Superfund Program
Proposed Plan

U.S. Environmental Protection Agency
Region 2

American Cyanamid Superfund Site

Township of Bridgewater, New Jersey

May 2018

EPA ANNOUNCES PROPOSED PLAN

This Proposed Plan identifies the preferred alternative for addressing Impoundments 1 and 2, also referred to as Operable Unit 8 (OU8), at the American Cyanamid Superfund site and provides the rationale for the preference.

The site is being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, also known as the Superfund law) in large part because of the type of waste and number of waste impoundments (disposal areas) that are present. OU8 includes acid tars that are considered Principal Threat Wastes (PTW), defined later in this plan, and the soil and clay impacted by the acid tars. OU8 is the last operable unit remaining at American Cyanamid. The U.S. Environmental Protection Agency's (EPA's) preferred alternative to address the acid tars and associated impacted materials made up of mainly volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) is Alternative 6, Excavation, Dewatering, Treatment/Destruction Off Site, Protective Cover.

EPA, the lead agency, in consultation with the New Jersey Department of Environmental Protection (NJDEP), the support agency, is issuing this Proposed Plan as part of its community relations program under Section 117(a) of CERCLA and Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This Proposed Plan summarizes information that can be found in greater detail in the Focused Feasibility Study (FFS). This and other documents are part of the publicly available administrative record file and are located in the information repository for the site. EPA encourages the public to review these documents to gain a more comprehensive understanding of the site and the Superfund activities that have been conducted.

EPA, in consultation with NJDEP, will select the remedy for OU8 after reviewing and considering all information submitted during a 30-day public comment period. EPA, in consultation with NJDEP, may modify the preferred alternative or select another response action presented in this Proposed Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all the information presented in this Proposed Plan.

SCOPE AND ROLE OF ACTION

As with many Superfund sites, the contamination at this site is complex, and the cleanup is being managed through several operable units, or OUs. Additional information regarding OUs 1 through 7 is provided in the

MARK YOUR CALENDAR

PUBLIC COMMENT PERIOD:
May 29, 2018– June 28, 2018
EPA will accept written comments on the Proposed Plan during the public comment period. Written comments should be addressed to:

Mark Austin
Remedial Project Manager
U.S. Environmental Protection Agency
290 Broadway, 19th Floor
New York, NY 10007
Email: austin.mark@epa.gov

PUBLIC MEETING:
June 12, 2018
6:00 P.M. Information Session, 7:00 P.M. Formal Meeting
EPA will hold a public meeting to explain the Proposed Plan and all of the alternatives presented in the Focused Feasibility Study. Oral and written comments will also be accepted at the meeting. The meeting will be held at:

Bridgewater Township Municipal Building
100 Commons Way
Bridgewater, New Jersey 08807

In addition, documents from the administrative record are available on-line at:
https://www.epa.gov/superfund/american-cyanamid

Site History section, below. This Proposed Plan addresses the final planned OU for the site, OU8. OU8 is comprised of Impoundments 1 and 2, each approximately 2 acres in size and ranging from 13 to 16 feet in depth. Both have a synthetic sheeting cover and water cap to limit odors and provide protection during flooding. The media being addressed by OU8 include the impoundment material (acid tars) contained within the berms, and soil and clay impacted by OU8 impoundment material out to the toe of the berm and underlying the impoundments down to the groundwater table.

Groundwater beneath the impoundments and the area outside the toe of the berms of Impoundments 1 and 2 are considered part of the site-wide remedy, which is currently being implemented and is referred to as Operable Unit 4 (OU4).

SITE DESCRIPTION

The 435-acre site is located in the southeastern section of Bridgewater Township, Somerset County, in the north-central portion of New Jersey (Figure 1). Bridgewater Township has a population of approximately 45,000 people.

For ease of reference, the site is divided into five areas: North Area, South Area, West Area, East Area, and the Impound 8 Facility. The Impound 8 Facility is designated as a Corrective Action Management Unit (CAMU), addressed as part of a previous Group III 1998 Record of Decision (ROD), regulated under the Resource Conservation and Recovery Act (RCRA). Impoundments 1 and 2, the subjects of this Proposed Plan, are located in the South Area which is west of Interstate Highway 287 and between the Conrail rail line and the Raritan River (Figure 2).

The site was used for more than eight decades to manufacture a range of products including rubber-based chemicals, dyes, pigments, chemical intermediates, petroleum-based products, and pharmaceuticals. Previous investigations identified that several surface impoundments, which are constructed waste lagoons, the surrounding soil and the groundwater aquifers below the site have been contaminated with waste chemicals from previous manufacturing processes.

The surrounding land use is a mix of light industrial and residential. The nearest residences are approximately 1,800 feet away from OU8. Of note, the nearest local business is approximately 400 feet to the north of both the impoundments. To the immediate north of the American Cyanamid site, a minor league ballfield, a commuter train rail station and several commercial businesses are located on redeveloped land that was once part of the site. That portion of the site was deleted from the National Priorities List (NPL) in 1998, when no contamination was found in that area, thus allowing for redevelopment.

