwater criteria [SGW]). After the data from biased and unbiased soil sampling locations were compared to these levels, delineation samples were collected in the vicinity of the biased and unbiased sample locations with COPC concentrations exceeding PADEP MSCs.

Data were also compared to criteria to determine if there is a risk for VOCs in the soil to volatize and impact indoor air quality. The criteria used were the Pennsylvania Act 2 default SGW residential screening levels and Pennsylvania Default Residential Volatilization to Indoor Air Screen values for soil, as provided in Section IV.A.4, Table 4, of the PADEP *Land Recycling Program Technical Guidance Manual* (PADEP 2004). Areas containing one or more samples with analytes at concentrations exceeding screening criteria were identified as Areas of Interest (AOIs). Twenty-three AOIs were identified (Table 2-1); the general distribution of these AOIs is illustrated on Figure 2-1. The evaluation of risks to human health is summarized in Section 2.7.1, and a summary of the risks to ecological receptors is presented in Section 2.7.2.

The RI noted that VOCs appear to be migrating into Area II from a non-DoD source to the west of the site. The Honeywell Frankford Facility (formerly Sunoco and Allied Signal) is located to the west of the FFA (across Bridge Street). A light non-aqueous phase liquid plume was discovered in the central portion of the Honeywell Frankford Facility in 1984, and a pumping system to recover the plume was installed in 1994. While the majority of contaminants within Area II that are associated with this plume have been reported in groundwater, related contamination in Area II soil was also noted. The RI specified that exceedances of soil, groundwater, and vapor intrusion screening criteria that are related to chemicals emanating from the offsite Honeywell Frankford Facility are not FUDS related and will not be addressed as part of the FUDS process for Area II or Area IV.

2.2.2.2 Supplemental Investigation, EA, 2014

As part of the feasibility study (FS) for Area II (EA 2016), a supplemental investigation was conducted in November 2014. The investigation further delineated lead exceedances in subsurface soil of the parade ground in Zone 1 (AOI 1) that were identified during the RI. The supplemental investigation also assessed the potential for vapor intrusion in the vicinity of Building 201 (AOI 13).

Nineteen soil borings were advanced to determine the lead concentrations present at depths of more than 6 inches (in.) across the parade ground. Soil borings were sited around RI boring Z1D07 and across the remainder of the parade ground. Each boring was advanced via direct push technology to a depth of 5 feet (ft) below ground surface (bgs). Field screening for lead in soil was conducted using an x-ray fluorescence (XRF) analyzer in 6-in. intervals, yielding 154 samples. Twenty confirmation soil samples were submitted for laboratory analysis of lead via USEPA Method 6010. Results indicate that lead exceedances above 1,000 milligrams per

kilogram (mg/kg) in the parade ground are confined to the area immediately surrounding RI sample location Z1D07.

Soil vapor samples were collected from three locations, two exterior locations beneath the asphalt/concrete and one interior sub-slab location (Figure 2-1). Samples were collected over three sampling events: November 2014 and January and March 2015. Results were compared to the residential and non-residential indoor air MSC with a soil gas to indoor air transfer ratio of 0.01. Based on the data, it was concluded that there is no risk to indoor receptors from vapor intrusion.

Table 2-1: Area of Interest Summary

AOI	Zone	Compound	Criteria Exceeded
1	1 & 2	Lead and arsenic	RDC/SGW
2	2	Benzo(a)pyrene	RDC
3		Trichloroethene	SGW
4		Benzo(a)pyrene	RDC
5		Lead	RDC/SGW
6		Aroclor 1260	RDC
7		Arsenic and benzo(a)pyrene	RDC
8		Arsenic	RDC
9		Benzo(a)pyrene	RDC
10		Lead	RDC/SGW
11	3	Arsenic	RDC
12		Benzo(a)pyrene and benzene	RDC/SGW
13		Arsenic, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluorene, trichloroethene	RDC/SGW
14		Arsenic, benzo(a)pyrene, and mercury	RDC/SGW
15		Benzene	SGW
16		Benzo(a)pyrene	RDC
17		Arsenic	RDC
18		Benzo(a)anthracene, benzo(b)fluorene, benzo(a)pyrene, dibenzo(a,h)anthracene	RDC Soil Vapor
19		Arsenic	RDC
20		Arsenic, antimony, lead, and benzo(a)pyrene	RDC/SGW
21		Lead and arsenic	RDC/SGW
22		Arsenic and benzo(a)pyrene	RDC
23		Arsenic	RDC

Notes:
AOI = Area of interest.
RDC = Residential direct contact.
SGW = Soil-to-groundwater.

2.3 COMMUNITY PARTICIPATION

The Final RI Report (EA 2014), FS Report (EA 2016), and the Proposed Plan (USACE 2016) were made available to the public on 1 August 2016. The notice announcing the availability of these documents was published in the *Star* newspaper on 27 July 2016 and in the *Philadelphia Daily News* on 29 July 2016. A public comment period was held from 1-31 August 2016. In addition, a public meeting was held on 18 August 2016 to present the Proposed Plan. At the meeting, representatives from USACE answered questions and presented information about FFA Area II and the remedial alternatives considered. USACE's responses to the comments received during the public comment period are provided in the Responsiveness Summary, which is included in Section 3 of this Decision Document. Select FFA documents can be accessed on the USACE Baltimore District website titled "Frankford Arsenal." The current web address for the page is http://www.nab.usace.army.mil/Missions/Environmental/Formerly-Used-Defense-Sites/Frankford-Arsenal/. All FFA documents in the Administrative Record are available to the public at the following location:

Frankford Branch of the Free Library of Philadelphia
4634 Frankford Avenue
Philadelphia, Pennsylvania 19124-5804
215-685-1473

2.4 SCOPE AND ROLE OF THE RESPONSE ACTION

The FFA has been divided into four areas, with Areas I through III addressing soil and Area IV addressing groundwater across the entirety of the FFA. Surface and subsurface soil in Area II is addressed by this Decision Document. This Decision Document does not include or affect any other areas at the FFA that fall under CERCLA. A separate Decision Document, selecting a no further action alternative, was finalized for Area I. Investigation and remedy selection activities are underway for Areas III and IV.

The response action for FFA Area II addresses unacceptable risks to human and ecological receptors[1] via direct contact with soil within AOCs 1, 6, 10, 13, 20, and 21. Soil within each of these six AOCs contain elevated concentrations of lead, Aroclor 1260, and/or benzo(a)pyrene. The response action addresses the unacceptable risks through removal and disposal or capping of soil with concentrations exceeding the risk-based remediation goals.

2.5 SITE CHARACTERISTICS

This section provides an overview of the physical characteristics of FFA Area II, including topography, geology, and distribution of underground utilities, and describes the nature and extent of contamination.

[1] Ecological risk was only identified in Zone 1 (AOC 1).

2.5.1 Topography

As stated in Section 1.1, FFA Area II consists of 36.9 acres. The topography at Area II is relatively flat. A gradual slope is present from the northern portion of Area II to the southern portion towards the Frankford Inlet and the Delaware River. The elevation ranges from 10 to 20 ft above mean sea level (amsl), with the northern portion of Area II being at approximately 20 ft amsl, and the southern portion along the Frankford Inlet being approximately 10 ft amsl.

2.5.2 Geology

The FFA is underlain by unconsolidated sediments of the Coastal Plain province. These unconsolidated materials sit on older crystalline rocks of the Piedmont. Surface deposits in reworked sections of Area II have been observed to be fill materials. Much of the FFA is underlain with fill material consisting of cinders, silt, bricks, concrete, wood, sand, silt, and gravel. The fill material is present to depths of 13 ft bgs; however, it is more typically present to depths of less than 5 ft bgs in the developed areas of Area II. Fill material deposits are thicker in the west and more common in areas surrounding buildings and underground utilities. Fill material is absent or thin (less than 1 ft) in areas where manicured lawn is present, such as the parade ground.

Fill material is underlain by the Trenton gravel, a Pleistocene unit of Wisconsin-age. The material is described as a pale or reddish-brown, gravelly sand with a wide range of grain sizes, inter-bedded with cross-bedded sands and gravel and clayey-silt layers (United States Geological Survey [USGS] 1991). Coarse sediments are composed of oblate pebbles and cobbles derived from Triassic red and gray shales, sandstones, and conglomerate and other bedrock derived up-valley. Local clay and silty clay are present in the Trenton gravel (USGS 2000). Locally, this gravel layer has areas of Holocene alluvium and swamp deposits with small amounts of clay. The average thickness of this unit at the FFA is about 40 ft; however, it can be as great as 80 ft (Langan Environmental & Engineering Services 2005 and EA 2014).

The bedrock beneath the unconsolidated deposits is comprised of crystalline rocks of the Wissahickon Formation, believed to be of early Paleozoic-age. The bedrock is mapped in the Philadelphia area as an oligoclase-mica schist with some gneissic, quartz-rich, and feldspar-rich members. The sediments of the Trenton gravel and the Wissahickon Formation are significant aquifers in the Philadelphia area (USGS 1991). Bedrock composed of weathered schist was observed during the RI from 34 to 44 ft bgs, where borings were advanced to refusal.

A majority of the surface area of Area II is covered with impervious surfaces that include asphalt, concrete, and various improvements. Pervious surfaces, including manicured lawns, are present in the northwestern portion of Area II, which was formerly a housing area and parade ground during DoD use of the site. In addition, pervious landscaped areas separating the sidewalks from the buildings are located adjacent to buildings in the housing area and other parts of Area II.

Groundwater across the FFA is designated as Area IV and is not addressed in this Decision Document for Area II. During the May 2012 groundwater sampling event conducted as part of the RI, groundwater was observed beneath Area II at depths ranging from 4 ft bgs along

Frankford Creek to 14 ft bgs in the parade ground area parallel to Tacony Street. Groundwater flow in shallow overburden wells is generally to the south towards Frankford Creek. Groundwater flow in deep overburden wells is generally to the south-southwest towards Frankford Creek. There are no wetlands, streams, or other surface watercourses located on the FFA Area II property.

Frankford Creek is located south of FFA Area II; it forms the boundary to the south/southwest of the FFA and acts as an inlet from the Delaware River. Engineering efforts in the 1950s resulted in the upstream portion of Frankford Creek being cut off from the existing portion of Frankford Creek, located to the south of the FFA. Therefore, there is no natural stream flow feeding the Creek except for discharge from runoff and outfalls. Flow characteristics of Frankford Creek are dominated by the tidal influence of the Delaware River, which has a tidal range of approximately 5.5 ft at Philadelphia (USGS 1991).

2.5.3 Underground Utilities

Area II, along with the rest of the FFA, has an extensive network of underground utilities, including tunnels formerly used for passage between certain buildings or for passage of utilities. These underground utilities likely provide preferential pathways for subsurface migration and potentially influence groundwater flow directions locally. Only the storm/sanitary sewers have connections and/or outfalls outside of the boundaries of Area II.

2.5.4 Nature and Extent of Contamination

Data from the RI for FFA Area II, summarized in Section 2.2.2.1, were used to characterize the nature and extent of contamination. COPCs in soil were identified through comparison of RI data to PADEP MSCs for soil (RDC and SGW), as well as PADEP criteria to determine if there is a potential for VOCs to volatize and impact indoor air quality. Areas containing one or more samples with analytes at concentrations exceeding MSCs were identified as AOIs. Some AOIs were later designated as AOCs and were targeted for remediation based on “elevated” concentrations of COCs that pose unacceptable risk or potential concerns to future receptors (see Section 2.7.3). Exceedances per AOI are summarized in Table 2-1. Metals, primarily lead and arsenic, and polycyclic aromatic hydrocarbons (PAHs), primarily benzo(a)pyrene, were reported during the RI at concentrations exceeding their respective screening criteria in surface soils (0-2 ft bgs). Metals and PAHs were also associated with fill materials found in the subsurface. Lead concentrations of more than 12,000 mg/kg were reported in samples from Zones 2 and 3, while the maximum lead concentration in Zone 1 was approximately 8,800 mg/kg. The maximum reported concentration of arsenic was 52.5 mg/kg, reported in a sample from Zone 3. Benzo(a)pyrene was reported at a concentration exceeding 500 micrograms per kilogram (µg/kg) in Zone 2. Locations with PCBs and VOCs, primarily benzene and trichloroethene, at concentrations exceeding screening criteria were less widespread. The PCB Aroclor 1260 was reported at a concentration of 38,000 µg/kg in one sample from Zone 2. VOCs and arsenic were not determined to be of concern to current or future receptors based on the risk assessments (see Section 2.7). The areas and volumes of contamination to be targeted by the response action are summarized in Section 2.7.3.

2.5.5 Conceptual Site Model

The conceptual site model for human health at Area II is presented in Figure 2-2. Potential sources and fate and transport mechanisms are described in this section, and the exposure routes and potential receptors are discussed in more detail in Section 2.7.1.

2.5.5.1 Potential Sources

Contamination of soil at Area II is believed to be the result of small-scale spills or dumping over years of daily operation at the DoD facilities. No large-scale releases or disposal operations have been documented.

2.5.5.2 General Fate and Transport

Detailed fate and transport is addressed in the RI (EA 2014). A general discussion of COC fate and transport and indoor air quality is provided herein.

Lead is the most prevalent metal detected at concentrations above screening criteria in Area II. Elevated lead concentrations in Zone 1 are mainly limited to the 0-6 in. depth interval. The widespread nature and limited vertical extent of lead indicates that the source of lead is most likely historical deposition onto undisturbed soils. Elevated concentrations of lead (as well as arsenic) in Zones 2 and 3 are likely associated with cinders/slag material that were historically spread along railroad tracks in the southern area of Zone 3. Lead, and other metals in general, are retained strongly in soil with little transport through runoff to surface water or leaching to groundwater except under acidic conditions. Therefore, metals persist in soil indefinitely unless transported by wind or dissolution into pore water or groundwater. The majority of Area II is covered with impervious surfaces. Those portions that are not covered by an impervious surface are covered by a vegetated mat, making migration of metals in soil via fugitive dust emissions insignificant.

Certain PAHs were detected above their respective MSCs, with benzo(a)pyrene being the most prevalent. No one point source for PAHs in Area II can be identified, based on their widespread occurrence. Benzo(a)pyrene mainly partitions to soil and sediment; therefore, benzo(a)pyrene present in soils in Area II is likely to remain in soil. PCBs in Area II are present in surface soils adjacent to transformers; they are likely to remain in soil with limited biodegradation.

Generally, migration of COCs from soil to groundwater is expected to be minimal, given the fact that COCs in soil are concentrated primarily in the vadose zone, at or near the surface, and given the characteristics of the COCs, as described above. Groundwater quality, along with any potential impacts to Frankford Creek, will be addressed under Area IV.

2.6 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Since its decommissioning from military use in 1977, Area II has been used primarily as a commercial business park with residential use. The current use and tenants include office space for a security company, the Philadelphia police, a book store, a real estate management company,

and an import business. Vacant buildings, storage facilities, and charter schools are also present. Outdoor recreational areas are located on the former parade ground and basketball court.

Area II is located in an urban, mixed-use area of northeast Philadelphia. It is bound to the north by Tacony Street and I-95, to the east by industrial properties, to the south by Frankford Creek and the Delaware River, and to the west by Bridge Street, beyond which is the Honeywell Frankford Facility (former Sunoco Chemicals Frankford Plant). Further south of Frankford Creek is the former Rohm and Haas Refinery. Further north of I-95 are more industrial properties and a residential area. Substantial changes to this mix of uses are not anticipated.

Based on information provided by the Site owner, the future uses for Area II consist of a mix of industrial, commercial, institutional, and residential. The 1-acre portion in the southeast corner of Area II, which was transferred to the Philadelphia Industrial Development Corporation in Spring 2014 as part of a larger land transfer associated with Area I, is expected to undergo industrial/commercial development under the new ownership. Re-development of Area II is expected to begin as soon as remedial activities are complete.

2.7 SUMMARY OF SITE RISKS

A baseline human health risk assessment (HHRA) and screening-level ecological risk assessment (SLERA) were conducted as part of the RI (EA 2014). Taking land use into account, the HHRA and SLERA estimate the risks at a site if no cleanup action were taken. These assessments provide the basis for taking action and identify the contaminants and exposure pathways that need to be addressed by the remedial action. This section summarizes the results of the HHRA and SLERA for FFA Area II.

Based on the risk assessment findings described below, the response action selected in this Decision Document is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

2.7.1 Baseline Human Health Risk Assessment

The objective of the HHRA was to evaluate potential human health risk under current and potential future conditions within Area II of the FFA. The HHRA evaluated potential human health concerns for exposure to environmental media within Area II of the FFA affected by past DoD activities. To determine human health concerns, the HHRA evaluated potential sources of contamination and routes of migration based on current and potential future uses of Area II. The HHRA results were based upon potential exposure pathways that could occur or are reasonably likely to occur in the future. Risks determined in the HHRA are considered baseline risks associated with exposure to the FFA. The baseline risk assumes no remedial actions or other means of exposure reduction (e.g., digging restrictions). The HHRA evaluates the reasonable maximum exposure that has the potential to occur. Therefore, HHRA results are considered potential and are used as a guideline in making risk management decisions.

