Technical Assistance Services
for Communities
BoRit Asbestos Superfund Site
Feasibility Study Review

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BoRit Feasibility Study Review
(Draft Final Feasibility Study Report, October 9, 2015)

A. INTRODUCTION

The BoRit Community Advisory Group (CAG) asked the Technical Assistance Services for Communities (TASC) program to review, summarize and comment on the Feasibility Study (FS) for the BoRit Superfund Site. The FS and its relationship to the Superfund process is discussed below. TASC's summary of the FS is in "Section B. Feasibility Study Summary and Technical Comments." "Section C. Review by Asbestos Remediation Professionals" is a summary of reviews by two consulting firms that conduct remediation of waste piles and contaminated soil. TASC technical comments are embedded in sections B and C of this review and are summarized below.

What is Superfund?
Superfund is the common name for the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). The program's name refers to the "super fund" of money that was set aside to clean up hazardous waste sites when it was established in 1980.

Figure 1. The Superfund Process

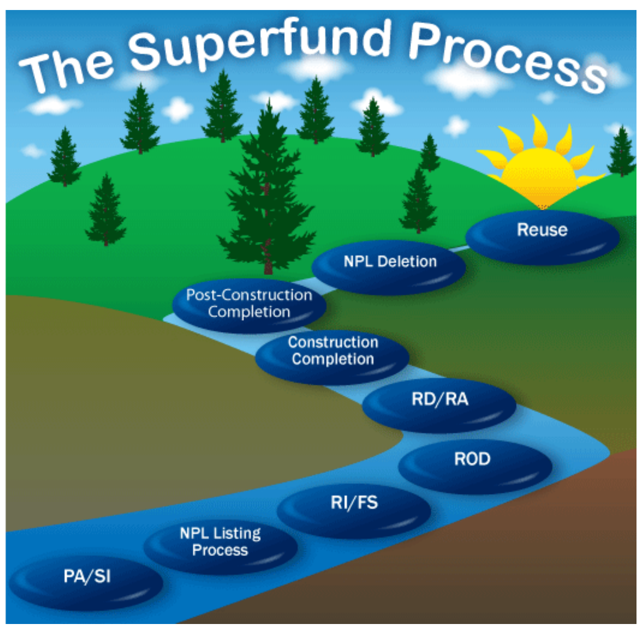


Figure 1 shows the Superfund process. It begins with a preliminary assessment and site inspection (PA/SI) and continues to the National Priorities List (NPL) listing process. The remedial investigation and feasibility study (RI/FS) stage determines the nature and extent of contamination at a site and evaluates treatment technologies. EPA then selects a remedy for sites in a decision document called a Record of Decision (ROD).

Leading up to the ROD, EPA selects a preferred remedy and presents this remedy in a document called the Proposed Plan. Public comments are solicited on the Proposed Plan before the ROD is completed. After the ROD, detailed cleanup plans are developed and implemented during the remedial design/remedial action (RD/RA) stage. A site is considered construction complete when the cleanup is in place. Post-construction completion stages often include monitoring of the cleanup.

If contamination is left on the site, EPA requires Five-Year Reviews to ensure that the remedy for the site remains protective of human health and the environment. EPA may delete a site from the NPL if EPA determines that no further response is required to protect human health and the environment. Deleted sites are still subject to Five-Year Reviews if remaining contamination levels prevent unrestricted use and unlimited exposure.

This report is provided by the United States Environmental Protection Agency's (EPA's) TASC program, which is implemented by independent technical and environmental consultants. TASC comments in this report do not necessarily reflect EPA's opinion or policy.

Summary of TASC Comments

TASC technical comments are embedded in sections B and C of this review, and summarized below:

Acceptable Cancer Risk

- The CAG may want to consider asking EPA if the preliminary remedial action objective (PRAO) can be set at a lower cancer risk level. An excess cancer risk of one in 10,000 is the highest cancer risk objective that EPA typically accepts without requiring remediation. EPA sometimes sets a site-specific cancer risk objective as low as an excess cancer risk of 1×10^{-6} (one in a million).

Surface Water Contamination

- The CAG may want to ask EPA if the protective measure for ecological receptors also adequately protects people swimming and fishing in surface waters.
- The CAG may want to ask EPA for advice in taking further action to prevent exposure to surface waters affected by off-site contaminants that are not being addressed by the BoRit Asbestos Superfund Site cleanup. Is signage needed to alert swimmers and fishers of potential risks from contaminants in surface waters and sediments, even though the contaminants are not site-related? Is this an issue that should be brought to the attention of the state or local authorities?

Remedy

- As pointed out by the asbestos remediation professionals, we believe WSS2 – Capping is the most appropriate remedy for this site. The following suggestions are not intended to undermine the appropriateness of capping, but they do emphasize the importance of comprehensive, robust and strictly-enforced engineered and institutional controls, which are yet to be set.

- The CAG may want to ask EPA for assurance that the geotextiles used beneath the cap are of sufficient strength to discourage burrowing animals.
- The CAG may want to ask EPA for more information about the design of the slope and EPA's confidence in the slope stability in the asbestos pile parcel.
- The CAG may want to ask EPA to consider whether additional activity-based sampling (ABS) under lower soil moisture conditions may be warranted for any asbestos-containing areas left uncovered on site or off site, even if the amount of asbestos in soil is less than 1 percent.

B. FEASIBILITY STUDY SUMMARY AND TECHNICAL COMMENTS

Section 1: Introduction

This section covers the purpose of the FS; site location and description; site history; physical characteristics of the study area, including surface drainage, geology and the floodplain; nature and extent of contamination, including summaries for each contaminated area; conceptual model, including asbestos and non-asbestos contaminants; human health and screening-level ecological risk assessments; identification of site-related contaminants; and current conditions and future use. Highlights of the introduction are discussed below.