According to the Federal Emergency Management Agency, the entire site, with the exception of the CAMU located in the far northwest portion, lies within a Special Flood Hazard Area designated as Zone AE. Zone AE is a zone where the base flood elevations are established based on a 100-year flood event. Because of the proximity of the overall site to the Raritan River and frequency of flooding, a flood control dike was constructed around the entire North Area which housed the former Main Plant area. Over the past several years, the area has been subject to frequent, and sometimes intense flooding, such as from Hurricanes Irene (2011) and Floyd (1999).

SITE HISTORY

Site-Wide - The site has had several previous owners/operators since a chemical and dye manufacturing facility was built in 1915. The American Cyanamid Company purchased the facility in 1929 and expanded it into one of the nation’s largest dye and organic chemical plants. As production increased from the 1930s through the 1970s, buildings and support services were expanded to accommodate increased demands for the products. The manufacture of bulk pharmaceuticals continued throughout the 1990s, generating untreated waste material that was managed in on-site waste impoundments.

Preliminary investigations that were completed in 1981 verified that approximately one-half of the site was utilized to support manufacturing, waste storage, or waste disposal activities, and that contamination source areas were confined primarily to the north area; however, on-site waste storage impoundments were located throughout the site. Twenty-seven impoundments were constructed in all. Most of the wastes from past manufacturing operations were stored in these on-site surface impoundments, while general plant wastes, debris and other materials were primarily disposed of on the ground at various locations. On September 8, 1983, the American Cyanamid site was placed on the NPL.

Site impoundments were initially characterized through investigations conducted in the late 1980s and early 1990s. Sixteen of the 27 impoundments used for storing wastewater treatment residuals and manufacturing byproducts originating from production of rubber intermediates and products, organic dyes, and coal tar distillation were identified for remediation under CERCLA. The remaining 11 impoundments are regulated under RCRA and generally contain non-hazardous substances. Past waste storage and disposal practices, along with other releases typically associated with normal operations of a manufacturing facility with such a long, diverse history, resulted in on-site soil and groundwater impacts.

In 1988, the American Cyanamid Company agreed to perform a site-wide Feasibility Study (FS) and corrective actions for the 16 CERCLA impoundments. At that time, those 16 impoundments were organized into three groups according to impoundment contents, location, and potential remedial alternatives. A ROD followed for each of the three groups:

- Group I – Impoundments 11, 13, 19, and 24
- Group II – Impoundments 1, 2, 15, 16, 17, and 18
- Group III – Impoundments 3, 4, 5, 14, 20, and 26

Due to the toxicity of Impoundments 1 and 2, EPA subsequently decided to move them into Group III.

A ROD for the revised listing of Group III Impoundments was issued in September 1998. However, a pilot test confirmed that the selected remedy for Impoundments 1 and 2 (low temperature thermal treatment and placement of material in the CAMU) was technically infeasible due to anticipated handling and air emission issues during the treatment phase of remedy implementation and could not be performed as originally determined. This finding resulted in the suspension of some remediation activities for the Group III Impoundments. However, Impoundments 5 (dry portion), 14, 20, and 26 have since been remediated and placed in the CAMU.

The remaining Group III Impoundments (1, 2, 3, 4, and 5 (wet portion)) presented significant technical challenges based on their physical setting and complex characteristics. In 2004, American Cyanamid, NJDEP, and EPA recognized the complexity of these impoundments and agreed that a comprehensive site-wide FS should be completed to re-evaluate remedial alternatives. In mid-2009, due to the complexity of the contaminants present in the acid tar waste within Impoundments 1 and 2, EPA moved the remedial evaluation of Impoundments 1 and 2 into a separate FFS, and continued with preparation of a site-wide FS for the remainder of the site (OU4).

Under the revised approach, six impoundments (3, 4, 5, 13, 17, and 24) were grouped into OU4 along with all site-wide contaminated soil and groundwater. The site-wide FS was completed and led to the final OU4 ROD issued on September 27, 2012. The remediation of OU4 is now underway.

Impoundments 1 and 2 - The location of Impoundments 1 and 2 within the Raritan River floodplain, along with the acidic, high volatile compound content and complex nature of the material, make addressing Impoundments 1 and 2 very different from the other materials elsewhere at the site.

Between 1947 and 1965, the American Cyanamid facility produced, among other things, benzene, toluene, naphthalene and xylene from coal light-oil refining. The residual byproduct of refining coal light oil was acid tar. The byproducts were managed and stored on site through the use of Impoundments 1 and 2.

Impoundment 1 was constructed in 1956 and used until 1965. The Impoundment encompasses approximately 2.1 acres and is approximately 15 feet deep from the top of the impoundment berm to its overall lowest extent, approximately 6 feet below the existing grade (Figure 3). This impoundment is constructed of sand, silt, and fine gravel and has a 1-foot layer of clay and silt placed at the bottom. The base of the clay layer is approximately 1 foot above the top of the water table in the overburden aquifer.

Impoundment 2 was constructed in 1947 and used until 1956. It is approximately 2.3 acres in size, is also approximately 15 feet deep from the top of the impoundment berms and it extends approximately 6 feet below the surrounding grade. Similar to Impoundment 1, the berms are constructed of sand, silt, and fine gravel, have a 1-foot layer of clay and silt at the bottom, and are located within approximately 1 foot above the top of the water table in the overburden aquifer.