2.7.1.1 Methodology Used in the Human Health Risk Assessment

The HHRA methodology involves a four-step process:

1. Data Evaluation
2. Exposure Assessment
3. Toxicity Assessment
4. Risk Characterization.

The methodology used for implementation of this process for the Area II HHRA is described below.

In Step 1, concentrations of contaminants in Area II were compiled and compared to USEPA Regional Screening Levels (RSLs) and PADEP MSCs, and COPCs were identified. The analytical data from the RI were reviewed to determine COPCs within Area II Zones 1, 2, and 3 (see Section 2.2.2.1 and Figure 2-1). A chemical was selected as a COPC and retained for further evaluation in the HHRA for each zone if the maximum detected concentration in soil in the zone exceeded the risk-based screening concentration.

During Step 2, actual or potential COPC release pathways were analyzed, potentially exposed human populations and exposure pathways were identified, COPC concentrations at potential points of human exposure were determined, and COPC intakes were estimated. An exposure pathway describes a mechanism by which a receptor (population or individual) may be exposed to COPCs. Receptors evaluated for each zone were resident (adult, child), trespasser (adult, adolescent), school student (adolescent), office/commercial worker, maintenance/landscape worker, construction worker, and daycare student (child, southeast portion of Zone 3 only).

The conceptual site model for human health at Area II, presented in Figure 2-2, identifies which exposure pathways were determined to be complete and therefore evaluated further in the HHRA. Exposure pathways begin from potential source areas and progress through the environment via various fate and transport processes to potential human receptors. A completed exposure pathway requires the following four components:

- A source and mechanism of chemical release to the environment
- An environmental transport medium for the released chemical
- A point of potential human contact with the contaminated medium
- A human exposure route at the point of exposure.

All four components must exist for an exposure pathway to be complete and for exposure to occur. Incomplete exposure pathways do not result in actual human exposure and are not included in the exposure assessment and resulting risk characterization. Potentially complete exposure pathways indicate that exposure to a contaminant may have occurred in the past, may be occurring currently, or may occur in the future.

For each receptor examined, the analysis assessed exposures that could occur by the following three complete pathways for soil:

- Dermal contact with COPCs
- Inhalation of dust contaminated with COPCs that may become airborne
- Ingestion of COPCs.

In Step 3, qualitative and quantitative toxicity data for each COPC were identified, and appropriate guidance levels for risk characterization were identified. The toxicity assessment considered the types of potential adverse health effects associated with exposures to COPCs, the relationship between the magnitude of exposure and potential adverse effects. Potential risks associated with the majority of COPCs were evaluated through comparison to toxicity values from USEPA's Integrated Risk Information System, or values from other accepted sources as detailed in the RI (EA 2014).

In Step 4, the calculated chemical intakes and toxicity values were used to quantitatively estimate carcinogenic risks and non-carcinogenic hazards for each potential receptor on a cumulative basis across all pathways and media. Carcinogenic risk results were compared to the USEPA carcinogenic "acceptable risk range" of 10^{-4} to 10^{-6}. For non-carcinogens, a threshold of 1.0 was used. Unacceptable risks for potential receptors were identified when cumulative carcinogenic risks exceeded the upper bound of the "acceptable risk range" (i.e., 10^{-4}) or cumulative non-carcinogenic hazards exceeded 1.0, based upon a target organ breakdown. Lead was evaluated through the use the USEPA blood lead models. The Integrated Exposure Uptake Biokinetic Lead Model (USEPA 2010) was used to evaluate potential concerns for residential exposure to lead in soil, focusing on children 0-7 years of age. To achieve a specific level of protectiveness, USEPA has established no more than a 5 percent probability that children (under 7 years of age) exposed to lead would have a blood lead level exceeding 10 micrograms per decileter. The Technical Review Workgroup's lead model for assessing risks associated with adult exposures to lead in soil was used to assess potential concerns for industrial scenarios (i.e., workers) and adolescent school children, in accordance with USEPA guidance (USEPA 2003a, 2003b, and 2009).

2.7.1.2 Findings of the Human Health Risk Assessment

When Area II was evaluated as a whole, the HHRA results indicated there are no exceedances of the carcinogenic or non-carcinogenic risk thresholds for any of the current or future receptors evaluated. However, to be conservative, each zone in Area II was also evaluated individually for potential localized risks due to localized areas of "elevated" concentrations. Localized areas of "elevated" concentrations were identified as sample locations with COPCs that potentially represent a carcinogenic risk level of 10^{-4} or a non-carcinogenic hazard quotient of 10. The carcinogenic risk level represents the upper-bound of the acceptable risk range of 10^{-6} to 10^{-4}.

No potential localized areas of "elevated" concentrations were identified within Zone 1. A localized area of "elevated" concentrations of benzo(a)pyrene was identified within the southwestern corner of Zone 3. The localized area of "elevated" benzo(a)pyrene concentrations would be a concern only for potential residential use of this area and is not a concern for

workers. A potential localized area of "elevated" PCB was identified within one transformer area in Zone 2. Aroclor 1260 at sample location T-1101 is a potential concern for residential receptors. This sample location was in surface soil adjacent to Building 28 in Zone 2 where surfaces are bare/vegetated and pervious.

Lead was not evaluated in terms of carcinogenic and non-carcinogenic risk because no reference dose for lead as a non-carcinogenic substance is available. Alternately, potential concerns from localized areas of "elevated" lead concentrations were evaluated through the use the USEPA blood lead models. Potential localized areas of "elevated" lead concentrations were identified as those areas with sample locations having lead concentrations greater than 1,000 mg/kg. This concentration is adequately protective of the current use receptors (e.g., school students and office/commercial workers) and removal of these "elevated" concentrations will result in lead levels that are also protective for future receptors, including the resident child. There were 16 sample locations within Zone 1 with lead detected at greater than 1,000 mg/kg. All of these sample locations are within exposed grassy areas. A majority of the sample locations above 1,000 mg/kg are located adjacent to the former residences that surround the parade ground, which are currently unoccupied or used for residential or commercial purposes. The widespread nature of exceedances and limited vertical extent of lead in Zone 1 indicates that the source is most likely historical deposition onto undisturbed soils. Potential sources for deposition include airborne dust particles and paint chips. Buildings in the areas with the observed highest concentration of lead in soil are among the oldest buildings at the FFA. These buildings have been historically painted (John Milner Associates 1979) and the paint was observed to be flaking during the RI field work.

Based on the results of the HHRA, three COCs associated with areas of localized "elevated" concentrations were identified: lead, Aroclor 1260, and benzo(a)pyrene. Further action was recommended for six AOCs (1 [includes sub-AOCs 1A-1D], 6, 10, 13, 20, and 21) where localized areas of "elevated" concentrations were identified, mainly due to risk from exposure to lead (Table 2-2, Figure 2-3). Based on the results of the HHRA, "elevated" concentrations of COCs within these AOCs pose unacceptable risk or potential concerns to future receptors.

Table 2-2. Area of Concern Risk Summary

AOC	Zone	COCs	HHRA Finding
1A-1D [1]	1	Lead	Unacceptable risk identified for future resident child receptor; 16 localized areas of "elevated" lead concentrations identified.
6	2	PCB (Aroclor 1260)	Unacceptable risk identified for future residential receptor; one localized area of "elevated" Aroclor 1260 concentrations identified.
10	2	Lead	Unacceptable risk identified for future resident child receptor; one localized area of "elevated" lead concentrations identified.
13	3	Benzo(a) pyrene	Unacceptable risk identified for future residential receptor; one localized area of "elevated" benzo(a)pyrene concentrations identified.
20	3	Lead	Unacceptable risk identified for resident child receptor; one localized area of "elevated" lead concentrations.
21	3	Lead	Unacceptable risk identified for future daycare students; four localized areas of "elevated" lead concentrations identified.

Notes:
(1) Sub-AOCs 1A, 1B, 1C, and 1D are non-contiguous.
AOC = Area of concern.
COC = Contaminant of concern.
HHRA = Human health risk assessment.
PCB = Polychlorinated biphenyl.

The baseline HHRA, in conjunction with the 2014 supplemental investigation (EA 2016), indicated that no remediation or institutional or engineering controls will be required to demonstrate attainment of site-specific risk-based standards in other portions of Area II.

2.7.2 Screening-Level Ecological Risk Assessment

The purpose of the SLERA was to determine if, under expected exposure conditions, chemicals found in the soil of Area II are at concentrations that may cause unacceptable risk to ecological receptors in the area. The SLERA was performed primarily for Zone 1 (EA 2014), since Zone 1 was identified as providing a habitat for ecological organisms. Zones 2 and 3 contain primarily buildings, parking lots, and impervious surfaces and, consequently, do not provide good habitat for ecological organisms.

2.7.2.1 Methodology of the Ecological Risk Assessment

USEPA uses an eight-step process for assessing ecological risk (USEPA 1997). The SLERA consists of Steps 1 and 2, which is a preliminary screening process using very conservative assumptions. Consequently, a second tier of the risk assessment process was performed as part of the RI for Area II (EA 2014), consistent with USEPA guidance (USEPA 2001). Specifically, the second tier refines exposure assumptions, which provides a more site-specific assessment of potential risks to ecological receptors in Zone 1 of FFA Area II.

Ecological receptors of concern identified for Area II include terrestrial plants and invertebrates, birds (represented by a robin and hawk), and mammals (represented by a shrew, rabbit, and fox).

The following measurement endpoints were evaluated in the ecological risk assessment:

- Media Chemistry for Soil—The measurement of chemical concentrations in soil provides the means, when compared to appropriate soil screening values, to assess the protection of terrestrial organisms that live in the soil.

- Chemical Doses for Terrestrial Birds and Mammals—The calculation of chemical doses to birds and mammals provides the means, when compared to toxic doses, for drawing inferences regarding the protection of birds and mammals that live at FFA Area II.

The ecological risk evaluation was limited to surface soil because ecological organisms are only exposed to soil in the “root zone,” which is bounded by the top 6 in. to no greater than 2 ft bgs. Additionally, only surface soil samples that are exposed (e.g., not covered with asphalt or concrete) were used for the COPC selection because there is an incomplete pathway between ecological receptors and pavement-covered samples. COPCs for exposed surface soils were identified using USEPA Ecological Soil Screening Levels, where available, and other available sources as described in the RI (EA 2014).

A food-web model was used to estimate the dietary intake of COPCs by wildlife species. The models estimate doses to birds and mammals for comparison to toxic doses. Dietary exposures were estimated as body-weight-normalized daily doses for comparison to body-weight-normalized daily dose toxicity reference values. Separate doses were calculated for food

ingestion and incidental soil ingestion, and these were summed to produce the total dose for each receptor of concern. The risk characterization consisted of comparing the exposure concentration to appropriate toxicity values for lower trophic level receptors (e.g., plants and soil invertebrates), and comparing calculated doses to dose-based toxicity reference values for higher trophic level receptors.

2.7.2.2 Findings of the Ecological Risk Assessment

Based on the risk characterization, high lead concentrations in exposed surface soil samples in Zone 1 do not represent an unacceptable risk to populations of lower trophic level organisms (plants and soil invertebrates); however lead concentrations may represent risk to the robin and shrew due to food web exposure. No threatened, endangered, or listed species have been identified in Area II of the FFA.

It should be noted that a degree of uncertainty is associated with the SLERA. Conservative screening values were used to bias uncertainty in the direction of overestimation of risks. Toxicological data that underpin the screening values are inherently uncertain because laboratory data are extrapolated to field sites. Additionally, COPCs were assumed to be 100 percent available to receptors. This is a highly unlikely circumstance based on soil chemistry. Under many circumstances, both inorganic and organic compounds are chemically bound in the soil matrix and are not available for uptake by receptors. This resulted in overestimation of risks. Due to the uncertainty associated with ecological risk and elevated background concentrations in an urban environment (anthropogenic, non-DoD sources), it is assumed that levels protective of human health will also be protective of ecological receptors by reducing ecological risks to levels consistent with or less than background risks.

2.7.3 Areas of Concern Targeted by the Response Action

AOCs to be addressed under this Decision Document, based on the risk assessment findings, are AOCs 1, 6, 10, 13, 20, and 21 (Figure 2-3). The areas and associated volumes of soil for each AOC are summarized in Table 2-3. Volumes were calculated based on aerial extent and depth of COCs exceeding remediation goals. Estimated volumes accounting for expansion of soils upon excavation were also calculated. Vertical and horizontal boundaries were based on existing data and the assumption that soil concentrations less than remediation goals were located midway between locations that were identified to exceed the remediation goal and the closest sampling location that did not exceed the remediation goal. The AOCs are described in more detail below.

2.7.3.1 AOC 1

Lead is the COC in AOC 1, which is located in the northwest portion of Area II. Since the data show non-contiguous localized areas of “elevated” concentrations, AOC 1 is further divided into four sub-AOCs, AOC-1A, AOC-1B, AOC-1C, and AOC-1D, for discussion and understanding of findings and site conditions.

AOC-1A is composed of manicured lawns, established trees, and ornamental landscaping. AOC-1A consists of areas surrounding historical buildings 1, 2/3, 4, 5, and 14; in the southwest corner of the parade ground; and along the western fence line. Buildings 1, 2/3, 4, 5, and 14

were constructed from 1816 to 1823 and are the oldest structures present in Area II. The parade ground is currently used by the adjacent charter school as a recreational area. The area surrounding the parade ground is part of the common area associated with use of the historical buildings, some of which are currently occupied for residential or office use. The parade ground and adjacent areas represent the majority of the greenspace associated with Area II and have been in continuous use as such since 1816. RI data indicate that lead concentrations exceeding the remediation goal are present from 0 to 6 in. bgs. These exceedances occur in an area of approximately 58,567 square feet (ft^2). The volume of soil exceeding the remediation goal is estimated to be 1,085 cubic yards (yd^3).

AOC-1B is located in the parade ground, which is currently used by the adjacent charter school as a recreational area. Data from the RI and 2014 supplemental investigation indicate lead concentrations exceeding the remediation goal are present from 0.5 to 30 in. bgs. The exceedances occur in an area of approximately 4,440 ft^2. The volume of soil exceeding the remediation goal is estimated to be 411 yd^3, based on an average depth of 2.5 ft. AOC-1B is composed of manicured lawn.

AOC-1C is located in Zone 2 west of historical Building 15 (circa 1835) and north of historical Building 108 (circa 1942). Data from the RI and the 2014 supplemental investigation indicate that lead concentrations exceeding the remediation goal are present from 0 to 5 ft bgs. It should be noted that this is based on an exceedance of the remediation goal at one sample location (due to limited vertical delineation). Therefore, this is a conservative estimate. The exceedances occur in an area of approximately 629 ft^2. The volume of soil exceeding the remediation goal, based on an average depth of 5 ft bgs, is estimated to be 117 yd^3. AOC-1C is located in a landscaped/mulched berm between a road and a parking area.

AOC-1D is located to the east of historical Building 101 (circa 1864). Data from the RI and 2014 supplemental investigation indicate that lead concentrations exceeding the remediation goal are present from 0 to 0.5 ft bgs. Lead concentrations exceeding the remediation goal occur in an area of approximately 969 ft^2. The volume of soil exceeding the remediation goal is estimated to be 18 yd^3. AOC-1D is composed of manicured lawn.

2.7.3.2 AOC 6

Aroclor 1260 is the COC in AOC 6, which consists of an active transformer (non-PCB) surrounded by structures. Aroclor 1260 concentrations exceeding the remediation goal are present from 0 to 3 ft bgs. These exceedances occur in an area of approximately 447 ft^2. The volume of soil exceeding the remediation goal is estimated to be 50 yd^3. AOC 6 is adjacent to an active transformer; the area is bare ground or covered with wood decking and surrounded with asphalt paving.

2.7.3.3 AOC 10

Lead is COC in AOC 10. This AOC is located in a grassy area to the west of historical Building 110 (circa 1941). It is bound to the north and west by roadway and to the east by Building 110. Concentrations of lead in delineation samples collected in the grassy area to the south were below the remediation goal. Lead was vertically delineated from 0 to 5 ft bgs. It should be

noted that this is based on a limited vertical delineation. Therefore, it is a conservative estimate. Lead concentrations exceeding the remediation goal occur in an area of approximately 2,417 ft^2. Based on elevated lead concentrations at depths up to 5 ft bgs, the volume of soil exceeding the remediation goal is conservatively estimated to be 448 yd^3. AOC 10 consists of manicured lawns and established trees. Additional vertical delineation of lead in soils at AOC 10 may reduce the volume of soil to be excavated. Typically, lead concentrations in Area II do not exceed the remediation goal in native soils, which are commonly found 3-5 ft bgs.

2.7.3.4 AOC 13

Benzo(a)pyrene is the COC in AOC 13. This AOC is located to the west and south of historical Buildings 201 and 202 (circa 1941). This AOC is paved with asphalt, which covers concrete in some areas. AOC 13 is used as a parking area for adjacent businesses. AOC 13 is adjacent to Frankford Creek and also has a concentration of utilities and rail road tracks within it. Benzo(a)pyrene was vertically delineated from 0 to 5 ft bgs. Benzo(a)pyrene concentrations exceeding the remediation goal occur at three sampling locations, delineating an area of approximately 12,655 ft^2. The volume of soils exceeding the remediation goal is estimated to be 1,875 yd^3, based on an average depth of 4 ft.