Site History, Location and Description

The BoRit Asbestos Superfund Site includes three adjacent parcels located near the intersection of West Maple Street and Butler Pike in Ambler Borough, Montgomery County, Pennsylvania. The parcels include:

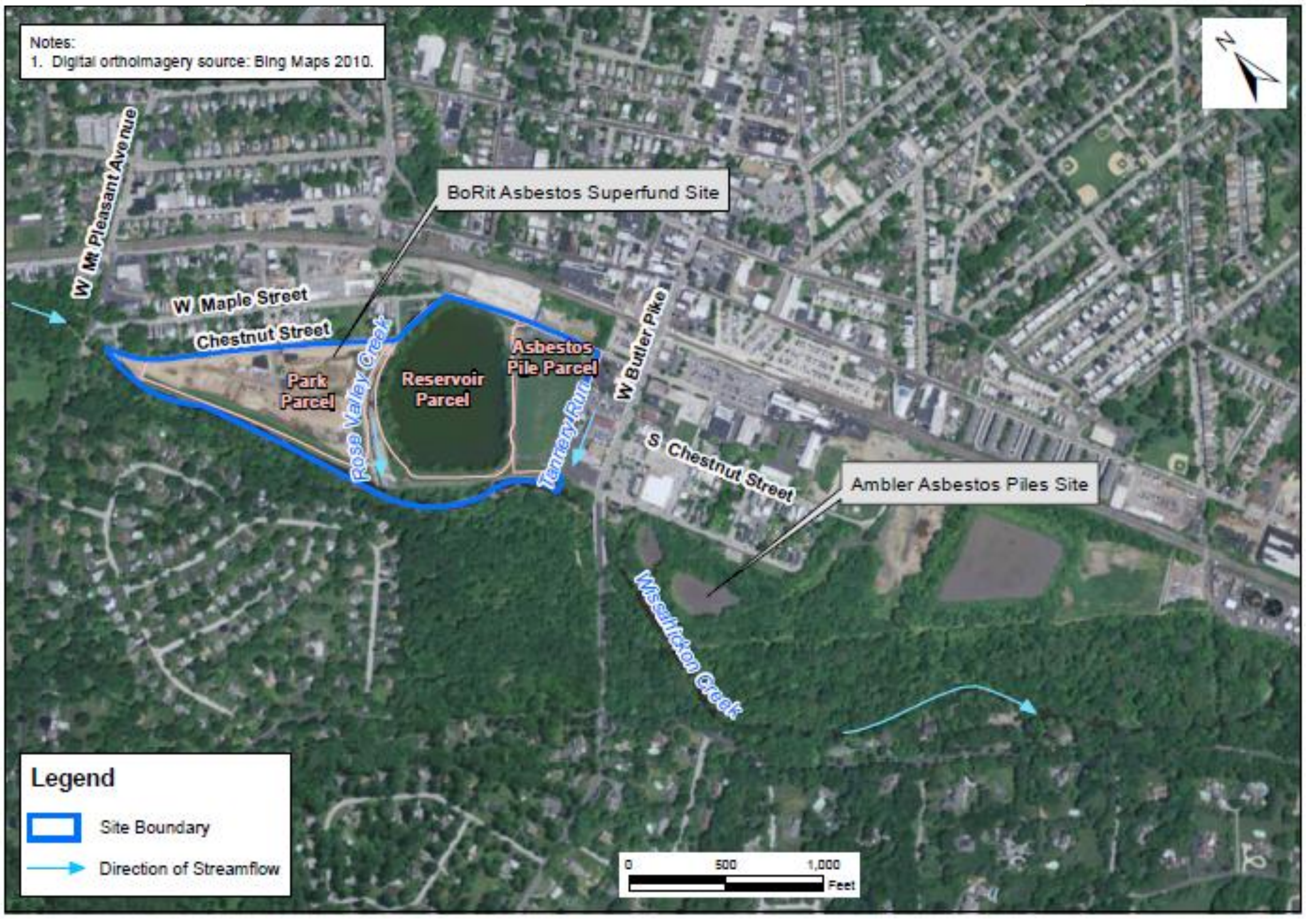
- The asbestos pile parcel
- The park parcel
- The reservoir parcel

The site also includes portions of Wissahickon Creek, Rose Valley Creek and Tannery Run, which flow next to the three site parcels. See Figure 2.

The site is a result of disposal operations by the former Keasby and Mattison (K&M) Company and succeeding companies (Certainteed Corporation and Nicolet Industries). K&M produced various asbestos products from 1897 to 1962. After 1962, Certainteed Corporation and Nicolet Industries purchased different portion of the facility and manufactured asbestos-cement pipe and automobile parts and laboratory table tops, respectively. Operations ceased by 1987.

Shallow groundwater is found in fractured upper bedrock with occurrences in the overburden material (material that lies above the bedrock) in the park parcel and the asbestos pile parcel. The shallow bedrock groundwater flows to the southwest across the park parcel, suggesting discharge to Wissahickon Creek and Rose Valley Creek. Shallow groundwater in the overburden is found both within and below waste material. Flow in the overburden is likely to be horizontal toward Wissahickon Creek.

Figure 2. BoRit Asbestos Superfund Site



CDM Smith

BoRit Asbestos Superfund Site
Ambler, Pennsylvania

Figure 1-1
Site Map

Nature and Extent of Contamination

The asbestos contamination at the site is the result of historical disposal practices at the three site parcels. Contamination is observed in waste, soil and air (in all three parcels) and surface water, seep water and sediment (in the reservoir parcel). Asbestos was also observed in site groundwater. Other contaminants detected in the asbestos containing material (ACM) waste include volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides and metals. Three potential sources of contamination were investigated, including the fire training area on the asbestos pile parcel, the former transformers on the reservoir and asbestos pile parcels, and the slag area on the asbestos pile parcel. The presence of dioxins was observed at the fire training area and polychlorinated biphenyls (PCBs) were noted at the locations of the transformers.

ABS: Residential Areas and Walking Trails

ABS was conducted on residential properties and walking trails to simulate possible soil-disturbing activities. No air samples collected during any residential raking/lawn maintenance ABS contained asbestos above the site-specific ABS preliminary remediation goal (PRG) of 0.04 fibers per cubic centimeter of air (f/cc). Also, no air samples collected during the walking trail ABS activities contained asbestos above the ABS PRG of 0.04 f/cc. Asbestos was detected in all surface soil samples collected for ABS scenarios.