Corrective action on groundwater discharges near Impoundments 1 and 2 - In late 2010, Wyeth Holdings Corporation, now known as Wyeth Holdings LLC (Wyeth Holdings) observed groundwater seeps on the banks of the Raritan River downgradient of Impoundments 1 and 2. Laboratory analysis of the seeps reported concentrations up to 20,000 parts per billion (ppb) of benzene. Soon thereafter, Wyeth Holdings implemented an interim plan consisting of the installation of activated carbon-filled sand bags along the river at the seep discharge points. Given the proximity of Impoundments 1 and 2 to the groundwater seeps, they are considered a likely source of the seeps.

Beginning in late 2011 and into 2012, a groundwater removal system was constructed to intercept and capture/prevent releases of groundwater originating from the site into the Raritan River. This system consists of an interim groundwater treatment facility, groundwater collection trench, and hydraulic barrier wall located downgradient of Impoundments 1 and 2. The system continues to operate today and monitoring efforts have indicated that the seeps have been successfully intercepted. The OU4 remedy includes plans to enhance the interceptor system and treatment facility.

ENFORCEMENT HISTORY

The American Cyanamid Company entered into Administrative Consent Orders (ACOs) with the NJDEP in 1982 and 1988 (amended in 1994) to investigate and remediate the site. In 1983, EPA listed the site on the NPL, and environmental remediation and restoration activities have been ongoing at the site since that time under CERCLA.

In December 1994, American Home Products Corporation purchased the American Cyanamid Company, and assumed full responsibility for environmental remediation as required under the NJDEP ACO for this site. In December 2002, American Home Products Corporation changed its name to Wyeth Corporation (Wyeth). In October 2009, Wyeth was purchased by Pfizer Inc., and became a wholly-owned subsidiary of Pfizer. Ownership of the site is held in the name of Wyeth Holdings, a wholly-owned subsidiary of Wyeth.

NJDEP was the lead agency for the site until March 2009, when EPA assumed the lead role.

On July 19, 2011, Wyeth Holdings entered an Administrative Settlement Agreement and Order on Consent with EPA requiring Wyeth Holdings to design and construct a removal system engineered to intercept and capture contaminated groundwater in the overburden and prevent it from seeping into the Raritan River. These activities have been completed and the system has been operating successfully to date.

Under a December 8, 2015 Consent Decree (CD) between EPA (in consultation with NJDEP) and Wyeth Holdings, the remediation of OU4 is now underway.

SITE GEOLOGY AND HYDROGEOLOGY

With regard to hydrogeological aspects, the site is underlain by a shallow overburden aquifer system and a deeper semi-confined bedrock aquifer system, including the area beneath Impoundments 1 and 2. The two aquifers are separated by a zone of weathered bedrock. *Overburden* - Overburden at the site consists of a combination of fabricated fill and Quaternary alluvial deposits exhibiting a fining upward sequence. The overburden aquifer consists of two water-bearing units – an unconfined surficial fabricated fill unit and an underlying confined-to-semi-confined sand and gravel zone. A low-permeability silt and clay unit generally separates the two units.

In the vicinity of Impoundments 1 and 2, groundwater is generally encountered at 6 to 7 feet below ground surface and flow is to the south toward the Raritan River.

Bedrock - The site is located in the Newark Basin section of New Jersey's Piedmont province and is underlain by the Passaic Formation. The Passaic Formation is a Late Triassic to Early Jurassic-age reddish-brown shale, siltstone, and mudstone with green and brown shale interbeds. Bedrock near the site strikes northeast-southwest and dips gently to the northwest.

Near Impoundments 1 and 2, bedrock is generally encountered at an elevation of approximately 15 feet below ground surface. Under natural conditions groundwater flow in the bedrock aquifer in the vicinity of Impoundments 1 and 2 is largely controlled by bedding planes and fracture systems.

Geologically, the site is situated in the New Jersey Piedmont geomorphologic province, which is an area of rolling, low-lying terrain interrupted only by the Watchung Mountains, about 1.5 miles to the north. Overall, the site is generally flat, with a natural slope and direction of approximately 2% to the south-southeast toward the Raritan River.

Surface geology - The natural soil of the site is a mixture of sand, silt, and clay (loam). Man-made fill/general solid wastes and disturbed soil and gravel also exist at ground surface in portions of the site.

Geology of unconsolidated deposits - The general area around the site is covered by naturally occurring unconsolidated sediment ranging in thickness from 5 to 30 feet. This sediment is either the weathering product (soil) of the underlying bedrock, or it is fluvial deposits related to the adjacent Raritan River.

Bedrock geology - The unconsolidated deposits are underlain by bedrock. This bedrock layer is part of the Passaic Formation, which consists of a series of reddish-brown shale, siltstone, and fine-grained sandstone units. The bedrock contains highly fractured zones which allow vertical groundwater flow. These bedrock fractures control the composition and distribution of the overlying water-bearing units and the groundwater flow regime in the overburden aquifer system.

SITE INVESTIGATION SUMMARY

Over the last 30 years, Impoundments 1 and 2 have been the subject of several comprehensive studies through multiple site investigations and treatability studies targeting the management, treatment, and potential remediation of the material within each impoundment. Historical samples collected prior to 2010 were generally obtained from areas along the impoundment berms and very little, if any, sampling occurred near the center of the impoundments.