Table 2-3: Area of Concern Characteristics and Remedial Areas and Volumes

AOC	Zone	Planned Future Use	Constituent Driving Risk	Impacted Sample Depths (ft bgs)	Surface Cover Type	Estimated Area (ft^2)	Estimated Volume (yd^3)	Estimated Volume with Expansion [1] (yd^3)
1	1 & 2	Residential, Commercial, and School	Lead	0-5	Grass	64,605	1,630	2,038
1A				0-0.5		58,567	1,085	1,356
1B				0-2.5		4,440	411	514
1C				0-5		629	117	146
1D				0-0.5		969	18	22
6	2	School	Aroclor 1260	0-3	Bare/grass	447	50	62
10	2	School	Lead	0-5	Grass/bare	2,417	448	559
13	3	Residential	Benzo(a) pyrene	0-5	Asphalt/ concrete	12,655	1,875	2,344
20	3	School	Lead	0-2	Weeds/ bare/ brick	4,894	363	453
21	3	School (recreational fields)	Lead	0-5, 5-7 at UBZ3-63	Asphalt/ concrete	33,053	6,059	7,574

Notes:
(1) Volume calculated using an expansion factor of 1.25.
AOC = Area of concern.
bgs = Below ground surface.
ft = Foot (feet).
ft^2 = Square foot (feet).
yd^3 = Cubic yard(s).

2.7.3.5 AOC 20

Lead is the COC in AOC 20. This AOC is located in the courtyard adjacent to historical Building 215 (circa 1864). This building is currently proposed for redevelopment and use a charter school. Lead was vertically delineated from 0 to 2 ft bgs. Lead concentrations exceeding the remediation goal occur in an area of approximately 4,894 ft^2. The volume of soil exceeding the remediation goal is estimated to be 363 yd^3, based on an average depth of 2 ft. The nature and extent of elevated lead levels in disturbed areas of this AOC are uncertain. Two former buildings (Buildings 216 and 217) occupied a majority of AOC 20. They were demolished by the current owner and any basements may have been filled with debris. Therefore, construction debris could be encountered in the subsurface. During the RI, AOC 20 was observed to be overgrown with evidence of construction debris on the surface. However, this area is targeted for redevelopment in the immediate future. The estimated volume of soil with lead concentrations exceeding the remediation goal may be a conservative estimate due to the presence of construction debris, which could lower the actual volume of soil that requires removal.

2.7.3.6 AOC 21

Lead is the COC in AOC 21. This AOC is located in an open area in proximity to Building 215 (circa 1864) near the former location of Building 227. Lead was vertically delineated from 0 to 5 ft bgs with localized exceedances from 5 to 7 ft bgs. AOC 21 is partially paved, and several utilities run through this area. Lead concentrations exceeding the remediation goal occur in an area of approximately 33,053 ft^2. The volume of soil exceeding the remediation goal is estimated to be 6,059 yd^3, based on an average depth of 5 ft. As of the date of the RI, AOC 21 was covered with gravel and construction debris piles.

At the time the baseline HHRA was completed, the anticipated land use for all of AOC 21 was assumed to be residential. However, since the property ownership change described in Section 2.2.1, a small portion of land (approximately 1 acre) that was once planned for residential use is now owned by the Philadelphia Industrial Development Corporation, and planned for commercial or industrial reuse. The baseline HHRA did not identify an unacceptable risk for the industrial/commercial land use exposure scenario at AOC 21. Therefore, the portion of AOC 21 that is owned by the Philadelphia Development Corporation does not require remedial action and is not being addressed in this Decision Document. Figure 2-3 reflects the updated boundary of AOC 21.

2.8 REMEDIAL ACTION OBJECTIVES

In order to develop remedial alternatives to address contaminated soil at Area II, remedial action objectives (RAOs) were developed to provide goals for protecting human health and the environment. The RAOs for Area II soils are:

- Prevent human exposure via direct contact of residential receptors to impacted soil that exceeds 2.2 mg/kg for Aroclor 1260, 0.9 mg/kg for surface soil and 1.3 mg/kg for subsurface soil for benzo(a)pyrene, and 1,000 mg/kg for lead.

- Prevent ecological exposure via direct contact of ecological receptors to impacted soil that exceeds 1,000 mg/kg for lead in AOC 1.

2.8.1 Remediation Goals

Numerical remediation goals representing COC concentrations that are protective of human health and the environment were determined in the FS (EA 2016) based on receptor groups and exposure pathways.

Factors taken into consideration when identifying applicable screening criteria for a specific contaminant for a specific medium included the following:

- Do remediation goals for carcinogens (benzo[a]pyrene and Aroclor 1260) provide protection of human health within the risk range of 10^{-4} to 10^{-6}?

- Are remediation goals for non-carcinogens (lead) sufficiently protective of human health?[2]

Achievement of the remediation goals would result in unlimited use and unrestricted exposure for Area II. Site-specific background values for lead and benzo(a)pyrene in Area II soils were taken into consideration during determination of the remediation goals since CERCLA generally does not clean up to concentrations below natural or anthropogenic background levels (USEPA 2002).

The selected remediation goals are based on human health risks and are intended to be protective of human health for an unrestricted site reuse (i.e., residential). The bases for the remediation goals are summarized in Table 2-4.

The rationale for selecting the remediation goals for each of the COCs (lead, benzo(a)pyrene, and Aroclor 1260) is discussed in the following sections.

2.8.2 Remediation Goal for Lead

Lead is the most prevalent COC in Area II and it is the driver for remediation in four of the six AOCs where remediation has been proposed (AOCs 1, 10, 20, and 21). The baseline HHRA indicated that future child resident receptors exposed to areas of elevated lead concentrations may develop elevated blood lead levels. The remediation goal for lead is based on review of the following to-be-considered guidance and background levels because no applicable or relevant and appropriate requirements (ARARs) were identified:

- USEPA RSLs
- PADEP MSCs

[2] As noted in Section 2.7.2, due to the uncertainty associated with ecological risk and elevated background concentrations in an urban environment (anthropogenic, non-DoD sources), it is assumed that levels protective of human health will also be protective of ecological receptors.

- The risk-based level for a school student, developed via USEPA blood lead modeling
- Background values for Area II.

The USEPA RSL for lead for a residential scenario is 400 mg/kg. The PADEP MSC for lead for a residential scenario is 500 mg/kg. The site-specific surface soil background lead concentration for Area II was identified as 1,000 mg/kg (as detailed in the RI). In addition, the adult lead model was used to determine a soil lead level that would not result in elevated blood-lead levels for school students. These calculations are presented in the RI (EA 2014). The resulting soil lead level that would not result in elevated blood-lead levels for school students was calculated as 1,320 mg/kg; this was conservatively rounded to 1,000 mg/kg. Remediation of lead concentrations exceeding 1,000 mg/kg would also be protective of the resident child because the resulting average concentration of lead across the zone would be lower than the USEPA RSL and PADEP MSC for a residential scenario.

Consistent with the background concentration at Area II, a remediation goal of 1,000 mg/kg was selected for lead since the targeted removal of soil with lead concentrations greater than 1,000 mg/kg will result in the protection of human health. This remediation goal will also protect the environment by reducing ecological risks in AOC 1 to levels consistent with background risks.

2.8.3 Remediation Goal for Benzo(a)pyrene

Benzo(a)pyrene is the COC for Area II AOC 13. The remediation goal for benzo(a)pyrene is based on review of the following to-be-considered guidance and background values because no ARARs were identified:

- USEPA RSLs
- PADEP MSCs
- Background values for Area II.

The USEPA RSL for a residential scenario based on a carcinogenic risk of $1x10^{-6}$ is 0.015 mg/kg. The PADEP MSC for a residential scenario is 0.57 mg/kg. The calculated risk-based preliminary remediation goals (PRGs) were 1.5 mg/kg for 10^{-4} risk, 0.15 mg/kg for 10^{-5} risk, and 0.015 mg/kg for 10^{-6} risk, similar to the USEPA RSL.

Site-specific benzo(a)pyrene background values for Area II are 0.9 mg/kg for surface soil and 1.3 mg/kg for subsurface soil, as detailed in the RI (EA 2014). Comparison of the background soil values to the USEPA RSL of 0.015 mg/kg reveals that the background surface soil value represents an approximate carcinogenic risk level of $6x10^{-5}$, while the background subsurface soil value represents an approximate carcinogenic risk level of $9x10^{-5}$. These risk levels are within the USEPA acceptable risk range and would result in acceptable risks for unrestricted exposure. Because they are within the acceptable risk range and would be protective of human health, the background values of 0.9 mg/kg for surface soil and 1.3 mg/kg for subsurface soil for benzo(a)pyrene were selected as the remediation goals.

2.8.4 Remediation Goal for Aroclor 1260

Aroclor 1260 is the COC for Area II AOC 6. The remediation goal for Aroclor 1260 is based on the following to-be-considered guidance, because no ARARs were identified:

- USEPA RSLs
- PADEP MSCs.

The USEPA RSL for the residential scenario based on a carcinogenic risk of 10^{-6} is 0.24 mg/kg. The PADEP MSC for a residential scenario is 9 mg/kg. The site-specific calculated risk-based PRGs were 22 mg/kg for 10^{-4} risk, 2.2 mg/kg for 10^{-5} risk, and 0.22 mg/kg for 10^{-6} risk. Site-specific Aroclor 1260 background values were not calculated due to the limited nature of its occurrence in Area II.

A comparison of the PADEP MSC of 9 mg/kg to the site-specific PRGs calculated during the HHRA and USEPA RSL reveals that the PADEP MSC represents an approximate carcinogenic risk level of $5x10^{-5}$. The site-specific risk-based PRG of 2.2 mg/kg, corresponding to a carcinogenic risk of 10^{-5}, was selected as the remediation goal for Aroclor 1260. The remediation goal of 2.2 mg/kg is within the acceptable risk range and would result in acceptable risks for unrestricted exposure.

Table 2-4: Site-Specific Remediation Goals

Contaminant of Concern	MSC for Soil RDC (mg/kg)	Site-Specific Soil Background (mg/kg)	Site-Specific Concentration for Carcinogenic Risk of 10^{-5} (mg/kg)	Remediation Goal(s) (mg/kg)
Lead	400	1,000	NA	1,000
Benzo(a)pyrene	0.57	0.9 (surface soil) 1.3 (subsurface soil)	0.15	0.9 (surface soil) 1.3 (subsurface soil)
Aroclor 1260	9	NA	2.2	2.2

Notes:
mg/kg = Milligram(s) per kilogram.
MSC = Medium-specific concentration.
NA = Not applicable.
RDC = Residential direct contact.

2.9 DESCRIPTION OF ALTERNATIVES

2.9.1 Description of Remedy Components

Alternative 1 – No Action

- No further remedial activities or long-term monitoring or maintenance would be conducted at Area II.
- Provides a baseline against which the other remedial alternatives are compared.
- Required under the NCP.

Alternative 2 – Excavation and Disposal

- Pre-design investigation to determine location of underground utilities
- Pre-design investigation where vertical delineation of contamination is required
- Removal of soils with contaminant concentrations exceeding remediation goals via excavation
- Field screening for lead during excavation in AOCs with lead concentrations exceeding the remediation goal to confirm the limits of removal
- Offsite disposal of excavated contaminated soil in a facility authorized to accept the waste
- Post-excavation confirmation sampling of soil from the excavation bottoms and sidewalls
- Placement of clean back fill into the excavations
- Restoration of the excavation area to pre-excavation conditions.

Alternative 3 – Installation of a Cap and Future Use Restrictions

- Pre-design investigation to determine location of underground utilities
- Installation of a cap of clean fill over soil with contaminant concentrations greater than remediation goals
- Installation of engineering controls to control stormwater flow, as needed
- Execution of an environmental covenant to restrict soil uses, enforceable by PADEP
- Five-year reviews to assess the protectiveness of the remedy, relative to the soil with contaminant concentrations exceeding remediation goals that will remain onsite.

2.9.2 Common Elements and Distinguishing Features of Each Alternative

Common Elements

The alternatives do not share remedial technologies in common. Both Alternatives 2 and 3 would require a pre-design investigation to determine the location of underground utilities, and both alternatives would be reliable and would achieve the RAOs upon completion. The timeframe for construction of either of these alternatives is expected to be less than 6 months.

Distinguishing Features

- Alternative 1 is the only alternative that does not address the unacceptable risks associated with COCs identified in Area II.

- Alternative 2 is the only alternative that includes excavation of soil containing COCs at concentrations exceeding remediation goals and disposal of these soils at an offsite facility. Alternative 2 would therefore incorporate confirmatory sampling to confirm that remediation goals have been met. This is also the only alternative that would not result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure. Therefore, 5-year reviews under CERCLA would not be required.

- Implementation of Alternative 2 would require an additional pre-design investigation to refine the vertical extent of lead contamination in soil.

- Alternative 3 is the only alternative that includes installation of a cap of clean fill over soils containing COCs at concentrations exceeding remediation goals. Alternative 3 is also the only alternative that includes future use restrictions and would require 5-year reviews, because hazardous substances, pollutants, or contaminants would remain onsite above levels that allow for unlimited use and unrestricted exposure.

2.9.3 Expected Outcomes of Each Alternative

Alternative 1 – No Action

Implementation of this alternative would not affect potential land use, although potential unacceptable risk to human health and ecological receptors would remain.

Alternative 2 – Excavation and Disposal

Following the removal of contaminated soil, any stockpiled soil not exceeding the remediation goals and clean back fill would be placed into the excavations. Restoration of the excavation areas would be conducted to the original pre-excavation conditions. Implementation of Alternative 2 would allow for unlimited use and unrestricted exposure at the AOCs.

Alternative 3 – Installation of a Cap and Future Use Restrictions

Capping of contaminated soil would address the identified risk by preventing direct contact with the COCs in soil. An environmental covenant on the deeds of the parcels of land would be required to restrict use of the areas of soils with COCs exceeding remediation goals that are capped or covered by existing impervious surfaces. The locations of COCs exceeding remediation goals, a description of the remedy, compliance reporting requirements, and any activity use limitations would be noted on the environmental covenant. However, these restrictions are not expected to be incompatible with the anticipated future industrial, commercial, institutional, and residential land uses of Area II.

2.10 COMPARATIVE ANALYSIS OF ALTERNATIVES

Pursuant to USEPA guidance, the remedial alternatives were examined for adherence to nine criteria as specified in the NCP.

2.10.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses elimination or reduction of potential risks to human health and the environment as identified in the RI (EA 2014). This is a threshold criterion and, per the NCP, the selected alternative must eliminate, reduce, or control threats to public health and the environment through treatment, engineering controls, or institutional controls.

Alternatives 2 and 3 are protective of human health and the environment. Alternative 2 would remove COCs above the remediation goals, and Alternative 3 would prevent receptors from directly contacting soils that contain COCs exceeding the remediation goals. Alternative 1 (No Action) would not be protective of human health or the environment because it does not address potential exposure to contaminated soil.

2.10.2 Compliance with Applicable or Relevant and Appropriate Requirements

This criterion evaluates compliance with chemical-, action-, and location-specific ARARs, as well as to-be-considered guidance. These requirements typically include federal and state environmental statutes. This is also a threshold criterion, and compliance with these requirements is required under CERCLA, unless a waiver is obtained.

No ARARs (chemical-, location-, or action-specific) were identified in the FS. For Alternatives 2 and 3, meeting the to-be-considered criteria (PADEP MSCs) for lead and benzo(a)pyrene is technically impracticable from an engineering perspective. However, Act 2 (PADEP 1995) also allows for alternate Background or Site-Specific Standards to be demonstrated. The remediation goals for lead and benzo(a)pyrene, which are protective of human health, are equivalent to background concentrations. The remediation goal for the PCB Aroclor 1260 is site-specific and risk-based. Remediation of soils exceeding these remediation goals as part of Alternatives 2 and 3 would allow the alternate Act 2 levels to be achieved. Alternative 1 would not meet Act 2 requirements.

2.10.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence evaluates the ability of each alternative to achieve RAOs and remain protective of human health and the environment in the long-term. This criterion also considers the magnitude of residual risk that would remain after implementation of each alternative and the adequacy and reliability of controls.

Alternative 2 would be the most effective and permanent option for achieving the RAOs at FFA Area II, followed by Alternative 3. Both Alternatives 2 and 3 would promote achievement of all RAOs, although there is a level of uncertainty associated with the effectiveness of Alternative 3.

The COC removal under Alternative 2 is a permanent alternative for addressing overall contamination at Area II. For Alternative 3, long-term effectiveness would depend on maintenance to ensure the integrity of the cap. Alternative 3 would also require enforcement of future use restrictions. Alternative 1 would not be effective as it would not address the RAOs. The magnitude of risk is high for Alternative 1, low for Alternative 2, and moderate for Alternative 3.

2.10.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Reduction of toxicity, mobility, or volume through treatment assesses the amount of hazardous materials permanently destroyed or treated by each alternative. The degree and irreversibility of expected reductions in toxicity, mobility, or volume of contamination are also considered, along with the type and quantity of treatment residuals that remain after treatment is complete.