None of the composite soil samples collected from residential or walking trail ABS locations exceeded the soil screening level of 1 percent asbestos.

Ambient Air

Ambient air samples were collected at least monthly at seven locations outside the perimeter of the site from November 2010 to October 2011. Asbestos was detected well below the site-specific ambient air PRG of 0.001 f/cc at two locations (0.00075 and 0.00079 s/cc) and just above the PRG at a third location (0.0012 s/cc) over the course of monthly sampling. No repeated detections of asbestos occurred at any location. The slight exceedance of the asbestos ambient air PRG at one location was believed to be associated with EPA Removal Program excavation activities on the site.

Conceptual Model

The conceptual site model integrates all information collected during the RI to explain the observed distribution of contamination.

<u>Asbestos</u>

Asbestos is the main contaminant at the site. The primary source of the asbestos contamination is the waste layer and contaminated soil in the park parcel, the berm of the reservoir parcel, and the pile area of the asbestos pile parcel. Asbestos is released to the air via dust re-suspension and to soil, surface water, sediment and groundwater via surface runoff when the ACM is disturbed. Waste areas that are not covered by fill or soil are vulnerable to disturbance.

<u>Non-Asbestos</u>

Other contaminants detected in the ACM waste include VOCs, SVOCs, pesticides and metals. These contaminants are released to soil, groundwater, surface water and sediment via surface runoff.

Risk Assessment Summaries

<u>Human Health Risk Assessment</u>

Asbestos in soil and air are risk drivers at the site. EPA considers human health risks unacceptable for maintenance workers at the asbestos pile and park parcels due to activities that disturb soil and release asbestos dust into the air.

Asbestos was detected in soil in one residential yard and at the walking trail downstream of the site. Air testing indicated that exposure to off-site asbestos, when present, is unlikely to result in unacceptable risks. EPA considers an increased risk of greater than one in 10,000 to be unacceptable.

Polycyclic aromatic hydrocarbons (PAHs) in surface water and sediment; pesticides, PCBs and metals in sediment; and VOCs, SVOCs, and metals in shallow bedrock groundwater were also detected at levels that may pose a risk to human health. Human health risks are considered unacceptable by EPA for:

- Current/future recreational user (swimmers and fishers) in Wissahickon Creek (due to PAHs in surface water and sediment and PCBs and metals in sediment).
- Future residents using groundwater as a drinking source (cancer and non-cancer risks due to VOCs, SVOCs and metals).

Ecological Risk Assessment

The site's Screening Level Ecological Risk Assessment (SLERA) indicated that asbestos and other chemicals may pose a risk to ecological receptors (wildlife). Most of the risks were related to direct contact with contaminants; risks from dietary exposure were limited. Risk drivers (contaminants causing the most risk) for terrestrial receptors (wildlife living on land) in direct contact with soil included several metals, PAHs, dioxins/furans and pesticides. For receptors in direct contact with creek and reservoir sediment, PAHs were the most common risk driver. Asbestos and metals were the primary risk drivers in surface water in both the creek and reservoir. Risks for dietary exposure to arsenic and asbestos in site soil were also noted for insectivorous (insect-eating) birds and mammals, respectively. Potential risks were identified for aquatic receptors (organisms living in water) for a limited set of metals and asbestos in seep water from the reservoir parcel.

Contaminants

The contaminants of potential concern (COPC) for either human health or ecological risk include the following:

- Soil/Waste – asbestos, bis(2-ethylhexyl)phthalate, dioxins and furans, chromium, lead, mercury, nickel and zinc.
- Reservoir sediment – carbon disulfide.
- Reservoir surface water – asbestos, aluminum, iron and lead.
- Seep water – asbestos, aluminum and iron.

Several SVOCs were identified as human health COPCs in creek surface water and sediment, but these contaminants are also found upstream of the site, indicating a possible upstream source. Portions of the stream banks were stabilized in the EPA Removal Program to prevent and minimize future contamination of the creeks.

DEFINITIONS

Chemicals of Interest (COIs) are all the chemicals that are evaluated in the remedial investigation.

Chemicals of Potential Concern (COPCs) are COIs that are found at concentrations exceeding their respective screening levels. COIs are evaluated in risk assessments.

Chemicals of Concern (COCs) are identified in the Feasibility Study. Preliminary remediation goals are set for each COC.

Groundwater was identified as a potential risk to future residents exposed to contaminated tap water. However, concentrations of risk-driving contaminants were below or near the maximum contaminant level (MCL) or were lower than an upgradient well; some do not appear to be coming from waste material at the site. Based on these observations, creek surface water, creek sediment and groundwater were not addressed in the remedial alternatives.

Table 1-3 of the FS report lists these chemicals as human health chemicals of concern (COCs):

- Asbestos
- Bis(2-ethylhexyl)phthalate
- Dioxins and furans
- Chromium
- Nickel
- Zinc

Carbon disulfide and total asbestos are listed as ecological COCs.

Current and Future Use

The site parcels are unused and vacant as the EPA Removal Program completes (or has completed) removal actions. Future use plans for the park parcel include a public park and open space. Whitpain Township would maintain ownership of the park parcel. The Wissahickon Waterfowl Preserve would maintain ownership of the reservoir parcel and continue to use the property as a waterfowl preserve. Future use of the asbestos pile parcel is unknown.

Section 2: Development of Remedial Action Objectives and Identification and Screening of Technologies

Section 2 of the FS Report reviews the affected media and contaminant exposure pathways, presents remedial objectives and goals, and evaluates remedial technology options.

2.1 Potential ARARs, Guidelines and Other Criteria

Superfund law requires that all applicable or relevant and appropriate requirements (ARARs) be considered in setting cleanup goals. ARARs can be requirements of other federal laws, such as the Resource Conservation and Recovery Act (RCRA), Clean Water Act (CWA), Safe Drinking Water Act (SDWA) and Clean Air Act (CAA). ARARs can also be state requirements that are stricter than federal requirements. Several ARARs are listed in Table 2.1a of the FS Report.