The 2010 characterization effort represents the most thorough data set summarizing the chemical content of the impoundment materials. Previous investigations addressed material properties and considered the application of specific technologies. The sampling from those previous investigations, including pertinent parameters such as calorific value, sulfur content, moisture content, density, corrosion potential, flash point, etc. were also compiled to support evaluation of technologies and develop alternatives. A statistical summary of the most representative site characterization is presented in Table 1. Characterization is segregated by impoundment location and material type.

The current contents of the two impoundments are similar in that the materials are very acidic (average pH of 1.5 SU) with a solid to semi-solid consistency and contains VOCs (primarily benzene, toluene, and xylene) and SVOCs (primarily naphthalene). Malodorous sulfur compounds, including hydrogen sulfide, sulfur dioxide, mercaptans, and carbon disulfide, are also present in these materials.

NATURE AND EXTENT OF CONTAMINATION

The subject of this Proposed Plan, OU8, is comprised of the acid tar waste associated with Impoundments 1 and 2 only. The area of OU8 consists of impoundment media that include the impoundment berms out to the toe of the slope (where the end of the berm is located and the natural floodplain terrain begins), acid tar waste or "impoundment material" contained within the berms, the soil and clay impacted by OU8 impoundment material, and all material underlying the impoundments potentially down to the groundwater table. Groundwater beneath the impoundments and the area outside the toe of the berms of Impoundments 1 and 2 is being addressed as part of the site-wide remedy under OU4.

The 2010 investigation was designed to characterize each impoundment as a whole by collecting samples from a representative horizontal grid and multiple depth intervals within each impoundment. In total, 53 spatially distributed samples were collected from Impoundments 1 and 2 and analyzed for metals, VOCs and SVOCs Sample results confirmed the presence of VOCs, SVOCs, and metals. Benzene, toluene, and naphthalene were the predominant compounds encountered in samples collected from both impoundments and are considered the primary contaminants of concern (COCs).

In Impoundment 1 samples, these three compounds account for more than 83 percent of the COC mass. Other VOCs and SVOCs were detected in the Impoundment 1 samples; however, their individual contribution to total COC mass is considered less significant in comparison to benzene, toluene, and naphthalene. To streamline data presentation and future discussion of remedial alternatives going forward, summary sampling results of 25 samples obtained from the 2010 characterization effort were parsed to determine compounds that accounted for more than 0.2 percent of total COC mass detected in Impoundment 1 materials. In total, 20 compounds exceeding the 0.2 percent threshold (and accounting for 96.3 percent of the total COC mass) were identified in Impoundment 1 materials. All 20 organics are shown in Table 2.

Similar to Impoundment 1, benzene, toluene, and naphthalene are the primary COCs present in Impoundment 2 samples. Collectively, these three compounds account for nearly 70 percent of the total COC mass in samples analyzed. Summary results from 28 samples collected from Impoundment 2 in 2010 were parsed as previously described using an identical mass threshold (0.2 percent). The Impoundment 2 data evaluation returned 21 compounds exceeding the 0.2 percent threshold, which accounted for 96.7 percent of the total COC mass identified in Impoundment 2 materials. A selected summary of these organics detected in Impoundment 2 samples is shown in Table 3.

Comparison of Impoundment 1 and 2 sampling results summarized in Tables 2 and 3 indicate strong similarities with respect to chemical composition. In general, the mean concentrations of benzene, toluene, and naphthalene are consistent between Impoundments 1 and 2.

Although differences are noted in the speciation and concentration of organic compounds detected in the impoundment materials, the chemical composition of Impoundment 1 and Impoundment 2 materials is similar and of comparable concentration magnitude. As

WHAT IS A "PRINCIPAL THREAT"?

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP Section 300.430(a)(1)(iii)(A)). The "principal threat" concept is applied to the characterization of "source materials" at a Superfund Site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to ground water, surface water or air, or acts as a source for direct exposure. Contaminated ground water generally is not considered to be a source material; however, Non-Aqueous Phase Liquids (NAPLs) in ground water may be viewed as source material. 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. The decision to treat these wastes is made on a site-specific basis through a detailed analysis of the alternatives using the nine remedy selection criteria. This analysis provides a basis for making a statutory finding that the remedy employs treatment as a principal element.

previously identified, the three primary COCs are benzene, toluene, and naphthalene, with benzene concentrations often an order of magnitude higher. Benzene is typically found at concentrations near 60,000 parts per million (ppm), or 6 percent by mass. However, as noted in Tables 1 & 2, benzene levels have been found up to 207,000 ppm (Imp. 1) and 183,000 ppm (Imp. 2). The material in these two impoundments is very acidic, with an average pH of 1.5 standard units (SU) and as low as 0.56 SU.

Because benzene and toluene are similar in structure and physical properties, and because benzene is considered more toxic, it is often used as a surrogate when discussing VOC treatment. Alternatives assembled and evaluated are capable of addressing the range of VOCs and SVOCs detected in the impoundment materials. However, based on the proportion of benzene and naphthalene detected in the impoundment materials, the technical feasibility of the alternatives considered was dependent on each alternative's ability to effectively address these compounds. Furthermore, since benzene and naphthalene respectively represent the typical environmental behavior of VOCs and SVOCs subject to remediation, these compounds are considered representative of VOCs and SVOCs in discussions below regarding technology application and the overall feasibility and efficacy of assembled alternatives.