Since none of the alternatives achieves remediation through treatment, none of the alternatives satisfies the statutory preference for treatment as the principle element. The alternatives also do not permanently destroy hazardous materials, reduce toxicity, or produce treatment residuals. Alternatives 2 and 3 would achieve reduction in the mobility of contaminants through removal or capping of the contaminated soils.

2.10.5 Short-Term Effectiveness

Short-term effectiveness considers potential negative impacts on community, workers, and the environment during remedial actions, as well as the time required to meet RAOs under each alternative.

Overall, Alternative 3 would have the best short-term effectiveness, followed by Alternative 2. Alternative 2 would have the most potential negative impacts to workers, the surrounding community, and the environment because it is the most invasive and would include removal and transportation of hazardous soil. Alternative 3 would create fewer negative impacts associated with removal of small amounts of relatively clean soil during installation of the cap. Alternative 1 would not create any additional risks to workers, the community, or the environment beyond those already present at the site.

Alternative 2 would meet the objective for protection of human health when excavation is complete and Alternative 3 would meet the objective as soon as additional restrictions are in place. Both would achieve protection of receptors within a year of implementation. Therefore, these RAOs are expected to be met within 1-2 years under Alternatives 2 or 3. Alternative 1 would not meet RAOs and thus not achieve protection of receptors.

2.10.6 Implementability

The implementability criterion addresses the availability, reliability, and ease of implementation of remedial technologies, the administrative feasibility, the ability to obtain the access necessary to perform the remedial actions, and any additional investigations or pilot studies required.

Overall, Alternative 2 would be the most implementable for AOCs without impervious cover and with shallow soil contamination. Alternative 3 would more implementable where impervious cover is already present and soil contamination is not at the surface. Both alternatives would require pre-design investigations. Alternative 2 would rely primarily on proven and reliable technologies and standard equipment. Excavation activities would need to be scheduled to minimize negative impacts to current site users, particularly the schools. Implementation of Alternative 3 would require careful consideration of how the cap would change the grade or appearance of the historical area. Engineering controls such as grading, curbing and/or expansion or relocation of existing drainage features could be required to protect historical buildings during times of frequent or large rain events following capping. Alternative 3 would also require long-term management (LTM) for continued reliability in the long term. The future use restrictions required under Alternative 3 are expected to be implementable. Alternative 1 would not be implementable from an administrative standpoint because it does not address contamination or risks.

2.10.7 Cost

In evaluating costs for remedial alternatives, capital costs were estimated, as well as annual costs for 30 years of O&M (including LTM and long-term compliance costs). Total costs are presented as 30 year present worth costs, using a discount rate of 7 percent.

The estimated costs for each alternative are presented in Table 2-5. These costs were approximated for use in comparing alternatives, and are consistent with the FS (EA 2016). The FS provides more details on the methodology used in estimating costs.

Table 2-5: Alternative Cost Comparison by Area of Concern

Alternative		AOC 1	AOC 6	AOC 10	AOC 13	AOC 20	AOC 21
1	**Total Cost**	$0	$0	$0	$0	$0	$0
2	**Capital Cost**	$832,000	$129,000	$293,000	$1,376,000	$239,000	$2,407,000
	Annual O&M Cost	$0	$0	$0	$0	$0	$0
	Total Cost	**$832,000**	**$129,000**	**$293,000**	**$1,376,000**	**$239,000**	**$2,408,000**
3	**Capital Cost**	$708,000	$115,000	$132,000	$25,000	$169,000	$413,000
	Annual O&M Cost	$11,000	$11,000	$11,000	$11,000	$11,000	$11,000
	Total Cost	**$829,000**	**$235,000**	**$253,000**	**$146,000**	**$290,000**	**$534,000**

Notes:
Capital costs listed include design costs.
AOC = Area of concern
O&M = Operations and maintenance.

No costs are associated with Alternative 1, No Action. Alternative 2 only has the capital costs associated with excavation, disposal, and restoration. Alternative 3 has capital costs for cap installation and implementation of an environmental covenant, remedial action operations costs for conducting annual cap inspections, and costs for 5-year reviews. Overall, Alternative 2 is less costly for AOC 6 and AOC 20, while Alternative 3 is less costly for AOC 13 and AOC 21. For AOC 1, the costs for implementation of Alternative 2 and Alternative 3 are similar. For

AOC 10, costs to implement Alternative 2 were estimated to be somewhat higher than the costs to implement Alternative 3; however, it is anticipated that the estimated cost would likely decrease following refined delineation of the contamination at depth as part of a pre-design investigation.

2.10.8 State/Support Agency Acceptance

This criterion considers whether the State agrees with, opposes, or has no comment on each of the remedial alternatives. PADEP reviewed the RI, the FS, and the Proposed Plan (EA 2014, 2016). Their comments on these documents indicate support for Alternatives 2 and 3. As noted in Section 3.1, during the public meeting PADEP acknowledged the State's concurrence with these alternatives, which would protect human health and the environment by addressing unacceptable risks at Area II.

2.10.9 Community Acceptance

This criterion considers local community opinion regarding each of the remedial alternatives. Comments received during the Public Comment Period are an important indicator of community acceptance. The community had several questions/comments as documented in Section 3.1 Responsiveness Summary; however, none of the questions/comments related to specific remedial alternatives.

2.11 PRINCIPAL THREAT WASTE

The NCP establishes an expectation that USEPA will use treatment to address the principal threats posed by a site wherever practicable (NCP §300.430(a)(1)(iii)(A)). The "principal threat" concept is applied to the characterization of "source materials" at NCP sites. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to groundwater, surface water or air, or acts as a source for direct exposure. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur.

No source areas or materials that would be expected to act as a reservoir of contamination with the potential to migrate (e.g., to groundwater) were identified in Area II; therefore, no principal threat wastes were identified. Based on the above criteria, the contamination identified in Area II does not constitute principal threat wastes.

2.12 SELECTED REMEDY

2.12.1 Summary of the Rationale for the Selected Remedy

The selected remedy for FFA Area II consists of Alternative 2 (excavation and disposal) at AOCs 1, 6, 10, and 20 and Alternative 3 (installation of a cap and future use restrictions) at AOCs 13 and 21.

At AOCs 1, 6, 10, and 20, Alternative 2 (excavation and disposal) is the most implementable alternative and also the most effective and permanent. This selected alternative will achieve RAOs, protect human health and the environment through removal of contaminated soil exceeding remediation goals, and will not require future use restrictions, O&M, or 5-year reviews. Soil contamination in AOCs 1, 6, 10, and 20 is generally shallow, and, therefore, relatively easy to access for removal. Contaminated soil extends to less than 1 ft bgs in AOC 1; 0-3 ft bgs in AOC 6; 0-5 ft bgs in AOC 10, and 0-2 ft bgs in AOC 20. Alternative 2 is also the most cost-effective alternative for AOCs 6 and 20 and is not expected to be significantly more expensive than Alternative 3 for AOCs 1 and 10. Unlike Alternative 3, Alternative 2 would not increase the elevation of the ground surface and is, therefore, more favorable in the context of the historical setting of these AOCs.

At AOCs 13 and 21, Alternative 3 (installation of a cap and future use restrictions) is the most implementable and cost-effective alternative because it is compatible with the concrete and asphalt paving already present over contaminated soils in these AOCs. Alternative 3 will achieve RAOs by preventing contact with contaminated soils and will remain protective of human health in the long-term through maintenance of the cap, concrete, and asphalt, and through future use restrictions.

Overall, the selected remedy is protective of human health and the environment and will achieve RAOs in all AOCs within 1-2 years. The selected remedy will be effective in the long term and will be implemented so as to minimize potentially negative impacts to the community, workers, and the environment during implementation.

2.12.2 Description of the Selected Remedy

The components of the selected remedy are listed in Section 2.9.1. This section provides details on the implementation the selected remedy for the specific AOCs.

2.12.2.1 Excavation and Disposal – AOCs 1, 6, 10, and 20

A pre-design investigation will be conducted prior to excavation to locate the underground utilities present at the AOCs. The investigation will use equipment such as ground penetrating radar, a metal detector, and a precision utility locator. The pre-design investigation will also include collection of soil samples to refine the vertical extent of soil contamination, where needed. Information from the pre-design investigation will be used in determining the extent of soil excavation, and in determining whether utilities in the excavation areas need to be supported or rerouted. An approved offsite disposal facility will also be identified prior to initiation of the remedial action.

Soil with COC concentrations exceeding remediation goals will be removed via excavation and disposed of offsite at an appropriate facility. Soils exceeding remediation goals are expected to be fully accessible. Estimated areas and volumes of soil requiring excavation and disposal in each AOC are provided in Section 2.7.3 and Table 2-3. For AOCs 1, 10, and 20, where lead is the COC, XRF field screening will be used during the excavation to identify soil with concentrations exceeding the remediation goal and determine the extent of each excavation. An instrument type-specific correlation analysis will be conducted to determine the XRF equivalent

of the laboratory remediation goal. Upon completion of each excavation, confirmatory samples for laboratory analysis will be collected from the bottom and sidewalls to demonstrate attainment of the remediation goals.

Excavations in the immediate vicinity of the existing buildings are not anticipated to be deeper than 1 ft bgs; therefore, no shoring of existing improvements is expected to be required. Excavations that exceed 1 ft bgs not adjacent to buildings are also not expected to require shoring because soils are expected to be cohesive based on observations made during the RI. Dewatering is also not expected to be required based on observed water levels of greater than or equal to 5 ft bgs during the RI.

Material exceeding remediation goals will be transported to the approved offsite disposal facility. Toxicity characteristic leaching procedure analysis will be performed on samples of the excavated soils to determine if any of the soil is classified as hazardous waste.

Following the removal of contaminated soil, any stockpiled soil not exceeding the remediation goals and other clean back fill will be placed in the excavations. Restoration of excavation areas will be conducted to the original pre-excavation conditions and grass re-seeding will be used where appropriate.

2.12.2.2 Installation of a Cap and Future Use Restrictions – AOCs 13 and 21

The selected remedy for AOC 13 will involve implementation of future use restrictions and 5-year reviews because areas of contaminated soil in this AOC are already paved with a covering of asphalt or concrete or both. In AOC 21, capping of unpaved areas will be conducted along with future use restrictions and 5-year reviews.

At AOC 21 a pre-design investigation will be conducted prior to cap installation to locate underground utilities. The investigation will use equipment such as ground penetrating radar, a metal detector, and a precision utility locator. Information from the investigation will be used in designing any intrusive elements of the soil cap. The cap will cover areas where soil exceeds remediation goals and is not already covered by an impervious surface (e.g., asphalt or concrete or both).

In unpaved areas, the cap at AOC 21 will extend beyond the limit of contaminated soil, where possible based on adjacent paving, such that the area of the cap is approximately 25 percent larger than the contaminated area. The area to be capped and the extent of the cap at this AOC will be determined during the design due to ongoing work by the property owner. The extent of the cap will be based on the contaminated areas not covered by asphalt (or concrete). It is anticipated that the cap will consist of a geosynthetic clay liner under clean compacted borrow material, covered by topsoil; however, this configuration may be altered in the cap design. Following capping, grass re-seeding of the capped area will be used where appropriate. The cap will be inspected annually and cap maintenance will be performed as required.

Since soil containing COCs above levels that allow for unlimited use and unrestricted exposure will remain in place in both AOCs 13 and 21, an environmental covenant will need to be placed on the deeds of the parcels of land. The covenants will include restrictions on the use of areas

where COC concentrations exceed remediation goals beneath the cap to limit exposure to remaining contaminated soils. The location of soils with COC concentrations exceeding remediation goals, a description of the remedy, compliance reporting requirements, and any activity use limitations will be noted on the environmental covenant.

Because hazardous substances, pollutants, or contaminants above levels that allow for unlimited use and unrestricted exposure will remain at AOCs 13 and 21, a statutory review will be conducted within 5 years after initiation of the remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

2.12.3 Summary of the Estimated Remedy Costs

The estimated total present worth cost to implement the selected remedy is $2,173,000. This includes $1,931,000 in capital costs, as well as $242,000 in future annual present worth costs ($22,000 annually) for O&M activities over a 30-year period. Of the total capital costs, remedial action construction costs account for a $1,717,000 (present worth); there are no anticipated remedial action operation costs. The costs for each AOC are summarized in Table 2-6, and are based on the best available information regarding the anticipated scope of the selected remedy.

Table 2-6: Cost of the Selected Remedial Alternative

Cost Item[1]	AOC 1	AOC 6	AOC 10	AOC 13	AOC 20	AOC 21
Design Cost	$97,000	$15,000	$43,000	$0	$25,000	$34,000
Remedial Action Construction Cost	$735,000	$114,000	$250,000	$25,000	$214,000	$379,000
Total Capital Cost[2]	**$832,000**	**$129,000**	**$293,000**	**$25,000**	**$239,000**	**$413,000**
Annual O&M Cost [3]	$0	$0	$0	$11,000	$0	$11,000
Total 30-Year O&M Cost (Present Worth)	**$0**	**$0**	**$0**	**$121,000**	**$0**	**$121,000**
Total Cost	**$832,000**	**$129,000**	**$293,000**	**$146,000**	**$239,000**	**$534,000**

Notes:
(1) Costs are present worth and include contingency unless specified.
(2) Total capital costs include Design Costs and Remedial Action Construction Costs.
(3) O&M costs consist of LTM costs (i.e., cap maintenance costs and 5-Year Review Costs).
AOC = Area of concern.
O&M = Operations and maintenance.

Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the selected remedy. Major changes in the costing will be documented in the form of a memorandum in the Administrative Record file or an explanation of significant differences. The order-of-magnitude engineering cost estimate provided in this Decision Document is expected to be within +50 to -30 percent of the actual project cost.

2.12.4 Expected Outcomes of the Selected Remedy

The estimated time to achieve RAOs in all AOCs is 1-2 years. This includes the time required to conduct pre-design investigations, remedial design, excavation/disposal and capping, site

restoration, and placement of the environmental covenant on the deeds for the parcels of land where capping is implemented.

In achieving RAOs, the selected remedy will reduce human health risks for all receptors evaluated (including resident children) to acceptable levels and will reduce ecological risks in AOC 1 to background levels. The remediation goals are summarized in Table 2-7. Future use restrictions, as described in the environmental covenant on the deeds, will be required to prevent contact with contaminated soil remaining under caps or impervious surfaces in AOCs 13 and 21. In AOCs 1, 6, 10, and 20, there will be no restrictions on future development or use, with respect to soil, following completion of the selected remedy.

Table 2-7: Remediation Goals for Contaminants of Concern

Contaminant of Concern	Remediation Goal(s) (milligrams per kilogram)
Lead	1,000
Benzo(a)pyrene	0.9 (surface soil) 1.3 (subsurface soil)
Aroclor 1260	2.2

Socioeconomic effects from the implementation of the selected remedy were evaluated qualitatively by addressing how improvements in the physical environment may affect the socioeconomics of the FFA vicinity, and how socioeconomic effects associated with the selected remedy may affect the physical environment. Changes associated with increased economic output and employment were assessed for the construction and O&M phases of the selected remedy. The selected remedy will provide a modest economic benefit to the region within approximately 2 miles of the FFA, which may attract expanded residential and commercial growth. The vast majority of economic benefit is expected to occur during the construction phase in that the remedial action itself is an economic benefit to those contractors conducting the action; however, these benefits are expected to be short-term. In the longer term, the remedial actions will expand the possibilities for re-use and development of Area II by decreasing use restrictions associated with contaminated soil. The remediation may also increase property values in Area II, the rest of the FFA, and adjacent properties by improving public perception. This increase may aid redevelopment and ease the financing process. There will be no long-term economic effects associated with O&M of the selected remedy because a minimal O&M program (i.e., routine inspection of capped areas and any other site changes) will be implemented. Employment associated with the O&M of the selected remedy will not result in a change to population and housing.

2.13 STATUTORY DETERMINATIONS

The selected remedy satisfies the statutory requirements of Section 121 of CERCLA:

- The remedy must be protective of human health and the environment
- The remedy must attain ARARs or define criteria for invoking a waiver

- The remedy must be cost effective

- The remedy must use permanent solutions and alternative treatment technologies to the maximum extent possible.

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 offsite disposal of untreated wastes.

The manner in which the selected remedy satisfies each of these requirements is discussed in the following sections.

2.13.1 Protection of Human Health and the Environment

Implementation of the selected remedy will protect human health and the environment. Soils with COC concentrations exceeding remediation goals will be remediated (via capping or removal). The remedy will reduce carcinogenic human health risks associated with benzo(a)pyrene and Aroclor 1260 to less than $1x10^{-4}$. Lead concentrations will be reduced to levels that are protective of human health and the environment, with ecological risks at or below background levels. In AOCs 1, 6, 10, and 20, soils exceeding the remediation goals will be removed, preventing future human exposure via dermal contact, ingestion, or dust inhalation, and also reducing ecological risks associated with food web exposures to lead. Contaminated soils in AOC 13 are covered by existing asphalt, which prevents contact with underlying soil. Future use restrictions will be used to ensure protectiveness. In AOC 21, capping of soils exceeding remediation goals that are not covered by impervious surfaces, in combination with future use restrictions, will reduce human health risks to acceptable levels. Capping will prevent exposure via dermal contact, ingestion, or dust inhalation. In the short term, dust and erosion controls will be used to control risk to workers, the community, and the environment during excavation and capping activities.