Table 2.1b of the FS Report identifies To-Be-Considered (TBC) criteria in the development of remedial action objectives (RAOs), PRGs and alternatives for the site. TBC criteria are requirements that pertain to federal and state criteria, advisories, guidelines, or proposed standards. They are generally not enforceable and do not have the status of potential ARARs, but are advisory.

ARARs are labeled as chemical-, location- or action-specific. Chemical-specific ARARs may be provided by federal drinking water standards, ambient air quality standards and waste disposal standards; Pennsylvania state groundwater, soil, surface water and watershed standards, and hazardous waste standards. Location-specific ARARs with potential application to the site include restrictions related to creeks and streams, endangered species and wildlife habitats, migratory birds, and floodplains. Action-specific ARARs applicable to the site include CWA effluent guidelines and standards, National Ambient Air Quality standards, federal and state standards for asbestos waste disposal, and state standards pertaining to air pollution related to construction activities.

2.2 Development of Preliminary Remedial Action Objectives

2.2.1 Preliminary Remedial Action Objectives

PRAOs are focused on source material (waste, soil and reservoir sediment) and site-related COCs. The PRAOs based on type of media are as follows:

- Waste/soil
    - Prevent inhalation of asbestos at concentrations posing an excess cancer risk of 1 x 10^{-4} (one in 10,000) in human receptors.

> **TASC Comment**
> The CAG may want to consider asking EPA if the PRAO can be set at a lower cancer risk level. An excess cancer risk of one in 10,000 is the highest cancer risk objective that EPA typically accepts without requiring remediation. EPA sometimes sets a site-specific cancer risk objective as low as an excess cancer risk of 1 x 10^{-6} (one in a million).

-
    - Prevent direct contact by ecological receptors to contaminated waste and soil containing ecological COC [asbestos, bis(2-ethyhexyl)phthalate, dioxins and furans, chromium, nickel, or zinc] concentrations above the respective PRGs.
- Reservoir sediment
    - Prevent direct exposure of ecological receptors to contaminated sediment with carbon disulfide concentrations above the ecological screening level of 4.1 μg/kg.
    - Minimize migration of asbestos from sediment to surface water to prevent surface water asbestos concentrations above the screening level considered protective of ecological receptors.

> **TASC Comment**
> The CAG may want to ask EPA if the protective measure for ecological receptors also adequately protects people swimming and fishing in surface waters.
>
> The CAG may want to ask EPA for advice in taking further action to prevent exposure to surface waters affected by off-site contaminants that are not being addressed by the BoRit Asbestos Superfund Site cleanup. Is signage needed to alert swimmers and fishers of potential risks from contaminants in surface waters and sediments, even though the contaminants are not site-related? Is this an issue that should be brought to the attention of the state or local authorities?

2.2.2 Remediation Zones

Four remediation zones were defined for the site by considering the extent of contamination, parcel boundaries, EPA removal activities, and PRAOs:

- Stream banks
- Park
- Asbestos pile
- Reservoir (berm and bottom subzones)

2.2.3 Estimated Quantity of Contaminated Soil, Waste and Sediment

The quantity of contaminated soil (considering all historical fill and bulk ACM on the surface or within fill) that poses a potential risk to human and/or ecological receptors is about 64,000 cubic yards. This estimate is based on observations of historical fill. The quantity of waste (considered to be ACM) is about 362,000 cubic yards. This estimate is based on observations of waste in soil borings completed during the RI. The quantity of native soil with residual contamination is about 37,400 cubic yards (estimated assuming a one-foot area of potentially-impacted native soil below the greatest depth of historical fill). The quantity of contaminated sediment is about 126,900 cubic yards.

2.3 Preliminary Remediation Goals

PRGs for all contaminated site media are shown in Table 2.3 of the FS, and Tables 1 and 2 below.

2.3.1 Preliminary Remediation Goals (PRGs) for Waste/Soil

Table 2-3 in the FS Report and Table 1 below provide PRGs for waste/soil at the site. The COCs are asbestos in soil and waste (based on asbestos in air during ABS) and bis(2-ethylhexyl)phthalate, dioxins/furans, chromium, nickel and zinc in soil. Soil contaminated with asbestos poses risks to human health and ecological receptors. The representative human health PRG for asbestos in soil is a site-specific value calculated by EPA for asbestos in air during ABS. The ecological PRG for asbestos in air is based on the no observed adverse effect level (NOAEL) toxicity reference value (TRV) for inhalation. Remediation of waste and soil will be assessed by achievement of the PRGs for asbestos. Soil contaminated with bis(2-ethylhexyl)phthalate, dioxins/furans, chromium, nickel and zinc pose a risk to ecological receptors. Ecological PRGs are based on either ecological screening levels or maximum background concentrations.

Table 1. Target Media, COCs and Preliminary Remediation Goals – Waste, Soil

Waste/Soil				
COC	Soil	Air (ABS)	Air (Ambient)	Basis
Asbestos	--	0.04 f/cc (ABS)(PCME)	0.001 f/cc (PCME)	Human Health Protection
Asbestos	--	--	25 WHO f/cc	Ecological Protection; NOAEL TRV
Bis(2-ethylhexyl)phthalate	925 µg/kg	--	--	Ecological Protection; ESL
Dioxins/Furans	0.199 ng/kg	--	--	Ecological Protection; ESL
Chromium	26 mg/kg	--	--	Ecological Protection; ESL
Nickel	38 mg/kg	--	--	Ecological Protection; ESL
Zinc	104 mg/kg	--	--	Ecological Protection; ESL
Notes: ABS = activity-based sampling ESL = ecological screening level MFL = million fibers per liter				

NOAEL = no observed adverse effect level PCME = phase contrast microscopy equivalent TRV = toxicity reference value µg/kg = micrograms per liter f/cc = fibers per cubic centimeter mg/kg = milligrams per kilogram ng/kg = nanograms per kilogram

2.3.2 Preliminary Remediation Goals for Reservoir Sediment

Table 2-3 in the FS Report and Table 2 below provide the PRGs for reservoir sediment. The COCs for sediment are asbestos in air and surface water and carbon disulfide in sediment. The PRG for asbestos in air is based on risk to human health and only applicable if the reservoir is dry and sediment is exposed. The PRGs for asbestos in surface water and carbon disulfide in sediment are based on risk to ecological receptors.