The location of the impoundments in the Raritan River floodplain, along with the acidity and complex nature of the materials, make addressing these impoundments technically challenging.

PRINCIPAL THREAT WASTE

Impoundment material, also referred to as acid tars, within Impoundments 1 and 2 meets the definition of Principal Threat Waste (PTW), presenting a significant risk to human health or the environment should exposure occur. Please refer to the text box entitled, "What is a Principal Threat" for more information on the principal threat concept, and the Summary of Site Risks Section for more information. The total volume of PTW is expected to be approximately 55,000 cubic yards, as described in Table 1. The PTW in Impoundments 1 and 2 acts as a likely source of benzene and other contaminants to groundwater, resulting in contamination of the groundwater aquifers beneath the site.

Notable constituents making up the PTW within both impoundments include: benzene, toluene and naphthalene. These contaminants were disposed and/or stored within Impoundments 1 and 2 in large quantities. All three chemicals also make up the primary COCs. PTW may also include soil and clay impacted by OU8 impoundment material (acid tar) and found within the berms and soil beneath the impoundments. PTW may also contain contaminants such as nitrobenzene and xylene.

SUMMARY OF SITE RISKS

A CERCLA response action is generally warranted if one or more of the following conditions is met:

- Cumulative excess carcinogenic risk to an individual exceeds 1×10^{-4}
- The non-carcinogenic hazard index is greater than one
- Site contaminants cause adverse environmental impacts
- Chemical-specific standards or other measures that define acceptable risk levels are exceeded (e.g., Federal Maximum Contaminant Levels or Ambient Water Quality Criteria)

Impoundments 1 and 2 contain PTW, which is a highly toxic and highly mobile source material that generally cannot be reliably contained and presents a significant risk to human health or the environment should exposure occur.

Baseline ecological and human health risk assessments were conducted for the area where Impoundments 1 and 2 are located to estimate the risks associated with exposure to contaminants based on current and likely future uses of the site. Relevant information associated with these risk assessments is summarized below.

Baseline Ecological Risk Assessment

Ecological risks assessments for the overall site are presented in the 1992 *Baseline Site-wide Endangerment Assessment* (BEA) (Blasland, Bouck, & Lee [BBL] 1992) and the 2005 *Baseline Ecological Risk Assessment* (BERA). These documents are available in the Administrative Record established for the OU4 ROD.

The BEA indicated that, with the exception of the great blue heron, the on-site habitat does not support threatened or endangered species. The most significant potential exposure pathway identified in the BEA involves aquatic biota exposure in the Raritan River. This pathway was subsequently addressed by installation of a groundwater collection trench and hydraulic barrier wall constructed downgradient of Impoundments 1 and 2 and upgradient of both Cuckel's Brook and the Raritan River.

Currently Impoundments 1 and 2 do not represent a viable habitat and therefore an ecological risk assessment was not included in the previous assessments. Further, since any remedy selected for OU8 will address the PTW in the impoundments down to the surrounding soil and clay, the potential for ecological risks due to exposure to the impoundment material will be eliminated.

Baseline Human Health Risk Assessment

Two human health risk assessments (HHRAs) have been completed for the site, and they are available in the administrative record file for OU8.

A 2006 HHRA evaluated exposure risks for the area surrounding Impoundments 1 and 2. The assessment evaluated potential risks to several receptors (i.e., patrol worker, site worker, adolescent trespasser, recreational visitor). It was concluded that site conditions in these areas do not represent an unacceptable risk to these receptors, either on or off the site. This assessment included evaluating air, soil, nearby Cuckold's Creek (aka Cuckel's Brook), and the Raritan River. Except for the unlikely scenario of a future resident using Cuckel's Brook for potable water, cancer risks for the exposure scenarios did not exceed the acceptable range of 10^{-4} to 10^{-6}.

The objective of a 2010 streamlined HHRA was to evaluate the potential cancer risks and non-cancer hazards associated with exposure to surface soil, groundwater and site impoundments. Since the current zoning of the site is industrial, the streamlined HHRA

WHAT IS RISK AND HOW IS IT CALCULATED?

A Superfund baseline human health risk assessment is an analysis of the potential adverse health effects caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these under current- and future-land uses. A four-step process is utilized for assessing site-related human health risks for reasonable maximum exposure scenarios.

Hazard Identification: In this step, the chemicals of potential concern (COPCs) at the site in various media (*i.e.*, soil, groundwater, surface water, and air) are identified based on such factors as toxicity, frequency of occurrence, and fate and transport of the contaminants in the environment, concentrations of the contaminants in specific media, mobility, persistence, and bioaccumulation.

Exposure Assessment: In this step, the different exposure pathways through which people might be exposed to the contaminants identified in the previous step are evaluated. Examples of exposure pathways include incidental ingestion of and dermal contact with contaminated soil and ingestion of and dermal contact with contaminated groundwater. Factors relating to the exposure assessment include, but are not limited to, the concentrations in specific media that people might be exposed to and the frequency and duration of that exposure. Using these factors, a "reasonable maximum exposure" scenario, which portrays the highest level of human exposure that could reasonably be expected to occur, is calculated.