2.13.2 Compliance with Applicable or Relevant and Appropriate Requirements

No ARARs (chemical-, location-, or action-specific) were identified for FFA Area II. The selected remediation goals are based on site-specific risk, and are equivalent to background concentrations, where applicable. Therefore, remediation of soils exceeding these remediation goals complies with the PADEP Act 2 provision for demonstration of background or site-specific standards.

2.13.3 Cost Effectiveness

The selected remedy will be cost-effective. As defined by the NCP, a remedy is "cost-effective if its costs are proportional to its overall effectiveness" (40 CFR §300.430(f)(1)(ii)(D)). For AOCs 1, 6, 10, and 20, removal and disposal is the most effective remedy, and the associated costs are also lower than or similar to the costs for implementation of capping (Table 2-5). For AOCs 13 and 20, capping costs are approximately a tenth to a quarter of the costs of excavation and disposal (Table 2-5). Excavation and disposal costs are elevated due to the cost of removing soils below paved surfaces. Based on the relatively low cost of capping and the fact that it will

protect human health, capping is substantially more cost effective than removal and disposal for AOCs 13 and 20. Estimated costs for implementation of the selected remedy in each AOC are summarized in Table 2-6.

The estimated total present worth cost to implement the selected remedy for all AOCs is $2,170,000. Of this, remedial action construction and operations costs account for $1,790,000, while design costs account for $214,000, and 5-year reviews account for $174,000.

2.13.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy uses the most cost effective, implementable, and permanent solutions and treatment technologies for each AOC. Removal and disposal of contaminated soils is the most permanent solution, and will be implemented at the AOCs where it is cost-effective. Based on the screening of remedial technologies for effectiveness, implementability, and cost in the FS, no alternative treatment technologies were retained for consideration in the remedial alternatives.

2.13.5 Preference for Treatment as a Principal Element

No principal threats have been identified at FFA Area II; therefore, treatment of principal threats is not part of the remedy. As described in the FS, *in situ* and *ex situ* treatment technologies for soil contamination were not considered beyond the technology screening step, due to the nature of COCs present in Area II, the extensive site improvements to the surface and subsurface, and the lack of available land onsite for staging and treatment of soils given current site uses.

2.13.6 Five-Year Review Requirements

The selected remedy will result in hazardous substances, pollutants, or contaminants remaining at AOCs 13 and 21 above levels that allow for unlimited use and unrestricted exposure. Therefore, 5-year reviews addressing AOCs 13 and 21 will be required.

2.14 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for FFA Area II was released for public comment on 1 August 2016. The Proposed Plan identified excavation and disposal as the preferred alternative for AOCs 1, 6, 10, 20 and installation of a cap and future use restrictions as the preferred alternative for AOCs 13 and 21.

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3. RESPONSIVENESS SUMMARY

This Responsiveness Summary has been prepared to present a summary of the comments and the USACE's responses to comments regarding the Proposed Plan for the FFA Area II soils. The Proposed Plan was issued to the public on 1 August 2016. The notice announcing the availability of the Proposed Plan was published in the *Star* newspaper on 27 July 2016 and in the *Philadelphia Daily News* on 29 July 2016. A public comment period was held from 1-31 August 2016. In addition, a public meeting was held on 18 August 2016 to present the Proposed Plan. At the meeting, representatives from USACE and PADEP answered questions and presented information about FFA Area II and the remedial alternatives considered. A summary of the meeting is provided in Appendix A.

3.1 STAKEHOLDER COMMENTS AND USACE RESPONSES

The public comment period ended on 31 August 2016. One written comment on the Final Proposed Plan was received via email from a member of the public. This comment and the USACE response are summarized below.

Comment: I (along with my arborists) am concerned about the idea of soil excavation around specific trees. An arborist-historian visited the site 2 years ago, and was thrilled to see what he referred to as "19th-century estate landscaping." Within the AOCs, there is the remarkable holly by #1; the HUGE copper beech by #5; and a good oak, a zelkova, and several old cherries near us in #4. Additionally, there are mostly-smaller but still valuable plantings in the AOC behind #14, and there are some lovely old specimens that may or may not be within the AOC along the Bridge Street line. Their root systems extend out about as far as their crowns do, and it is impossible to visualize what "measures" the Corps could have in mind that would permit BOTH the removal of soil immediately around them AND the non-disturbance of their root systems.

Response: USACE cannot provide specific details at this point, since we have not developed detailed work plans yet. When the work is performed, USACE's contractor will hire an arborist who will provide their expertise and recommendations on how best to accomplish the work. USACE has had past success on other projects cleaning up soil while preserving trees and vegetation. Typically this involves using hand digging or an air spade around trees. For this Frankford Arsenal project, USACE anticipates that we will only need to remove the top 1 foot of soil in most areas, so we won't be digging deep in most areas. Damage to trees usually occurs when you dig more than 2 feet, since you start disturbing/destroying a larger portion of the root structure. If we run into a problem in an area where we want to dig deeper, we will need to consult with the property owner and PADEP about how to proceed. We may have the option of leaving the deeper soil in place, and covering it with clean soil. The property owner has also expressed this concern about the trees, and USACE intends to work with him to preserve these valuable resources. He will be reviewing the remedial action plans.

3.2 TECHNICAL AND LEGAL ISSUES

No issues were raised during the comment period that impact the technical or legal requirements for the remedy.

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4. REFERENCES

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Figures

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Legend

- Area I Boundary
- Area II Boundary
- Area III Boundary

Buildings

- Demolished
- Existing

Sources
Google (Imagery) 2016
Cabrera, 2011
USACE, 2009

N
W E
S

NOTE: Area IV represents groundwater beneath Areas I, II, & III

Feet
0 100 200 400

FRANKFORD ARSENAL
PHILADELPHIA, PENNSYLVANIA

Figure 1-1
Site Map

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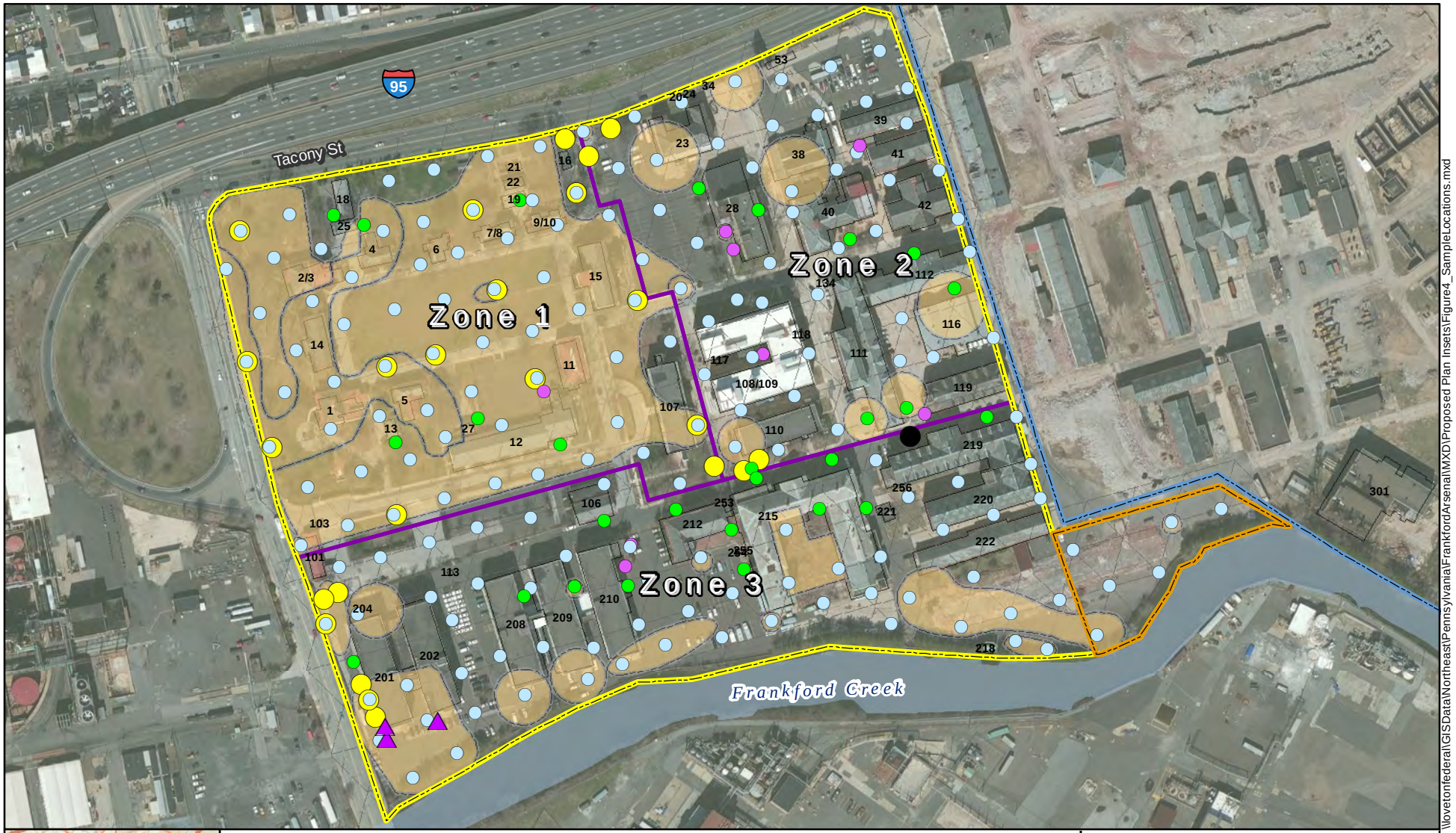
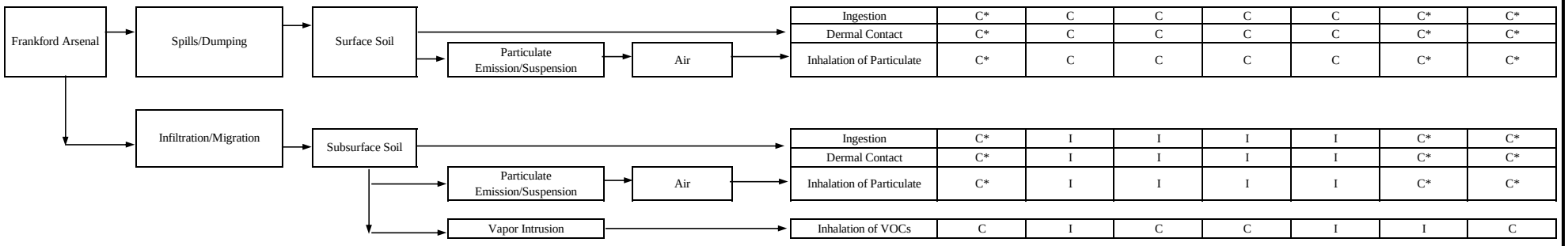


FRANKFORD ARSENAL
PHILADELPHIA, PENNSYLVANIA

Figure 2-1
Sample Locations

FIGURE 2-2
HUMAN HEALTH CONCEPTUAL SITE MODEL
FORMER FRANKFORD ARSENAL

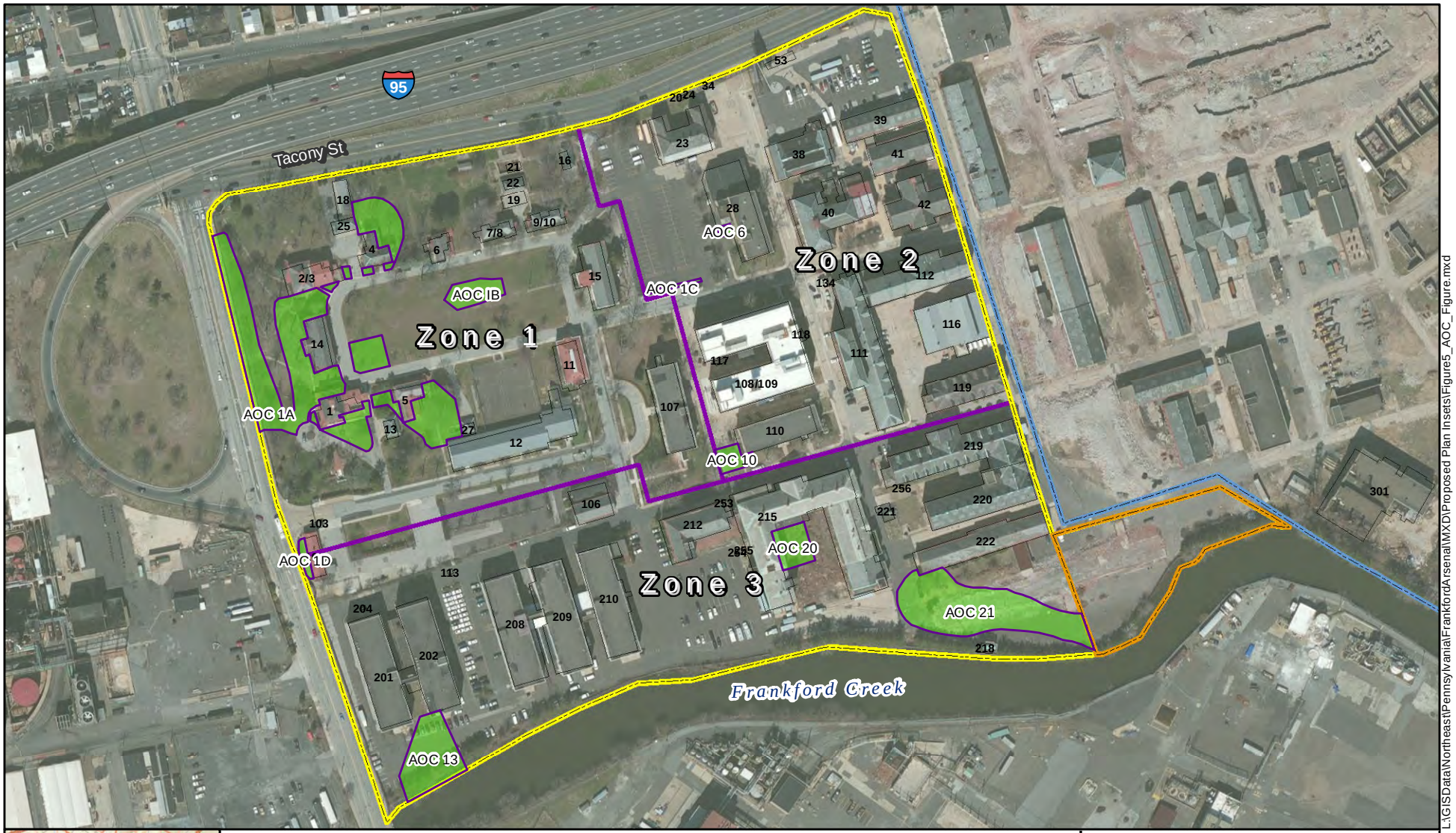


PRIMARY SOURCE	PRIMARY RELEASE MECHANISM	SECONDARY SOURCE[1]	SECONDARY RELEASE MECHANISM	TERTIARY SOURCE	EXPOSURE ROUTE	POTENTIAL RECEPTORS						
						Resident (Adult and Child)	Trespasser (Adult and Adolescent)[2]	School Students[3] (Adolescent)	Office/Commercial Worker (Adult)	Maintenance Worker/Landscaper (Adult)	Construction Worker (Adult)	Day Care Students[4] (Child)
Frankford Arsenal	Spills/Dumping	Surface Soil			Ingestion	C*	C	C	C	C	C*	C*
					Dermal Contact	C*	C	C	C	C	C*	C*
			Particulate Emission/Suspension	Air	Inhalation of Particulate	C*	C	C	C	C	C*	C*
	Infiltration/Migration	Subsurface Soil			Ingestion	C*	I	I	I	I	C*	C*
					Dermal Contact	C*	I	I	I	I	C*	C*
			Particulate Emission/Suspension	Air	Inhalation of Particulate	C*	I	I	I	I	C*	C*
			Vapor Intrusion		Inhalation of VOCs	C	I	C	C	I	I	C

LEGEND

I	Incomplete or negligible exposure pathway.
C	Potentially complete exposure pathway.
C*	Potentially complete exposure pathway evaluated, evaluated for contact with total soil (surface and subsurface soil combined).
VOC	Volatile Organic Compound

1) Groundwater is also a medium of concern but will be evaluated as a separate operable unit.
2) This receptor was not evaluated quantitatively because other receptors represent a more conservative exposure.
3) This receptor is only evaluated for Zones 1 and 2
4) The daycare receptor is only evaluated for the southeastern portion of Zone 3.