Table 2. Target Media, COCs and Preliminary Remediation Goals – Reservoir Sediment

Reservoir Sediment					
COC	Sediment	Air (ABS)	Air (Ambient)	Surface Water	Basis
Asbestos	--	0.04 f/cc (ABS)	0.001 f/cc	--	Human Health Protection (if reservoir is dry and sediment exposed)
Asbestos	--	--	--	0.0001 MFL	Ecological Protection; ESL
Carbon Disulfide	4.1 µg/kg	--	--	--	Ecological Protection; ESL
Notes: ABS = activity-based sampling ESL = ecological screening level MFL = million fibers per liter NOAEL = no observed adverse effect level PCME = phase contrast microscopy equivalent TRV = toxicity reference value µg/kg = micrograms per liter f/cc = fibers per cubic centimeter mg/kg = milligrams per kilogram ng/kg = nanograms per kilogram					

2.4 General Response Actions

General response actions (GRAs) are initial broad remedial actions that may satisfy PRAOs and represent the range of remedial actions available for the site. The GRAs provided in the FS include the following:

1. No Action
2. Institutional/Engineered Controls
3. Monitoring
4. Monitored Natural Attenuation/Monitored Natural Recovery
5. Containment
6. Removal
7. Treatment
8. Disposal

2.5 Identification of Remedial Technologies and Process Options

In order to address the source material, remedial technologies were mainly evaluated based on the suitability for asbestos and other site-related contaminants in waste/soil and sediments. Table 2-4 in the FS Report presents the viable remedial technologies and associated process options that were identified for the contaminated materials on the site.

2.6 Screening of Remedial Technologies and Process Options for Technical Impracticability

EPA evaluated several technologies and process options within each GRA based on technical implementability. EPA screened out all process options that were not technically implementable and kept all process options that were technically implementable within each GRA. Those that were eliminated are shown using gray shading in Table 2-4 in the FS Report. Monitored Natural Attenuation/Monitored Natural Recovery was eliminated, as well as a few technologies within other GRAs.

2.7 Evaluation of Remedial Technologies and Process Options for Effectiveness, Implementability, and Relative Cost

The technology screening approach is based on procedures outlined in EPA's 1988 *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*. The criteria used are effectiveness, implementability and relative cost. The effectiveness criterion outweighs the implementability and relative cost criteria. The technologies and process options that were kept based on this screening evaluation are listed below. Combinations of these technologies and process options are used to build the reasonable alternatives that are required by the National Contingency Plan (NCP).

1. No action
2. Institutional Controls/Engineered Controls
    a. Proprietary controls (easements or covenants)
    b. Governmental controls (zoning, building codes, groundwater use regulations and fishing bans)
    c. Enforcement and permit tools (legal tools such as administrative codes)
    d. Informational devices (recorded notices in property records or advisories)
3. Inspection and Monitoring
    a. Sampling and analysis
    b. Site inspection
4. Containment
    a. Containment structure
    b. In-situ capping
5. Removal
    a. Excavation
    b. Dredging
    c. Dewatering
    d. Handling and transport
6. Treatment
    a. In situ joule heating vitrification – Contamination would be treated in place with electrodes inserted in boreholes. The electrical current would cause the

contaminated material to melt. The resulting product is inert and not fibrous like asbestos.

   b. Ex situ plasma arc vitrification – Contaminated media would be excavated and treated in a plasma arc furnace, causing the media to melt. The resulting product is inert and not fibrous.
   c. Ex situ thermo-chemical treatment – Contaminated media would be excavated and treated using thermochemical conversion. The resulting reaction product would be rock-like and inert.

7. Disposal
   a. On site in an engineered cell that would be covered or capped.
   b. Off site at a facility permitted for the specific waste type.

Section 3: Development and Screening of Remedial Action Alternatives

This section presents the remedial alternatives developed for the site and compares them to the criteria of effectiveness, implementability and cost.

3.1 Remedial Alternative Development

The potentially applicable remedial technologies selected after the initial screening have been combined into seven waste, soil and reservoir sediment (WSS) alternatives, which will be compared to the criteria of effectiveness, implementability and cost. The WSS alternatives are:

- WSS1 – No Action
- WSS2 – Capping
- WSS3 – Excavation and Off-site Disposal
- WSS4 – In Situ (in place) Joule Heating (heating with electrodes)
- WSS5 – Excavation, On-site Ex Situ (removed or not in place) Plasma Arc Furnace, and On-site Disposal
- WSS6 – Excavation, On-site Ex Situ Thermochemical Conversion Technology (TCCT), and On-site Disposal
- WSS7 – Excavation, Off-site Ex Situ TCCT, and Off-site Disposal

3.2 Description and Screening of Waste, Soil, and Reservoir Sediment Remedial Alternatives

The retained technologies and process options were combined to develop remedial action alternatives, which are summarized below.

<u>3.2.1 Common Elements</u>

With the exception of WSS1 – No Action, confirmation sampling will be conducted for each alternative. Confirmation sampling would be used to assess the effectiveness of the completed remedial action. Cost estimates assumed that confirmation sampling activities may include conducting ABS, surface soil sampling, ambient air monitoring, and surface water sampling, when applicable. It was also assumed that ABS sampling would be limited to one activity (e.g., hiking) and include collection of both soil samples and air samples in locations where high detections of asbestos were previously detected. Ambient air monitoring would be conducted in the same locations sampled during the RI.

Five-Year Reviews (FYRs) are included as common elements across all alternatives in order to determine if the selected remedy is protective of human health and the environment.

3.2.2 Alternative WSS1: No Action

The No Action Alternative is used as a baseline for comparison with other alternatives. The baseline conditions evaluated are those that were present at the site prior to initiation of EPA Removal Program work on the site. Superfund law requires this alternative to be considered.