Toxicity Assessment: In this step, the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure and severity of adverse effects are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other noncancer health hazards, such as changes in the normal functions of organs within the body (*e.g.,* changes in the effectiveness of the immune system). Some chemicals are capable of causing both cancer and noncancer health hazards.

Risk Characterization: This step summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site risks for all COPCs. Exposures are evaluated based on the potential risk of developing cancer and the potential for noncancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, a 10^{-4} cancer risk means a "one in ten thousand excess cancer risk;" or one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions identified in the Exposure Assessment. Current Superfund regulations for exposures identify the range for determining whether remedial action is necessary as an individual excess lifetime cancer risk of 10^{-4} to 10^{-6}, corresponding to a one in ten thousand to a one in a million excess cancer risk. For noncancer health effects, a "hazard index" (HI) is calculated. The key concept for a noncancer HI is that a "threshold" (measured as an HI of less than or equal to 1) exists below which noncancer health hazards are not expected to occur. The goal of protection is 10^{-6} for cancer risk and an HI of 1 for a noncancer health hazard. Chemicals that exceed a 10^{-4} cancer risk or an HI of 1 are typically those that will require remedial action at the site.

groundwater and site impoundments. Since the current zoning of the site is industrial, the streamlined HHRA evaluated site workers and trespassers exposed to surface soil and impoundments at the site. The groundwater is a designated potable water supply; therefore, the residential exposure to groundwater pathway was also evaluated. Groundwater is being addressed under OU4 and is not the subject of this Proposed Plan.

Industrial worker's exposure to surface soil and site impoundments, including Impoundments 1 and 2, was found to exceed the acceptable risk range of $1x10^{-4}$ to $1x10^{-6}$ and the non-cancer Hazard Index of 1, as shown in the table below. In order to determine the cancer risks and non-cancer hazards associated with exposure to impacted media, the maximum detected concentrations in each impoundment were compared to their respective human health risk-based screening levels. This ratio yielded a cancer risk or non-cancer hazard (whichever is the most sensitive endpoint) associated with each chemical. The surface soil risk-based screening levels are based on a worker's direct exposure (via ingestion, inhalation of particulates and dermal contact) while working at the site over a period of 25 years.

Summary of hazards and risks associated with impoundments 1 and 2

Receptor	Hazard Index	Cancer Risk
Industrial Worker (adult)		
Impoundment 1	**34**	**7×10^{-2}**
Impoundment 2	**7**	**1.1×10^{-2}**
The COCs driving the risk in impoundments 1 and 2 are benzene, toluene, xylene, naphthalene and nitrobenzene. It should be noted that the list of risk drivers in the impoundment areas is underestimated. Due to the high concentrations of several chemicals, the presence of other potential risk drivers is masked.		

It is the lead agency's current judgment that the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) provide a general description of what the remedial action is intended to accomplish. Development of the RAOs considered the understanding of the contaminants in Impoundments 1 and 2, and is based upon an evaluation of risk to human health and the environment and reasonably anticipated future use. A performance objective for the selected remedy is to make the associated floodplain areas available for the reasonably anticipated future use of limited passive recreational use, such as walking, wherever practicable within a timeframe that is reasonable given the characteristics of the site. The RAOs for OU8 have been developed to satisfy these expectations.

The following RAOs have been developed for OU8:

- Remove, treat, and/or contain material that is considered PTW.
- Prevent human exposure (direct contact) to COCs above cleanup levels in soil.
- Minimize or reduce current or future migration of COCs from Impoundments 1 and 2 to groundwater.

The footprint of OU8 is contained entirely within the footprint of OU4, which addresses site-wide soil and groundwater. OU8 includes all soil and clay material and PTW in Impoundments 1 and 2, to the outside toe of the berm surrounding them; it does not include groundwater. As such, there is no RAO specifically for groundwater since groundwater will be managed entirely as part of, and consistent with, the remedy selected in the 2012 ROD for OU4. The OU8 remedy will prevent or minimize future migration of COCs from the OU8 impoundments, including to groundwater, but if migration does occur, it will be addressed through the OU4 treatment processes. The OU4 remedy includes the use of hydraulic barrier walls and extraction wells to capture contaminant mass and maintain an inward gradient around the site, and these controls extend beyond the limits of OU8.

Preliminary Remediation Goals

Preliminary Remediation Goals (PRGs) are typically developed during the Remedial Investigation (RI)/FS process and are based on Applicable or Relevant and Appropriate Requirements (ARARs) and other readily available information, such as concentrations associated with 10^{-6} cancer risk or a hazard quotient equal to one for non-carcinogens calculated from EPA toxicity information. Initial PRGs may also be modified based on exposure, uncertainty, and technical feasibility factors. As data are gathered during the RI/FS, PRGs are refined into final contaminant-specific cleanup levels. Based on consideration of factors during the nine criteria analysis and using the PRG as a point of departure, the final cleanup level may reflect a different risk level within the acceptable risk range (10^{-4} to 10^{-6} for carcinogens) than the originally identified PRG.