Legend

- Area of Concern (AOC)
- Area I Boundary
- Area II Boundary
- Philadelphia Industrial Development Corporation
- Zone 1, 2 and 3

Feet
0 50 100 200

N
W E
S

Sources
ESRI (Imagery) 2013
Cabrera, 2011
USACE, 2009

FRANKFORD ARSENAL
PHILADELPHIA, PENNSYLVANIA

Figure 2-3
Areas of Concern

L:\GIS\Data\Northeast\Pennsylvania\FrankfordArsenal\MXD\Proposed Plan Insets\Figure5_AOC_Figure.mxd

Appendix A
Minutes from the Public Meeting on the Proposed Plan

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U.S. ARMY CORPS OF ENGINEERS, BALTIMORE DISTRICT
FORMERLY UTILIZED SITE REMEDIAL ACTION PROGRAM

PUBLIC MEETING ON PROPOSED PLAN
FOR THE
FORMER FRANKFORD ARSENAL – AREA II SOILS

AUGUST 18, 2016

LLOYD C. WILSON, JR. AMERICAN LEGION POST 224, PHILADELPHIA

The following is a summary of a public meeting held on Thursday, August 18, 2016 at the Lloyd C. Wilson, Jr. American Legion Post 224, Philadelphia, Pennsylvania. Copies of the meeting sign-in sheet, posters, and presentation are provided as attachments.

POSTER SESSION

U.S. Army Corps of Engineers, EA Engineering (contractor to the U.S. Army Corps of Engineers), and Pennsylvania Department of Environmental Protection staff were available to discuss displayed posters about the cleanup of the Former Frankford Arsenal (FFA) Area II soils and answer questions from 6:00 pm to 6:50 pm. No community members entered comments into the record during the poster session.

INTRODUCTIONS

At 6:50 pm, Mr. Chris Gardner from the U.S. Army Corps of Engineers, Public Affairs Office, Baltimore District introduced himself and Mr. Todd Beckwith, U.S. Army Corps of Engineers, Project Manager, Baltimore District. Mr. Gardner thanked the Post for hosting the meeting and turned the meeting over to Mr. Beckwith.

Mr. Beckwith introduced Mr. Michael O'Neill and Ms. Denise Wilt from EA Engineering, contractors to the U.S. Army Corps of Engineers, who are working on the FFA Area II Soils project.

Mr. Beckwith also introduced Ms. Pamela Trowbridge with the Pennsylvania Department of Environmental Protection (PADEP).

PRESENTATION – Mr. Todd Beckwith

For our agenda, I will be giving a little background on the Arsenal itself, talking about the environmental process we follow when doing cleanups, and discussing the Area II soils investigation. The Arsenal has been divided into three areas for purposes of environmental investigation—Areas I, II and III—as well as the site-wide groundwater investigation, Area IV. The focus of tonight's meeting is the Area II soils investigation, the different cleanup alternatives considered, and what comes after the Proposed Plan. I'll also give a brief status update on our other projects at the Arsenal.

Many of you are even more familiar with the background of the Arsenal than I am. The Arsenal was commissioned in 1816 and has a long history of operating for 161 years until 1977. It had a wide range of different missions over the years, starting as a depot with minimal storage and gunpowder testing and maintenance of munitions and guns. Around 1850, the Arsenal moved more into research and development and manufacturing with a focus on small arms, although they also did some artillery work. The Arsenal had many scientists who worked there, and many innovations occurred at the Arsenal related to powder chemistry, metallurgy, and improving the manufacturing process for small arms.

The facility was closed in 1977, and the Army initiated extensive decontamination efforts. At that time the environmental laws we have today were not in place, so the focus in 1977 was the standards of the day to make sure no safety hazards were left behind. They did do an extensive decontamination effort that was focused on explosives hazards and radiological issues. They went through a radiological decommissioning effort with the Nuclear Regulatory Commission and also did some explosive decontamination work including a controlled burn of the explosive manufacturing area in 1980. After the decontamination effort, it was determined to be safe for reuse and transferred to a couple different property owners. A commercial business park is in what we consider Areas I and II, with Area III taken by the Pennsylvania Fish and Boat Commission and that area is still used as such today.

This graphic shows our environmental cleanup process and gives you a list of the steps we go through. The Preliminary Assessment and Site Inspection were the first steps done in 1977 when historical records were looked at, as well as aerial photos, and a determination is made as to what types of operations occurred and what are the potential contamination issues based on the history of the site. After that review is done, we move to the Remedial Investigation phase, and go out and collect data to determine what is in the ground and if there is any potential contamination. During this phase, we collect soil samples and groundwater samples and determine the nature and extent of contamination. We also develop a risk assessment to determine what are the potential risks to human health and the environment. The cleanup process is a risk-based process which means that all the decisions about whether cleanup is required is based upon the results of the risk assessment. Just because a compound is detected somewhere, it doesn't necessarily mean you need to remove it; if we decide it is a risk to the public, we take an action.

If we determine there are unacceptable risks, we move into the Feasibility Study phase and evaluate different cleanup alternatives to address those risks. After that is done, we move into the Proposed Plan phase which is why we are here tonight—this is a Proposed Plan meeting for Area II. We have completed the Remedial Investigation and Feasibility Study, evaluated cleanup actions for Area II soil, and are now putting the Proposed Plan out for public comment. We are in the midst of the public comment period with the intent to get feedback from the public on the proposed cleanup actions.

After the public comment period, we consider the comments and prepare responses to those comments, and then we move into the Decision Document phase and sign a Decision Document with what our final cleanup action will be for the site. After the Decision Document is signed, we implement the Decision Document and go out and do the cleanup. The Army works with our lead regulatory agency, the Pennsylvania Department of Environmental Protection, all through the process.

This aerial photograph shows the boundaries of the three distinct areas, I, II and III; we use this geographic division to manage the project more efficiently and prioritize the work. The focus of the meeting tonight is Area II which is the oldest part of the Arsenal; it was the first property acquired by the Army. The Army continued to acquire property up through 1940, growing and moving to the east to Area III.

These boundaries you see identifying the three areas were based on current property owners; there was a transaction a few years ago that changed property boundaries slightly. Two years ago, Dietz & Watson bought property and built a new warehouse. Property that was owned by the Philadelphia Fish and Boat Commission is now owned by the Philadelphia Parks and Recreation. There is also a piece of property which is now owned by the Philadelphia Industrial Development Corporation

I'll now get into some of the details of our investigation. The purpose of a Remedial Investigation is to determine the nature and extent of contamination, what contaminants are potentially in the soil and how far they extend, as well as to conduct a human health and ecological risk assessment to determine any potential risk to the public.

At Area II, we collected 445 surface and subsurface samples. The samples were sent to a laboratory and analyzed for a list of several hundred compounds—volatile organic compounds, semi-volatile organic compounds, metals. We get the results back and they tell us what is the concentration of those compounds in the soil, and then we do a risk assessment that estimates what is the potential exposure to these different receptors that we anticipate to be present on the site. At Area II, we assumed the receptors would be residential although there are only a few residences on the property; school students as there is a school on the property; office workers; landscaper/maintenance workers; and construction workers. We follow EPA's guidance for conducting the risk assessment—a very specific process that we follow.

The details of the risk assessment are in the Remedial Investigation Report, but overall the risk assessment concluded there is no unacceptable risk under the current land use, but if the property was converted into residential use, there is potentially unacceptable risk at six areas of concern that would need to be addressed. At those six areas of concern, the main contaminants of concern are lead at four areas, PCBs at one area, and benzo(a)pyrene at one area. Lead is a common metal used in making bullets, present in lead paint and smokestack emissions, and was also present in gasoline for many years. PCBs are coolants and were present in electrical transformers through the 1970s. Benzo(a)pyrene is part of a class of compounds called PAHs, commonly found in roofing tar, crude oil, any incomplete combustion product, cigarette smoke, and charred meats.

This aerial photograph shows the soil sampling locations at Area II. The blue dots show what we call unbiased sampling where we grid out the whole site and space the samples equally apart, so that we can get an unbiased sampling result as to where potential contamination might be. We also had some biased samples where we know based on past history of the site we want to collect some samples at specific locations. We also have delineation samples where after we get initial sampling results, we collected more samples to determine the nature and extent of the contamination and get a boundary as far as the contamination extends.

This map shows the six areas of concern. Area of Concern 1 is essentially all of these areas within Zone 1, and the contaminant of concern is lead. We think the source of the lead is lead-based paint from this adjacent building and fence; it is mostly found just in the top surface soil.

Area of Concern 6 is a small area with PCB contamination next to an electrical transformer; a very small amount of soil contamination that we plan to just excavate and remove it.

Area of Concern 10 has lead contamination, again likely coming from lead-based paint on a nearby building.

Area of Concern 13 is where we have benzo(a)pyrene in the soil, currently it is under asphalt and concrete. We are not sure of the source of the benzo(a)pyrene, although there is asphalt there so that may be the source.

Area of Concerns 20 and 21 are next to the Rolling Mill, and there is lead shot in the courtyard where they melted lead ingots so the likely source of the lead is the lead shot.

Those were the six Areas of Concern we identified during the investigation so the next step is we evaluate alternatives for addressing those Areas of Concern through a Feasibility Study. We go through a screening process with a laundry list of alternatives and screen out what does not make sense. After we did that screening process, we were left with three alternatives: no action, excavation, and capping. No Action is always included as a baseline to compare against other alternatives. The Excavation and Disposal alternative involves digging up the soil and taking it to a regulated landfill for disposal. Alternative 3 is the installation of a cap and future use restrictions where we would cover the soil to prevent exposure to the soil in the future and have appropriate restrictions in place so that if someone were to dig in the area proper precautions would be taken.

The Proposed Plan is out now for public comment and has this list as the preferred cleanup option for each Area of Concern. For four of the Areas of Concern we are recommending Excavation and Disposal where we would dig up the soil and dispose of it off-site; we felt this alternative was easily implementable at these locations and had the best long-term effectiveness.

When we evaluate each of these alternatives, we have nine specific EPA criteria that we use: protection of human health, compliance with regulations, long-term effectiveness, short-term effects, is it implementable, what is the cost, is there a reduction of toxicity or volume, what is the regulatory acceptance, and what is the public acceptance. Based on our evaluation, these were identified as the preferred alternatives. There are only two locations where we are not doing Excavation and Disposal—Area of Concern 13 and 21. There is already a cap in place at these locations as there is an asphalt and concrete cover over those areas. Based on the property owner's future planned use of those areas, no digging is planned nor any future redevelopment, and he is comfortable with us leaving the contamination in place and covering it so we think that is the best solution for those two areas of concern.

That is our "plan" and the reason we are having the meeting tonight is to get public input on the Proposed Plan. If you want to submit comments, there are different ways to comment.

You can tell us your comments tonight, fill out a written form, or email me or send me your comments in the mail.

PUBLIC COMMENTS AND QUESTIONS

Community Member: When is the deadline for comments?

Mr. Beckwith: August 31, 2016.

Community Member: Will we be able to see all the public comments later?

Mr. Beckwith: When we prepare the Decision Document, we have a section called the Responsiveness Summary that provides a list of all the comments as well as our responses.

Community Member: Do you have a date when work will begin?

Mr. Beckwith: After the public comment period, we will develop the Decision Document which will take several months. Then we will need to award a contract to do the remedial action which involves putting work plans in place so I would anticipate we should be able to start work next summer.

Community Member: Is there a specific format to use to make comments?

Mr. Beckwith: Just sending me an email is fine.

Community Member: Is this a first time for holding a public forum? I was surprised to hear a public forum was being held.

Mr. Beckwith: Environmental programs were not in place back when the Arsenal closed, but now we have requirements for public comment periods and public meetings.

Community Member: We as members of this community over several decades have been known to play in these waters and swim in these waters. The contamination when they were moving some of the contaminated soil from the Arsenal site and the Palmrya site where they had a test range for testing depleted uranium at that site impact this community. I was born in the late 40s and grew up here in the 50s and 60s and then myself and a number of members of our community left here to go to Vietnam, like our fathers who left before us in World War II, the brothers who served in Korea, the sons and nephews who served in Vietnam. To the best of my knowledge because of the readings of PCBs, we were corralled between two of EPA's largest toxic sites and/or cancer zones. They were making the landing pads we used in Vietnam, and some of the guys were working at the plants that made the landing pads. As with the Love Canal issue, where those residents were contaminated with PCBs, we went up there to participate in 1979 and early 1980s because a lot of the veterans had become dual contaminate; in other words they were contaminated before they went to Vietnam, nothing to do with Agent Orange. A lot of the female members of this community born in the 30s, 40s and 50s birthed three to five children, but by the mid-to late 60s and 70s, we were seeing stillbirths and miscarriages. And it is a known fact that people from an area of Bridesburg, Port Richmond, Fishtown, Upper Kensington, Juniata Park, all these people around us, along with Allied Chemical and Rohm & Hass, most of them were the recipient of some type of adjustment to the community and the well-being of the community. We would like to bring that to the attention of the proposed site

cleanups to find out if they really got a full evaluation from the minority communities. Not to make this one-sided, but it is known that when the I-95 corridor came from Boston down to Key West, Florida, most of the area they encompassed was disproportionately put out of range of the minority recipients of the community. The bottom line is we would like to know if at any time in the upcoming future will those who were left out before be able to make comments and update the things that may benefit us now as long-standing residents of this community and will we be getting some type of idea and concept about what was harmful, what still may be harmful, and what we possibly can do in the future to prevent us being left out in the future. You can see by the turnout tonight because we don't go out to a lot of informational seminars and symposiums we might have missed out on a lot of information, but now that we have a chance to update ourselves, we want to know that anytime in the future we can keep ourselves updated. I am 67-years old and have lost a lot of friends and family to cancerous agents that they would not have normally had to be a part of their contributing factors to their deaths. I just want to get a clear idea in my mind that maybe there would have been someone available to explain to tell us about this in the past and that maybe in the future you can update us.

Community Member/Post Commander: I understand the Army Corps of Engineers is focusing on this plot of land, but when you integrate exposures and duration over the years and how that affects the risk, I know there is a strong correlation. We know there is a strong correlation between the health standards of the residents in those communities and what is going on along the river. It is a sad commentary because many people's lives, including my mother's, got cut short because she worked along that corridor. My friend, whose mother worked on the ground, died at 41 of cancer. These are all cancer-related deaths, and we know there are other factors, but some of them were not even smokers. This is not the place for this discussion, but I think the issue is broader than what has been said.

Ms. Trowbridge, PADEP: What you are talking about I understand. All up and down the Philadelphia waterfront was heavy industrial uses for many years. All the folks living real close to that stuff, they would breathe it in from smokestacks and cars which didn't have controls like we do today. We didn't have the environmental regulations back then that we do today and we didn't have the health and safety laws. When you said your mother worked there, she might have been using her bare hands with chemicals; we just didn't have those protections. All of that is in place now which is great, so moving forward hopefully folks will be okay. We are always finding new chemicals along the way. You may have read in the newspapers recently about the PFOAs that have been found in Warminster. We know some of the chemicals found here are cancer causing, and that is why we want to get it cleaned up. We know PCBs and benzo(a)pyrene cause cancer. The numbers we are having the cleanup meet are very low numbers, like a drop of water in a swimming pool. We are trying to make sure if someone is exposed to the small amount of chemicals remaining for 30 years from living on the property, they will be ok and are not going to have cancer in the future. This is how the risk assessment looks at future exposures. Surprisingly with this particular site, for as old an industrial site as the Arsenal is, it is not that heavily contaminated.

Community Member: Meaning what?

Ms. Trowbridge: I have been on this project since 2006. We spent 2009 digging a lot of holes [in Area I]. In Area I, we took down buildings so we could get to the contamination easier. In this section [Area II], we are not taking down the buildings based on the historic nature of the

buildings, with some on the National Historic Register. The Army is going to do the remediation, but they have to go through my program at the State for our approval first, and we review all documents.

Your concerns are very valid. My department had an environmental justice person, and we lost that position but I think that position is being re-built. We used to have an environmental justice person in every regional office, and your regional office is our Norristown office, across the street from the Montgomery County Courthouse. The environmental justice that we have been doing moving forward is when they redevelop these areas, we don't want to develop any dirty industries. You saw the warehouse for Dietz & Watson, that's one of the re-uses which is a good clean industry. Mr. Hankin has that strip left, and I not sure what his original plans were for commercial development, but we are not getting any more dirty industries on the waterfront. Philadelphia bought the piece by the waterfront because they are trying to put in a walking/biking trail so there will be access to the waterfront again. Comments tonight are focused on Area II. If you have other comments, please come see me afterwards.

PRESENTATION – Mr. Todd Beckwith

Before we finish, I want to give you an update on the other Areas at the Arsenal. For the Area I Soils, we did an investigation and completed quite a few soil removals and all the cleanup necessary. A No Further Action Decision Document was signed for Area I soils on July 1, 2015.

For the Area III Soils where the Dietz & Watson, the Philadelphia Parks and Recreation, and the Boat Launch properties are located, we are finalizing a Remedial Investigation Report and a Feasibility Study. There was one area of concern identified on the Boat Launch property that we want to take action on where there is some lead-contaminated soil. We will be going through this same process for Area III in the next year or so.

Area IV is the site-wide groundwater, and we have put in groundwater monitoring wells across the Arsenal and been studying the groundwater for several years. We are working on finalizing the Remedial Investigation Report and that will probably be the last document for Area IV.

PUBLIC COMMENTS

Community Member/Post Commander: You mentioned for Area 1 Soils there have been several removal actions completed since 1999, and the Corps of Engineers has determined there are no unacceptable risks remaining in the environment. Does someone else have to concur?