Implementability is easy and cost is minimal for the No Action Alternative, but it would not decrease Toxicity/Mobility/Volume (T/M/V) of on-site contaminants or protect human or ecological health. Alternative WSS1 would not meet chemical-specific ARARs.

3.2.3 Alternative WSS2: Capping

Alternative WSS2 would include and complete the EPA Removal Program work started in 2008. It includes capping waste, soil and sediment with clean natural material. It also includes health and safety controls, erosion controls and re-grading. Parts of this alternative have already been completed, such as creek bank stabilization, cover installation at asbestos pile, dewatering and treatment of reservoir surface water, and covering reservoir bottom. Parts not complete yet include the cover at the park, refilling the reservoir, implementation of institutional controls, confirmation sampling, long-term monitoring, O&M and FYRs.

Alternative WSS2 would not change the concentrations of contaminants, but would address the main exposure routes and reduce the potential exposure to human and ecological receptors. The alternative is easily implemented and the costs are low compared to the other screened technologies. Alternative WSS2 will be retained for further evaluation.

3.2.4 Alternative WSS3: Excavation and Off-site Disposal

Alternative WSS3 includes the following major components:

- Removing and stockpiling of soil covers and other contaminated material (contaminated waste and reservoir sediment) installed by EPA Removal Program for reuse.
- Dewatering reservoir.
- Excavating contaminated material for off-site disposal from stream banks, asbestos pile, park and reservoir.
- Backfilling excavated areas with imported fill and stockpiled material.
- Refilling of reservoir.
- Monitoring and confirmation sampling.
- One FYR.

Alternative WSS3 would not change the concentration of contaminants but would move contaminated material to an off-site facility, removing risk to human and ecological receptors at the site. A large volume of material would be transported from (waste) and to (clean fill) the site; related truck traffic would impact the local community. Excavated waste would have to be disposed of in a facility permitted for asbestos and capacity of such a facility may be limited. Excavation of material would cause a short-term risk to workers. Due to the effectiveness of Alternative WSS3, it will be retained for further consideration.

3.2.5 Alternative WSS4: In Situ Joule Heating

Alternative WSS4 includes the following major components:

- Cover and linings previously installed by EPA would remain.
- Dewatering of reservoir.
- In situ joule heating of contaminated material at the stream banks, asbestos pile, park and reservoir.
- Backfilling of excavated areas with imported fill and stockpiled material.
- Refilling of reservoir.
- Confirmation sampling.
- One FYR.

Alternative WSS4 would physically transform ACM to an inert material, which would significantly and permanently reduce the T/M/V of contaminants. Contaminated material would be treated in place, minimizing exposure risks to workers and human and ecological receptors. Due to limited suppliers, treatment equipment and experienced workers are not readily available; coordination with local agencies would be necessary. Alternative WSS4 will be retained based on effectiveness.

3.2.6 Alternative WSS5: Excavation, On-site Ex Situ Plasma Arc Furnace, and On-site Disposal

Alternative WSS5 would include the same components as Alternative WSS3, but excavated material would be treated in an on-site ex situ plasma arc furnace unit and then used to backfill excavated areas.

This alternative would significantly and permanently reduce the T/M/V of contaminants. However, significant time would be needed to complete it due to limited unit availability, lack of commercial use and limited treatment capacity. Alternative WSS5 was not retained for further evaluation.

3.2.7 Alternative WSS6: Excavation, On-site Ex Situ TCCT, and On-site Disposal

Alternative WSS6 would include the same components as Alternative WSS5, but contaminated material would be treated in an on-site ex situ thermo-chemical conversion treatment unit.

Alternative WSS6 would require excavating a large quantity of waste, posing a short-term risk to workers and the community. However, the treatment offers permanent reduction of contaminants. TCCT is a proprietary process and equipment and personnel are limited, but it was retained for further evaluation based on effectiveness.

3.2.8 Alternative WSS7: Excavation, Off-site Ex Situ TCCT, and Off-site Disposal

Alternative WSS7 would include the same components as Alternative WSS6, but contaminated material would be transported off site to a TCCT treatment facility and disposed of in an off-site disposal facility.

The treatment facility is in Tacoma, Washington. The travel distance from the site to the treatment facility results in higher costs than any other alternative. Excavation and transportation would also increase short-term risks to the community. Therefore, Alternative WSS7 was not retained.

3.3 Proposed List of Alternatives Retained for Detailed Analysis
The proposed list of the retained alternatives include:

- WSS1 – No Action
- WSS2 – Capping
- WSS3 – Excavation and Off-site Disposal
- WSS4 – In Situ Joule Heating
- WSS6 – Excavation, On-Site Ex Situ TCCT, and On-site Disposal (Re-named WSS5 in Section 4)

EPA's nine evaluation criteria address statutory requirements and considerations for remedial actions in accordance with the NCP and additional technical and policy considerations.

1. Overall protection of human health and the environment
2. Compliance with ARARs
3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility or volume through treatment
5. Short-term effectiveness
6. Implementability
7. Cost
8. State (support agency) acceptance
9. Community acceptance

Also, the FS evaluates the potential for green remediation for all the alternatives. State and community acceptance are not assessed until after comments are submitted, and therefore are not considered in the FS evaluation.

Section 4: Detailed Analysis of Retained Alternatives

Section 4 of the FS Report presents the remedial alternatives retained after preliminary screening and evaluates them using the nine evaluation criteria.

4.1 Definition of Criteria Used in the Detailed Analysis of Retained Alternatives
Section 4.1 provides a detailed description of the nine evaluation criteria presented in Section 3.3 of the FS.

4.2 Detailed Analysis of Retained Alternatives
Section 4.2 analyzes the site's remedial alternatives using seven of EPA's nine criteria (all but state and community acceptance). Table 4-5 in the FS Report and Table 3 below provide a summary of the findings.