To meet RAOs, EPA typically identifies PRGs to aid in defining the extent of contaminated media requiring remedial action. In this case, the PRGs for OU8 are identical to those selected in the 2012 ROD for OU4 that apply to the COCs for OU8. It should be noted that toluene and xylene were not COCs for OU4 because exposure to these chemicals did not result in an unacceptable risk for OU4, but they do present an unacceptable risk in Impoundments 1 and 2. Therefore, PRGs were calculated for these contaminants using the same methodology as was used to calculate PRGs for OU4. Similarly, 1,2-dichlorobenzene and n-nitrosodiphenylamine were COCs for OU4 but are not COCs for OU8, so PRGs for these contaminants are not included in this Proposed Plan. Each PRG that was developed for OU4 was reviewed to make sure it is still appropriate.

In summary, the vast majority of PTW in Impoundments 1 and 2 will be excavated and disposed of off-site. For any remaining soil and/or clay material impacted by the OU8 PTW, which includes the entire footprint of OU8 out to the outside toe of the berms, the following PRGs, consistent with the OU4 ROD, will be used to identify any remaining waste requiring treatment to meet RAOs:

Preliminary Remediation Goals
Material Impacted by Impoundment 1 and 2 Waste

COC	PRG (ppm)
Benzene	4,460
Nitrobenzene	12,300
Naphthalene	6,180
Toluene	460,000
Xylene	25,000

SUMMARY OF REMEDIAL ALTERNATIVES

Section 121(b)(1) of CERCLA, 42 U.S.C. § 9621(b)(1), mandates that remedial actions must be protective of human health and the environment, be cost-effective, and use permanent solutions and alternative treatment technologies and resource recovery alternatives to the maximum extent practicable. CERCLA § 121(d), 42 U.S.C. § 9621(d), further specifies that a remedial action must require a level or standard of control of the hazardous substances, pollutants, and contaminants that at least attains ARARs under federal and state laws, unless a waiver can be justified pursuant to CERCLA Section 121(d)(4), 42 U.S.C. § 9621(d)(4).

Remedial alternatives for OU8 are summarized below. Capital costs are those expenditures that are required to construct a remedial alternative. Operation and maintenance (O&M) costs are those post-construction costs necessary to ensure or verify the continued effectiveness of a remedial alternative and are estimated on an annual basis. Present worth is the amount of money which, if invested in the current year, would be sufficient to cover all the costs over time associated with a project, calculated using a discount rate of seven percent and a 30-year time interval. Construction time is the time required to construct and implement the alternative and does not include the time required to design the remedy, negotiate performance of the remedy with the responsible parties, or procure contracts for design and construction.

Remedial Alternatives	
Alternative	**Description**
1	No Action
2	Alternative 2 was screened out and was not considered further
3	In-situ Stabilization and Solidification (ISS) Treatment, Inner Hydraulic Barrier Wall (HBW), Protective Cover
4	Steam-Enhanced ISS Treatment, Inner HBW, Protective Cover
5	Steam-Enhanced ISS Treatment, Excavation and Placement in CAMU, Protective Cover
6	Excavation, Dewatering, Treatment/Destruction Off Site, Protective Cover

Common Elements

All of the remedial alternatives except Alternative 1 (No Action) address the PTW within the impoundments. To ensure OU8 does not have any remaining unacceptable risks to human health or the environment post-remedy completion, all alternatives would employ an engineered cap. In addition, all alternatives except for Alternative 1 would include long-term monitoring, institutional controls to prevent future residential land use over the 4-acre impoundment footprint, and further institutional controls consisting of restrictions on land use of capped floodplain soil. The degree of monitoring that would be required is different for each alternative based upon whether a significant amount of PTW is removed (Alternatives 5 and 6) or would remain in place (Alternatives 3 and 4). All alternatives would employ a comprehensive health and safety program and a perimeter air monitoring program would be developed to ensure worker and community protection during construction/remediation activities.

Another common element of the alternatives is the application of the ISS (In-situ Stabilization and Solidification) technology. For ISS (alone or in combination with other remedial components), the variability of the waste material within the impoundments may result in the use of a range of different treatment additives (such as Portland cement, lime kiln dust and cement kiln dust) to achieve the remedial performance criteria (discussed in the remedial alternatives, below).

Because the footprint of OU8 is located entirely within the footprint of the OU4 site-wide remedy, which addresses soil and groundwater contamination, costs for each alternative do not include groundwater monitoring. This monitoring will be conducted as part of the OU4 remedy, as the OU8 remedy cannot be considered completely separate from the OU4 remedy.

Because hazardous substance will be left behind at levels that do not allow for unlimited use and unrestricted exposure, five-year reviews will be required for each alternative, as required by CERCLA Section 121(c) and the NCP [40 C.F.R. § 300.430(f)(4)(ii)].

Alternative 1 - No Action

Capital Cost:	$0
O&M Costs:	$0
Periodic Costs :	$0
Implementation Timeframe:	Not Applicable

The NCP requires that a "No Action" alternative be developed as a baseline for comparing other remedial alternatives. Under this alternative, no action would be taken to remediate the PTW or impacted soil and clays within the impoundments or berms at OU8. No other controls would be included under Alternative 1.

Note: Alternative 2 from the FFS was screened out and was not considered further.