Ms. Trowbridge: I review everything. The Army is the responsible party and I am the regulator. I make sure the Army follows Pennsylvania laws. The Army Corps of Engineers is representing the military branch that created the mess and has been designated as the agency that will clean up the mess.

Community Member: Is this the only meeting for Area II?

Mr. Beckwith: Yes, this is the only planned meeting.

Ms. Trowbridge: In the future, there will be meetings for Area III and then Area IV.

Community Member: Is there more information online?

Ms. Trowbridge: All the information is at the library.

Mr. Gardner: Either tomorrow or Monday, I'll put this presentation online on the Corps' Frankford Arsenal site. The Remedial Investigation Report, Feasibility Study and Proposed Plan are already online at that web site. The link is in the fact sheet that was on the registration desk http://www.nab.usace.army.mil/Missions/Environmental/Formerly-Used-Defense-Sites/Frankford-Arsenal/. The web site also has information on Area I.

Community Members: Will there be job opportunities when the work starts? Can local veterans be hired to work on construction projects?

Mr. Beckwith: We have to follow the Federal Acquisition Regulation which does address veteran-owned businesses and providing them with hiring preference.

Community Member: Why was capping selected as the preferred alternative for several areas? Are those areas less toxic?

Mr. Beckwith: There is already a cap in place. There are some utilities in those areas which would make it more difficult to remove the soil. The future use of the property doesn't warrant additional digging in that area so it makes sense to leave the areas capped.

Mr. Gardner: If you include your email addresses on the sign-in sheets, we will continue to provide information and updates on Areas III and IV.

The presentation and comment/question period ended at 7:35 pm. U.S. Army Corps of Engineers, their contractors, and PADEP staff remained to continue to provide information and answer questions.

ATTACHMENTS

MEETING SIGN-IN SHEET

FORMER FRANKFORD ARSENAL – AREA II
PROPOSED PLAN MEETING
18 August 2016

NAME	AFFILIATION	PHONE NUMBER	MAILING/EMAIL ADDRESS
Kim Brantley	224	215 520 3114	29 Hepburn Ln Willingboro 08046
LEON BRANTLEY	224	215-800-4867	NU AMVAW
BOB SMILEY	FRANKFORD GAZETTE	215 847 5506	
Guy D Lewis	POST COMMANDER	267 252 0687	7643 LEWIS ROAD guydlewis@comcast.net CHELTENHAM, PA. 19012
Pamela Trowbridge	PA DEP	717-705-4839	ptrowbridge@pa.gov
Tanya Lewis Brown	Frankford Resident	(215)873-6601	TaBrown@girardcollege.edu
Rev. Colleen Kelly	FRK Resident	267-970-9367	Collybee63@aol.com
STANLEY ADAMS	224	215-584-9775	
		215-624-7849	Nolan Hill
Richard Johnson	224	267-809-4930	4649 Paul St 19124

FORMER FRANKFORD ARSENAL – AREA II
PROPOSED PLAN MEETING
18 August 2016

NAME	AFFILIATION	PHONE NUMBER	MAILING/EMAIL ADDRESS
H. Christopher Jackson	SAL Post 224	215-626-4944	hcjacksonphila@AOL.com 8053 Edlidge St. Phila., PA 19136

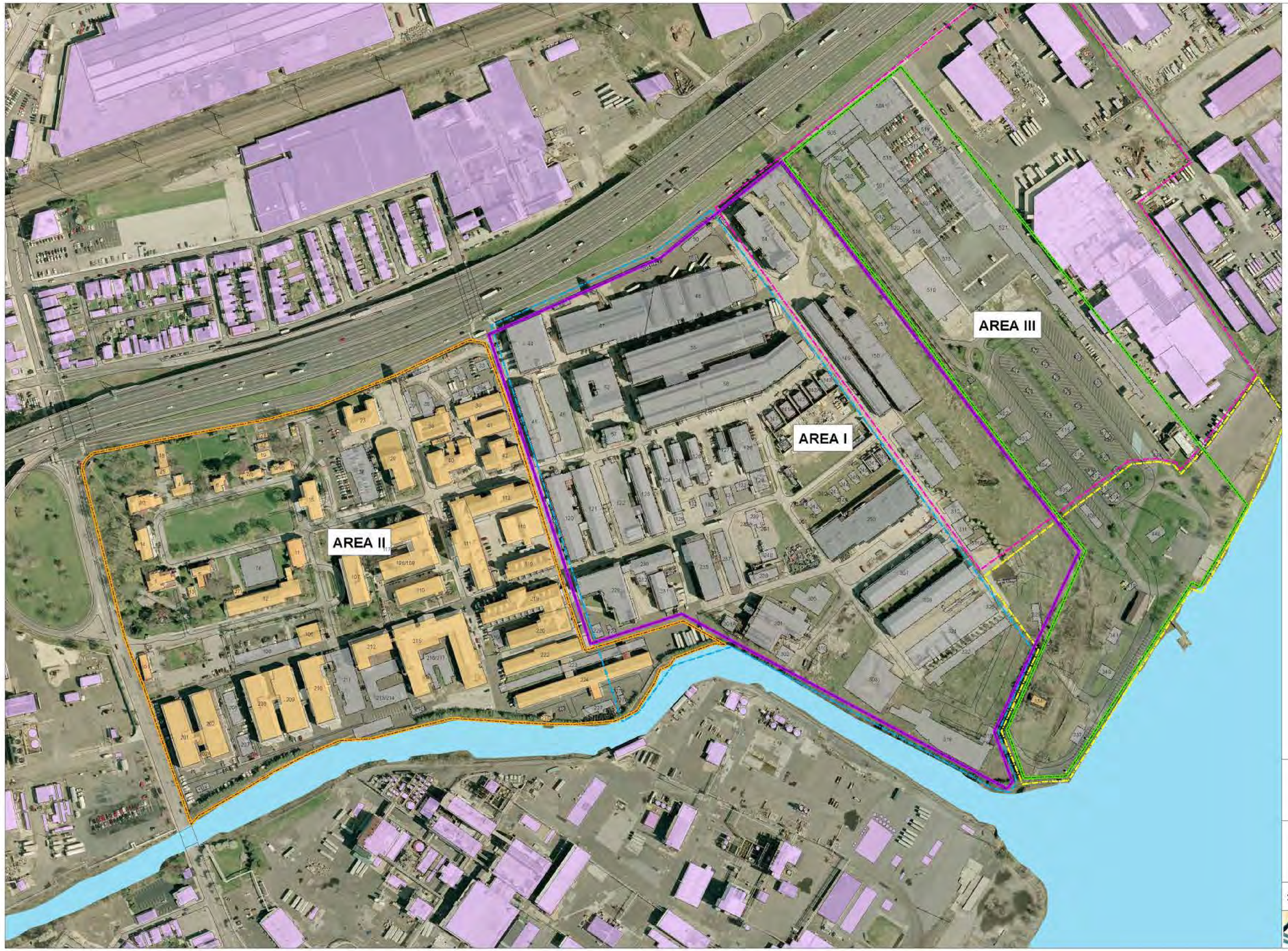
POSTERS

US Army Corps of Engineers®

Former Frankford Arsenal
Area II Soils
Proposed Plan Public Meeting

US Army Corps of Engineers®

Former Frankford Arsenal Project Map



N

Phase Area Boundary
- Area I
- Area II
- Area III

Property Boundary
- City of Philadelphia
- Dietz & Watson
- PIDC

Buildings
- Existing FFA Building
- Demolished FFA Building
- Outside FFA Area
- Waterbodies

0 200 400
Scale (feet)

FORMER FRANKFORD ARSENAL AREA I AND AREA III PROPERTY CHANGES

FORMER FRANKFORD ARSENAL PHILADELPHIA, PENNSYLVANIA

2/2015	CABRERA Project No. 08-3103.00	FIGURE 3

Cabrera Services
1106 N Charles St
Suite 300
Baltimore, MD 21201

U.S. Army Corps of Engineers, Baltimore District

Environmental Cleanup Process

*Coordination with the Pennsylvania Department of Environmental Protection, the lead regulatory agency, throughout the process.

Preliminary Assessment

Site Inspection

Remedial Investigation/Feasibility Study

Proposed Plan and Comment Period

Decision Document

Potential Remedial Design/Remedial Action (if necessary)

Site Close-Out Report

Reviewed historical documents

<u>Remedial Investigation:</u> Determine the nature of the waste; assess risk to human health and the environment.

<u>Feasibility Study:</u> To develop, screen, and evaluate alternatives for clean-up.

Presents alternatives and provides a recommendation for the preferred alternative.

US Army Corps of Engineers®

Former Frankford Arsenal Area II Soil Sample Locations

Sources
ESRI (Imagery) 2011
Cabrera, 2011
USACE, 2009

Frankford Arsenal
Philadelphia, Pennsylvania

Project: 6233017

Date: July 2016

0 75 150 300
Feet
1 inch = 175 feet

Figure 2-2
Soil Characterization and Delineation Sample Locations

Path: W:\overton\federal\GIS\Data\Northeast\Pennsylvania\FrankfordArsenal\MXD\Draft\PSI Figure 2-2 Soil Char and Delin Sample Loc.mxd

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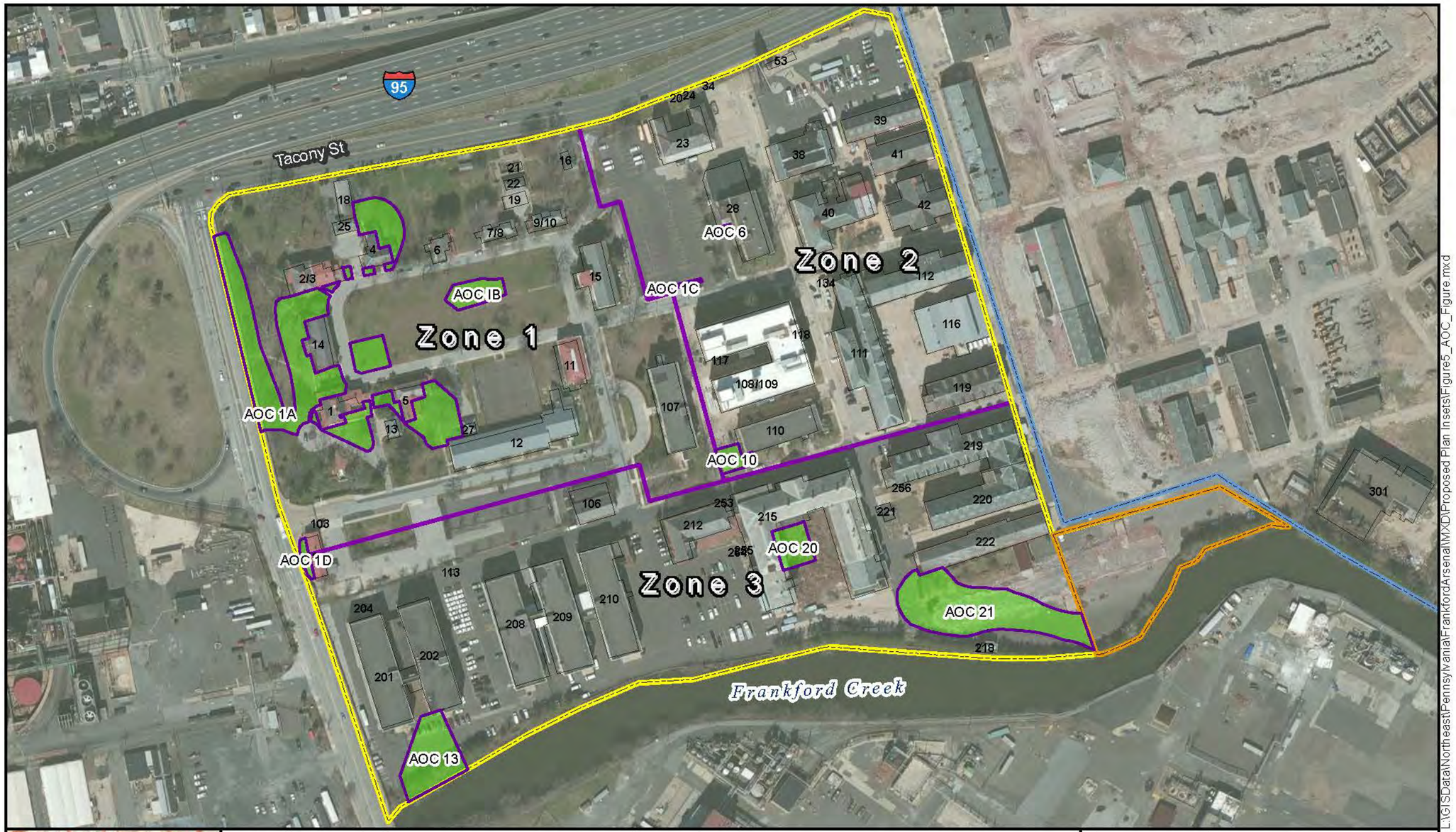
Former Frankford Arsenal Area II Soils: Map of Areas of Concern



Legend

- Area of Concern (AOC)
- Area I Boundary
- Area II Boundary
- Philadelphia Industrial Development Corporation
- Zone 1, 2 and 3

Feet
0 50 100 200

Sources
ESRI (Imagery) 2013
Cabrera, 2011
USACE, 2009

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FRANKFORD ARSENAL
PHILADELPHIA, PENNSYLVANIA

Figure 4
Areas of Concern

L:\GISData\Northeast\Pennsylvania\FrankfordArsenal\MXD\Proposed Plan Insets\Figure5_AOC_Figure.mxd

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Former Frankford Arsenal Area II Soils: Feasibility Study Alternatives Evaluated

ALTERNATIVE 1: NO ACTION

- This alternative is not being proposed for any of the Areas of Concern in Area 2 addressed in the Proposed Plan

ALTERNATIVE 2: EXCAVATION AND DISPOSAL

- Alternative 2 is being proposed for **AOCs 1, 6, 10 and 20**
- In AOCs 1, 6, 10 and 20, the contaminated soils are accessible, meaning that in many cases the public has a direct contact pathway to the contaminated soils. This also means that the soils can be excavated. Generally, these are factors in the selection of Excavation and Disposal for these AOCs.
    - Involves the estimated excavation and disposal of an approximately 3,112 cubic yards of contaminated soil from the site

ALTERNATIVE 3: INSTALLATION OF A CAP AND FUTURE USE RESTRICTIONS

- Alternative 3 is being proposed for **AOCs 13 and 21**
- In AOCs 13 and 21, the contaminated soil is below an already existing cap. In the case of AOC 13, the existing cap is asphalt paving and at least 8 inches of concrete. In AOC 21, the existing cap is asphalt paving. These existing caps serve to limit potential contact between the public and the contaminated soils. The existing caps also would complicate potential excavation of the soil and increase the cost of any such excavation. As such, for these AOCs, the Army is recommending leaving the caps in place and implementing restriction of future work that would reduce the efficacy of the existing caps.

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Former Frankford Arsenal Area II Soils: Proposed Remedial Action by Area of Concern

Area of Concern	Chemicals of Concern	Preferred Remedial Alternative
AOC-1	Lead	Alt 2 – Excavation and Disposal
AOC-6	PCB 1260	Alt 2 – Excavation and Disposal
AOC-10	Lead	Alt 2 – Excavation and Disposal
AOC-13	Benzo(a)pyrene	Alt 3 – Installation of Cap and Future Use Restrictions
AOC-20	Lead	Alt 2 – Excavation and Disposal
AOC-21	Lead	Alt 3 – Installation of Cap and Future Use Restrictions

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Former Frankford Arsenal Area II Soils: What are the "Chemicals of Concern"

USACE has identified and will be remediating three "Chemicals of Concern" (COCs) that pose the greatest potential risk to human health at the site: **lead, PCB 1260,** and **BAP**. Lead was also identified as a COC for ecological receptors in Zone 1.