Table 3. Summary of Detailed Analysis for Retained Alternatives

Criteria	WSS1	WSS2	WSS3	WSS4	WSS5
	No Action	**Capping**	**Excavation and Off-site Disposal**	**In Situ Joule Heating**	**Excavation, On-site Ex Situ TCCT, and On-site Disposal**
Overall Protection of Human Health and the Environment	No	Yes	Yes	Yes	Yes
Compliance with ARARs	No	Yes	Yes	Yes	Yes
Long-Term Effectiveness	**0**	**4**	**5**	**4**	**5**
Reduction of Toxicity, Mobility, or Volume through Treatment	**0**	**0**	**0**	**4**	**5**
Short-Term Effectiveness	**0**	**4**	**2**	**3**	**2**
Implementability	**5**	**4**	**2**	**1**	**1**
Cost	**$**	**$$$**	**$$$$$$**	**$$$$$$**	**$$$$$$**

Notes:
TCCT = Thermal-chemical conversion technology
ARAR = applicable or relevant and appropriate requirements

Balancing Criteria (excluding cost):
0 = None
1 = Low
2 = Low to Moderate
3 = Moderate
4 = Moderate to High
5 = High

Balancing Criteria (Cost)
$ = Low
$$ = Low to Moderate
$$$ = Moderate
$$$$ = Moderate to High
$$$$$ = High
$$$$$$ = Very High

4.3 Comparative Analysis of Retained Alternatives

Section 4.3 provides a qualitative comparison of the five remedial alternatives using the seven EPA evaluation criteria discussed above. Table 4-5 of the FS Report and Table 3 above summarize this evaluation.

Section 5: Summary

The summary section of the FS Report presents the key components of the FS process that were used to identify and evaluate viable remedial alternatives to address site contamination. This section also concludes that, except for Alternative WSS1 (No Action), all of the retained alternatives could achieve the threshold evaluation criteria. However, the comparative analysis of the alternatives was based on pre-Removal Program work (baseline) conditions. EPA Removal Program work at the site is anticipated to be complete by September 2016, meaning the selected remedy will be implemented under conditions very different than those assumed in the FS. Except for Alternative WSS1 (No Action) and WSS2 (Capping), implementation of the retained alternatives would undo the work completed by the EPA Removal Program.

After the FS is finalized, EPA will present the preferred alternative for the site to the public in a Proposed Plan, which will summarize the Remedial Investigation/Feasibility Study (RI/FS), the alternatives, and the key factors that led to identifying EPA’s Preferred Alternative. The

Proposed Plan will allow the Commonwealth of Pennsylvania (through the Pennsylvania Department of Environmental Protection) and the community to provide comment on EPA's Preferred Alternative.

Section 6: References

This section lists the documents used as references in developing the FS Report.

C. REVIEW BY ASBESTOS REMEDIATION PROFESSIONALS

Skeo Solutions subcontracted with two environmental consulting firms with experience in asbestos remediation to review the RI/FS and provide their opinions on the FS report. Skeo asked the reviewers to answer these questions:

- Did EPA consider all reasonable solutions for cleaning up the site? If not, what technology or cleanup method do you suggest they also consider?
- Which cleanup alternative do you recommend as the best solution? Why?
- If WSS2 – Capping is chosen as the preferred alternative, will it provide long-term protection of groundwater and air if it is properly maintained? Do you see any serious problems with the capping alternative?

Reviewers
Michael Longman, VertaseFLI Limited (FLI), and Alexis Fricke and Susan Borden, LT Environmental (LTE) reviewed the RI/FS.

Mr. Longman has over 20 years of experience within quarrying, waste management, and contaminated land assessment and remediation in the United Kingdom (UK). Mr. Longman's experience includes remediation of asbestos-contaminated soils on military bases and fuel storage facilities; remediation of landfills, including excavating, processing and treating landfill wastes; and designing and managing projects to classify waste soils and demolition materials contaminated with loose asbestos fibers.

Ms. Fricke has 37 years of experience in interpretation and implementation of environmental regulations. Ms. Fricke's experience includes managing a refinery reclamation project that included asbestos-impacted soil. She has also developed materials management plans for ACM removal along light rail lines. Ms. Fricke participated in the stakeholder process for drafting revised asbestos in soil regulations for Colorado. She has developed asbestos management guides and standards for controlling asbestos exposures and air monitoring for several international corporations.

Ms. Borden has 30 years of experience as a professional geologist, with significant experience in asbestos-containing solid waste remediation efforts. Ms. Borden was an active participant in rewriting the Colorado Department of Public Health and Environment regulations pertaining to solid waste sites and facilities related to asbestos-contaminated soil management. In 2014 and 2015, Ms. Borden oversaw the removal of 47,000-cubic yards of regulated asbestos contaminated soil at a redevelopment project. She was the senior project manager for asbestos contaminated soil remediation efforts on the former Lowry Air Force Base in Denver, Colorado.

Summary of Review Comments

Did EPA consider all reasonable solutions for cleaning up the site?
The reviewers indicated that EPA considered all reasonable solutions for cleaning up the BoRit Asbestos Superfund site. None of the reviewers identified a technology or method that had not been considered by EPA.

Mr. Longman said that the process of developing and screening remedial action alternatives was comprehensive and robust. The detailed analysis of retained alternatives also fully considered the social-economic, technical appropriateness, deliverability and costs of the selected options. He also said that he agrees with the retained alternatives, though experience with WSS4, WSS5, WSS6 and WSS7 is minimal or non-existent in the UK.

The LTE reviewers, Ms. Borden and Ms. Fricke, said the seven remedial alternatives initially identified encompass all reasonable technologies, including some that are experimental. Because of the unique properties of asbestos, technologies applicable to other contaminants are not effective for asbestos and alternatives for asbestos are generally limited to isolation.

Which cleanup alternative do you recommend as the best solution?
The reviewers identified WSS2 – Capping as the best remedy for the site.