Lead:

- Is a metal commonly associated with paint (pre-1978) and dust from industrial operations.
- Onsite sources include the production of bullets with a lead core, as well as plating and metallurgical laboratory operations.
- The FFA is located within a historically industrialized area of Philadelphia; other background sources of airborne lead (such as lead from car emissions, industrial such as naturally occurring sources like minerals in soils or man-made sources like car emissions or industrial operations) are possible, but not easily individually identifiable.
- **Identified in AOCs 1, 10, 20 and 21**

Benzo(a)pyrene (BAP):

- Is a polycyclic aromatic hydrocarbon (PAH). PAHs form during the incomplete burning of oil, coal, gas, garbage, wood, or other organic substances (such as charbroiled meat and tobacco).
- They generally occur as complex mixtures and not as individual compounds.
- PAHs are used to make dyes, plastics, and pesticides. PAHs are contained in asphalt, and they can also be found in roofing tar, coal, coal tar pitch, creosote, and crude oil.
- No single point source for PAHs can be identified based on their widespread occurrence; in general, they are detected in fill material at the site.
- **Identified in AOC 13**

PCB 1260:

- Is a polychlorinated biphenyl (PCB). PCBs were widely used as lubricants and coolants in electrical equipment, including transformers, because they do not burn easily and are good insulating materials.
- Their manufacture ceased in the United States in August 1977.
- PCB 1260 in soil at FFA is the likely result of a release from an electrical PCB transformer.
- **Identified in AOC 6**

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Former Frankford Arsenal: Status of Areas I, II, III and IV

Area I Soils:

- Several removal actions were completed since 1999 and the Corps of Engineers determined there are no remaining unacceptable risks to human health or the environment.
- The Final No Further Action Decision Document for Area I Soils was signed on 1 July 2015

Area II Soils:

- Proposed Plan released summer 2016 outlining preferred remedial alternatives for Areas of Concern with soil contamination
- Currently accepting feedback regarding Area II Soils Proposed Plan, anticipate beginning remedial work on site later in 2016

Area III Soils:

- The Area III Soil Remedial Investigation Report was finalized in March 2016
- The Corps of Engineers is evaluating alternatives for addressing Area III soil contamination in a Feasibility Study

Area IV Site-Wide Groundwater:

- The Groundwater Remedial Investigation Report is expected to be finalized in fall 2016

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Former Frankford Arsenal Area II Soils:
How to Submit a Public Comment

The Corps of Engineers will continue accepting public comments on the Former Frankford Arsenal Area II Soils Proposed Plan until the 30-day public comment period ends on Aug. 31, 2016. Comments can be provided verbally to the stenographer, submitted in writing this evening, or submitted via traditional mail or e-mail:

Written comments can be sent to the following mailing address:
U.S. Army Corps of Engineers
ATTN: Todd Beckwith, Rm. 10040-E
10 South Howard St.
Baltimore, Md. 21201

Or e-mailed to:
todd.t.beckwith@usace.army.mil

Mailed letters must be postmarked by Aug. 31, 2016.

Former Frankford Arsenal Area II Soils: Risk Assessment

Scientific process that estimates potential ecological and human health risks that could result from exposure to chemicals in the soil at Area II.

Risk assessment answers the questions:

- Is there a hazard?
- How serious is it?
- Who would be exposed?
- How would exposure occur (pathways)?

Data collection - soil sampling & chemical analysis

Potential receptors

Soil contact
Accidental ingestion/eating
Breathing soil particles

Former Frankford Arsenal Area II Soils Risk Assessment

Five reasonable maximum exposure receptors were identified based upon the current and future land use at Area II. * Exposure duration listed under each photo.

Residential
*350 days per year, 30 years (adult)
* 350 days per year, 6 years (child)

School student
*180 days per year, 8 years

Office/commercial worker
*180 days per year, 25 years

Landscaper/Maintenance Worker
*50 days per year, 25 years

Construction Worker
*250 days per year, one year

Risk assessment conclusions:

- No unacceptable risk for school students, office/commercial workers, landscaper/maintenance workers, and construction worker
- Potential risk for a future resident at six AOCs

PRESENTATION

Former Frankford Arsenal Proposed Plan for Area II Soils

Todd Beckwith

Project Manager

August 18, 2016

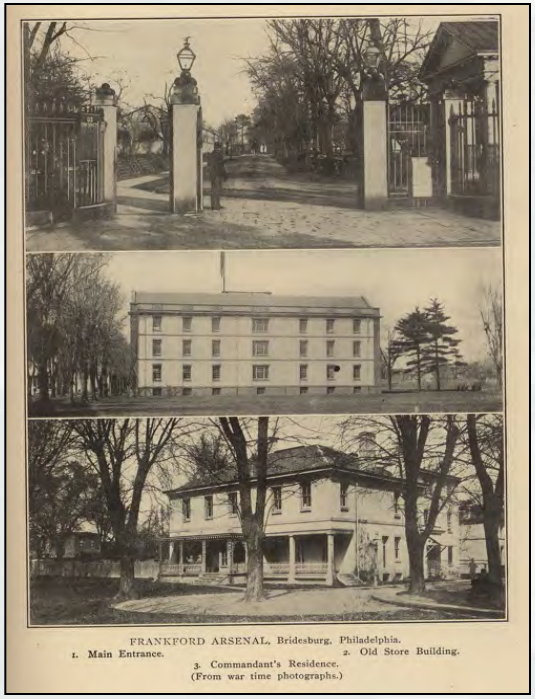
U.S.ARMY

US Army Corps of Engineers

BUILDING STRONG®

Agenda

- Arsenal History
- Environmental Process
- Area II Soils Investigation
- Cleanup Alternatives
- Next Steps
- Status of Other Areas


FRANKFORD ARSENAL, Bridesburg, Philadelphia.
1. Main Entrance. 2. Old Store Building.
3. Commandant's Residence.
(From war time photographs.)

Former Frankford Arsenal

- Commissioned in 1816
- Military artillery and small arms ammunition research, manufacturing, testing, and storage facility
- Closed in 1977
- Large scale decontamination and decommissioning efforts followed
- Property transferred for economic reuse
- Currently used as a commercial business park and recreational area

Environmental Cleanup Process

*Coordination with the Pennsylvania Department of Environmental Protection, the lead regulatory agency, throughout the process.



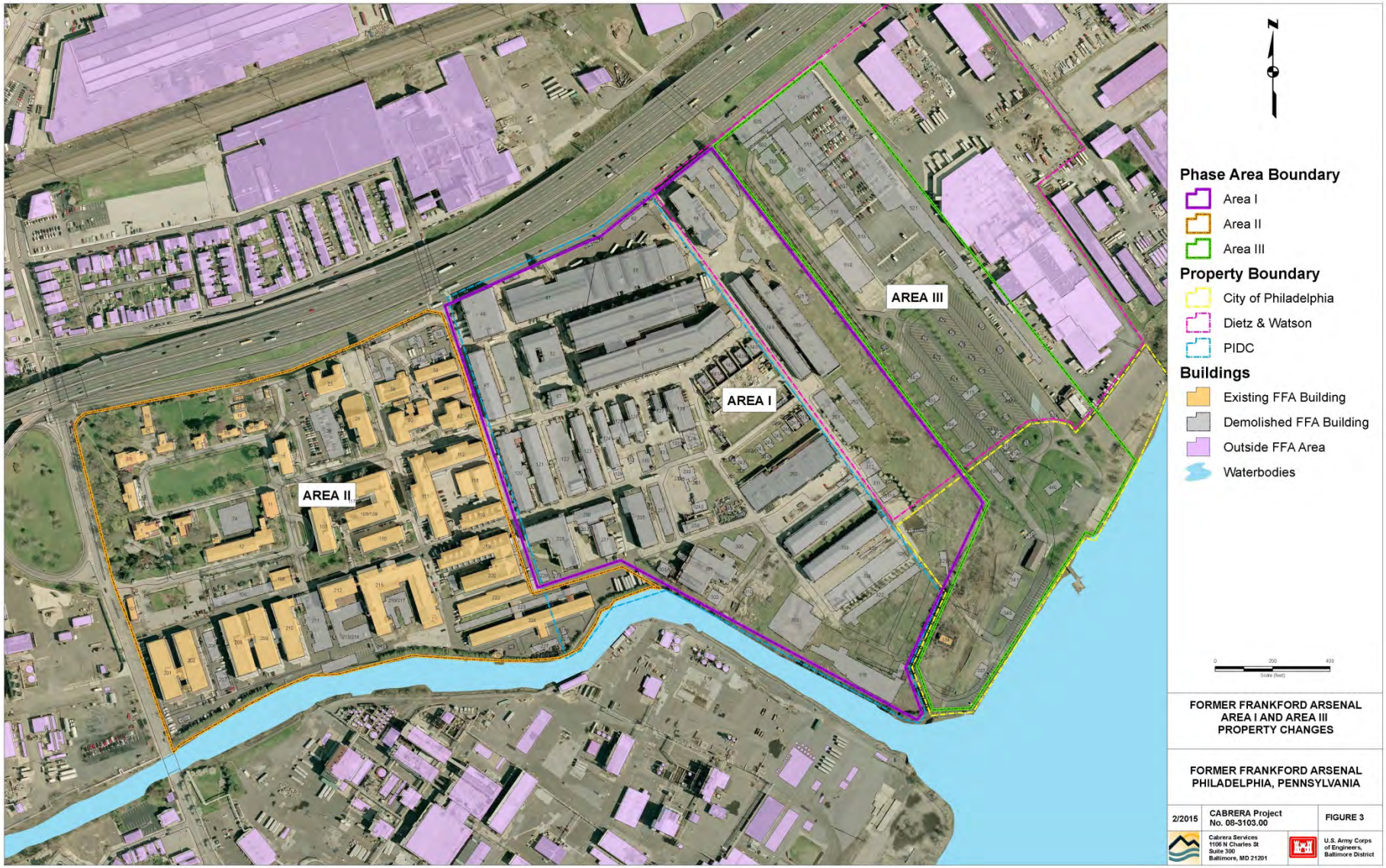

Preliminary Assessment → Site Inspection → Remedial Investigation/Feasibility Study → ★ Proposed Plan and Comment Period → Decision Document → Potential Remedial Design/Remedial Action (if necessary) → Site Close-Out Report

Reviewed historical documents

Remedial Investigation: Determine the nature of the waste; assess risk to human health and the environment.

Feasibility Study: To develop, screen, and evaluate alternatives for clean-up.

Presents alternatives and provides a recommendation for the preferred alternative.


AREA II
AREA I
AREA III
Phase Area Boundary
Area I
Area II
Area III
Property Boundary
City of Philadelphia
Dietz & Watson
PIDC
Buildings
Existing FFA Building
Demolished FFA Building
Outside FFA Area
Waterbodies
0
200
400
Scale (feet)
FORMER FRANKFORD ARSENAL
AREA I AND AREA III
PROPERTY CHANGES
FORMER FRANKFORD ARSENAL
PHILADELPHIA, PENNSYLVANIA
2/2015
CABRERA Project
No. 08-3103.00
FIGURE 3
Cabrera Services
1106 N Charles St
Suite 300
Baltimore, MD 21201
U.S. Army Corps
of Engineers,
Baltimore District

Area II Remedial Investigation

- PURPOSE: Collection of data to determine nature and extent of contamination. Includes human health and ecological risk assessment
  - 445 surface and subsurface samples collected
  - Risk assessment considered 5 different exposure receptors: Resident, School Student, Office Worker, Landscaper/Maintenance, Construction Worker
- Risk assessment conclusions:
  - NO Unacceptable risk under current land use
  - Potential unacceptable risk at six AOCs for future residential use
    - Lead in soil at AOC 1, 10, 20, 21
    - PCB 1260 in soil at AOC 6
    - Benzo(a)pyrene in soil at AOC 13

US Army Corps of Engineers

Area II Soil Sample Locations

Legend

Soil Sample Locations

- Delineation Soil Sample
- Biased Soil Sample
- Unbiased Soil Sample
- Transformer Sample
- Location Not Sampled

Zones

- Zone 1, 2 and 3
- Area I Boundary
- Area II Boundary
- Philadelphia Industrial Development Corporation
- Boring Included in Geologic Cross-Section

Label Key

UBZ-	Unbiased Soil Sample
BZ-	Biased Soil Sample
D-	Delineation Soil Sample
Z1-	Zone 1
Z2-	Zone 2
Z3-	Zone 3
SO-	Soil Sample
mg/kg	Milligrams per Kilogram

Sources
ESRI (Imagery) 2011
Cabrera, 2011
USACE, 2009

Frankford Arsenal
Philadelphia, Pennsylvania

Project: 6233017

Date: July 2016

0 75 150 300
Feet
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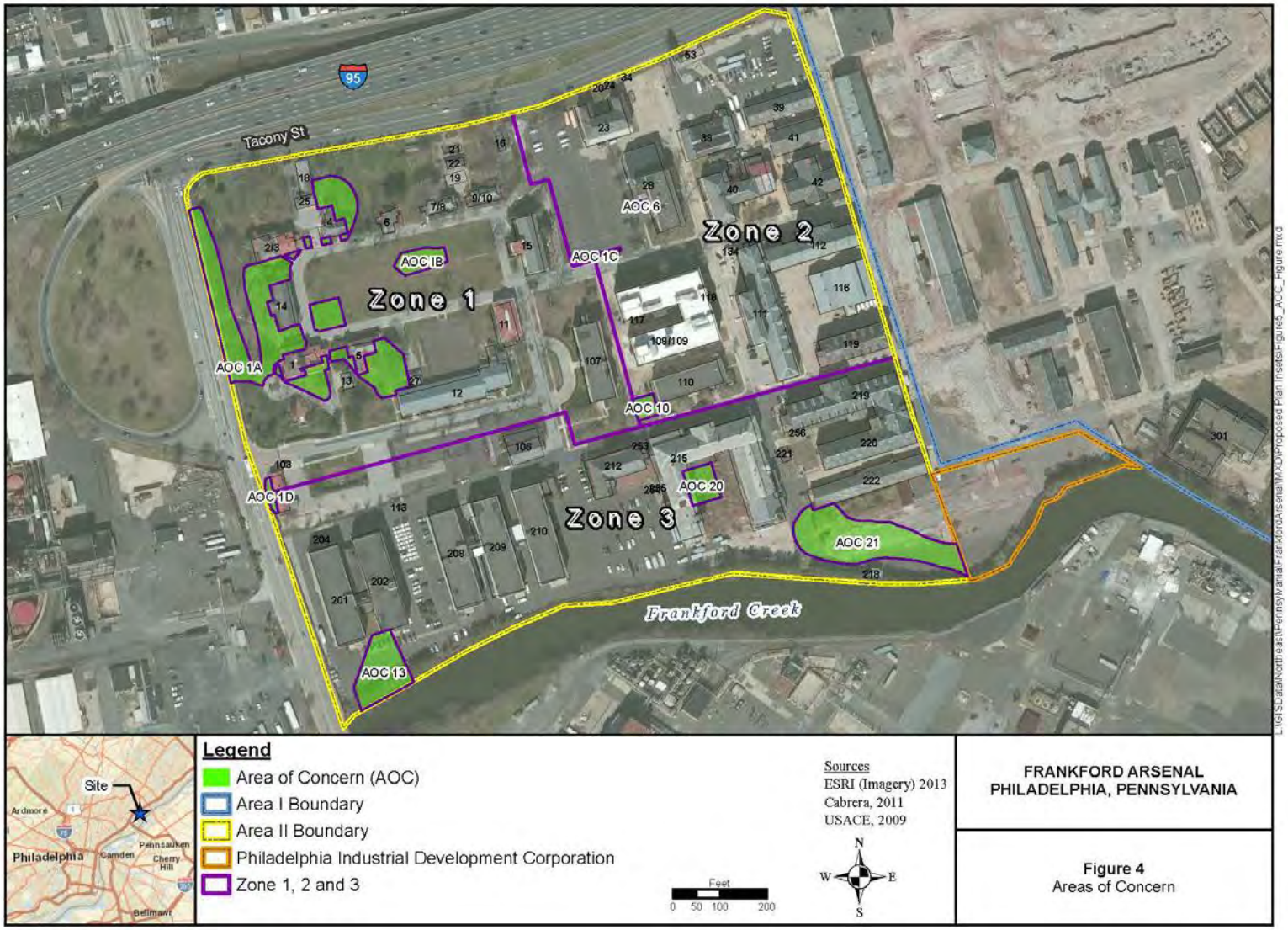
Area II Soils: Map of Areas of Concern

US Army Corps of Engineers



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FFA Area II Soils Feasibility Study
Remedial Alternatives Evaluated

ALTERNATIVE 1: NO ACTION

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ALTERNATIVE 2: EXCAVATION AND DISPOSAL

- Alternative 2 is being proposed for **AOCs 1, 6, 10 and 20**
- In AOCs 1, 6, 10 and 20, the contaminated soils are accessible, and can be easily excavated disposed at an offsite landfill.
- Involves the estimated excavation and disposal of an approximately 3,112 cubic yards of contaminated soil from the site

ALTERNATIVE 3: INSTALLATION OF A CAP AND FUTURE USE RESTRICTIONS

- Alternative 3 is being proposed for **AOCs 13 and 21**
- In AOCs 13 and 21, the contaminated soil is below an already existing cap (asphalt and/or concrete. Leaving the caps in place at AOCs 13 and 21 is consistent with future land use in the area..

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FFA Area II Soils Proposed Plan: Proposed Remedial Action by Area of Concern

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AOC-20	Lead	Alt 2 – Excavation and Disposal
AOC-21	Lead	Alt 3 – Installation of Cap and Future Use Restrictions

Ways to Comment

- Orally at tonight's meeting.
- Fill out a written form and turn it tonight.
- Email or mail your written comments by August 31.

Todd.t.Beckwith@usace.army.mil

Or

Mail: U.S. Army Corps of Engineers
ATTN: Todd Beckwith
Rm. 10400-E, 10 South Howard St.,
Baltimore, Md. 21201

Next Steps

- Take public comments under consideration and prepare responses to comments.
- Prepare a Decision Document, with Responsiveness Summary.
- Final Decision Document placed in the library and online.

Status of Areas I, II, III, and IV

- **Area I Soils:** Several removal actions were completed since 1999 and the Corps of Engineers determined there are no remaining unacceptable risks to human health or the environment. The Final No Further Action Decision Document for Area I Soils was signed on 1 July 2015

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Questions or Comments?