Mr. Longman said that he believes the re-engineering, re-profiling and capping of wastes in-situ together with localized collection and off-site disposal, to be the most appropriate methodology. His rationale is summarized below:

- In the UK, a site of this nature would have a similar human health and ecological risk assessment, followed by a remediation options appraisal. Such risk assessments would demonstrate that a risk exists at this site and that remedial action is required (i.e., doing nothing would not be acceptable).
- The remediation options would be on-site encapsulation with post remediation controls, full excavation and off-site disposal to a licensed landfill, or a combination of the two.
- The key risks from this site are release of respirable asbestos fibers into the atmosphere, which would pose a risk to site workers and immediate site neighbors. Even with appropriate controls, excavation, loading and transportation of asbestos wastes away from the site could lead to unacceptable risks.
- Beyond these risks from mass excavation and export, there could be significant impact to the local community from truck traffic. Such large movements of materials would also represent the least environmentally sustainable approach, resulting in a large carbon impact.
- The cost of mass excavation and disposal followed by import of replacement materials would be very expensive and take a long time.
- Re-profiling, re-engineering and on-site encapsulation is the most appropriate methodology to achieve the remediation objectives. Post-remediation monitoring and controls would be necessary to make sure the remedy is not damaged by future activities or extreme weather.

- Re-profiling, re-engineering and on-site encapsulation would cause much less disturbance of asbestos wastes than mass excavation. With appropriate controls, on-site encapsulation would pose minimal short-term risks.
- Re-profiling, re-engineering and on-site encapsulation is a tried and tested method. Significant and widespread experience is available, which is likely to result in a higher quality end product and less variance from anticipated budgets.

The LTE reviewers based their opinion on 1) the data provided, 2) an evaluation of the literature for asbestos toxicity and movement in the environment, and 3) an evaluation of regulations and technologies for asbestos management. They found that the FS is adequate in its identification of remedial alternatives and in its recommendation of capping as the preferred alternative. Their rationale is summarized below:

- The preferred alternative WSS2 – Capping provides containment of the park, asbestos pile, reservoir bottom, and reservoir berm via capping. In addition, streambed stabilization conducted during the Removal Program provides containment of asbestos in stream banks and bottom sediment. The advantage of WSS2 is that most of the remediation work is finished. Due to elimination of the exposure pathway from capping and stream armor, asbestos exposures have been mitigated. Continued asbestos exposure mitigation relies on maintenance of the cap and stream armor.
- The excavation and off-site disposal alternative, WSS3, would negate the Removal Action work accomplished to date. More importantly, it would result in extensive soil disturbance and potential additional exposures during excavation and transport. The final off-site landfill design would be similar to the cap already in place at the site; in effect, the asbestos would just be moved from one area to another, with the same end result in an alternate location.
- The other two alternatives, WSS4 and WSS5, also would require disturbance of ACM that is already contained, potentially resulting in additional exposures. In addition, as stated in the FS, this technology is unproven at a large scale and finding vendors to provide the treatment technology makes the implementability of these alternatives questionable.

If WSS2 – Capping is chosen as the preferred alternative, will it provide long term protection of groundwater and air if it is properly maintained?
The reviewers indicated that WSS2 – Capping would provide long-term protection of groundwater and air if appropriate institutional and engineered controls are in place and long-term maintenance is conducted.

Mr. Longman indicated that WSS2 – Capping will provide long-term protection of groundwater and air if post works monitoring and controls are equally robust and comprehensive (i.e., institutional controls and engineered controls are maintained). He made several points about maintaining institutional and engineering controls and ensuring the structural integrity of the cap. These are summarized below:

- Institutional and engineering controls for all capped areas are very important to prevent future exposure of underlying asbestos wastes.
    - The greatest risks to the cap are likely storm damage and excavation activities.
    - Because it is a raised landform, the asbestos pile parcel may be at a slightly higher risk for erosion than other capped areas.
    - A gradient of 3:1 for the asbestos pile parcel is much better than was previously present. If not already considered, we suggest that cap design calculations consider the heterogeneous nature of the waste in the pile, perched groundwater bodies in the pile, perimeter engineering works, and the effects of exceptional weather (e.g., large mass of snow adding to the loading on the slopes).
    - We suggest that the geotextile placed at the base of the cap should be strong enough to deter borrowing animals.
    - The 1 percent screening value for soils is not a risk-based screening value; risks from remediation activities, ABS, and intentional or accidental exposure of asbestos wastes in the future may be underestimated. For example, the PRG for air was exceeded even when soils were below the 1 percent screening value for asbestos and soil moisture contents were high. Therefore, maintenance of the capped areas is important to reduce human health risk.
- High moisture content in soils can significantly inhibit the release of asbestos fibers into the air. If not already done, it might be appropriate to do ABS when soil moisture contents are considerably lower than 30 percent to replicate the worst-case scenario for activities that may take place on this site in the future. [*Appendix I of the Remedial Investigation Report reports measured soil moisture values of 5.3 to 24.1 percent for ABS activities.*]

The LTE reviewers also pointed out that long-term control of asbestos exposure depends on continued maintenance of the cap and stream armor, but they did not discuss specific maintenance issues.

The LTE reviewers agreed with Mr. Longman that the 1 percent screening value for asbestos in soil and waste is not a risk-based value. Their research found studies that have shown that soil with less than 1 percent asbestos can release sufficient asbestos fibers to air to present a risk to human health.

The LTE reviewers said that they would not expect off-site groundwater to be impacted by asbestos. Although the exposure pathway of primary concern for humans is inhalation, some studies in animals suggest that ingestion of asbestos fibers can result in gastrointestinal effects.

Concentrations of asbestos in groundwater were measured at six monitoring wells across the site. None of the groundwater samples from the monitoring wells exhibited asbestos concentrations in excess of the EPA MCL. These results suggest that more distant water wells would not be impacted by asbestos at concentrations above the EPA MCL.

TASC Comments

As pointed out by the asbestos remediation professionals, we believe WSS2 – Capping is the most appropriate remedy for this site. The following suggestions are not intended to undermine the appropriateness of capping, but they do emphasize the importance of comprehensive, robust and strictly-enforced engineered and institutional controls, which are yet to be set.

- The CAG may want to ask EPA for assurance that the geotextiles used beneath the cap are of sufficient strength to discourage burrowing animals.
- The CAG may want to ask EPA for more information about the design of the slope and EPA's confidence in the slope stability in the asbestos pile parcel.
- The CAG may want to ask EPA to consider whether additional ABS under low soil moisture conditions may be warranted for any asbestos-containing areas left uncovered on site or off site, even if the amount of asbestos in soil is less than 1 percent.

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