Alternative 3 – ISS Treatment, Inner Hydraulic Barrier Wall (HBW), Protective Cover

Capital Costs	$44,000,000
Operation & Maintenance Costs	$3,900,000
Periodic Costs	$150,000
Total Present Value	$48,000,000
Construction Time Frame	20 months

Alternative 3 involves ISS treatment on the PTW and soil and clays found to have been impacted by the OU8 impoundment material. This remedial approach would provide for permanent, long-term treatment and reduction of contaminant mass and solidification of impoundment material including pH adjustment, installation of a hydraulic barrier wall or HBW (which is a physical barrier designed to reduce lateral migration of groundwater or waste materials), placement of a low-permeability engineered cover with active vapor control, berm armoring, and infrastructure upgrades to allow for closure-in-place. The anticipated duration of field activities for Alternative 3 is 20 months. A comprehensive health and safety program and perimeter air monitoring program would be developed to ensure worker and community protection.

Details - This alternative consists of three major components:

- ISS treatment of impoundment material
- Installation of an inner HBW
- Installation of a protective cover

ISS would be applied to provide for permanent, long-term reduction of contaminant mass and solidification of all impoundment material. Treatment would result in pH adjustment and increased material strength to support construction equipment and the engineered cover, and would create a low-permeability monolith that reduces leaching of COCs. Based on treatability and pilot study findings, ISS of material in both Impoundments 1 and 2 can meet the required ISS performance criteria goals established for OU8, which are:

- Hydraulic conductivity: less than 10^{-6} cm/s
- Unconfined Compressive Strength (UCS): greater than 40 psi
- Benzene leachability reduction: greater than 90 percent
- pH: 4 to 12 SU

Note: UCS is a measure directly related to the material's ability to support loads such as an engineered cover.

ISS would be completed using large-diameter mixing augers to incorporate ISS reagents into the impoundment material creating a series of overlapping, treated columns. Columns would extend to a depth of approximately 2 feet below the bottom of the impoundments.

Assuming one shift per day, a 5-day work week and 90 percent operating time (to account for severe weather and holidays), it would take approximately 8 months to complete the ISS mixing process in both impoundments.

There is a measurable amount of VOC mass reduction associated with ISS, resulting from the agitation/auger-mixing and exothermal nature of ISS chemical reactions. During mixing operations, vapors would be controlled using a vented outer shroud on the mixing augers. Each vented shroud would be used to actively collect (via vacuum) and direct vapors to a thermal oxidizer and caustic scrubber (two units, one per ISS rig). A water cap would be maintained on untreated material within the impoundments to minimize VOC emissions.

While VOC-mass reduction will occur during ISS, the primary method of treatment for this alternative is sequestration within a solidified matrix.

An inner HBW would be installed to minimize contact of upgradient groundwater with the treated monolith. Details of the HBW (e.g., construction, materials, monitoring, etc.) would be determined during design.

Following completion of ISS operations, curing, and removal of the temporary vented cover, a protective cover would be installed over the impoundments to prevent direct contact with treated material, control vapors as needed, and protect against flooding. For the purposes of this Proposed Plan, it has been assumed that this would consist of a low-permeability engineered cover with a vapor control component, however, the specific cover design would be established during the design phase.

The engineered cover would be maintained through routine inspections and implementation of corrective measures, as necessary. Vegetated areas would be maintained once annually, or as needed. Site inspections would include evaluating the impoundment area for evidence of erosion, cracking, sloughing, animal burrows, stressed vegetation, etc. Maintenance for the engineered cover during post-closure care would be performed semiannually in perpetuity.

Alternative 4 – Steam-Enhanced ISS Treatment, Inner HBW, Protective Cover

Capital Costs	$56,000,000
Operation & Maintenance Costs	$3,900,000
Periodic Costs	$150,000
Total Present Value	$60,000,000
Construction Time Frame	24 months

This alternative involves heating the impoundment contents via steam injection to provide enhanced reduction of contaminant mass, implemented in conjunction with ISS treatment. This alternative also includes pH adjustment, installation of an HBW and a low-permeability engineered cover with active vapor control and berm armoring, and infrastructure upgrades to allow for closure-in-place. The anticipated duration of field activities for Alternative 4 is 24 months. A comprehensive health and safety program and perimeter air monitoring program would be developed to ensure worker and community protection.

Details - This particular alternative consists of four major components:

- Steam-enhanced injection into impoundment materials
- ISS treatment of impoundment material
- Installation of an inner HBW
- Installation of a protective cover

Steam-enhanced ISS would be applied to increase VOC mass reduction beyond the expectations of Alternative 3, adjust the pH of the impoundment material, increase material strength to support construction equipment and the engineered cover, and create a low-permeability monolith that reduces leaching of COCs to groundwater. Based on treatability and pilot study findings, ISS of material in both Impoundments 1 and 2 can meet the selected ISS performance criteria goals established for OU8, as listed under Alternative 3.

Steam-enhanced ISS would be completed using large-diameter mixing augers. During the initial mixing operations, steam infused with compressed air would be injected by the mixing equipment to heat the impoundment material and promote contaminant volatilization during homogenization. Following steam-enhanced mixing, ISS reagents would be mixed into the impoundment material creating a series of overlapping, treated columns. Columns would extend to a depth of approximately 2 feet below the bottom of the impoundments.

Assuming one shift per day, a 5-day work week and 90 percent operating time (to account for severe weather and holidays), it would take approximately 12 months to complete the ISS mixing process in both impoundments.

VOC-mass reduction for Alternative 4 will be greater than for ISS alone; however, it is not possible to quantify the greater level of mass reduction that might occur. The majority of VOCs and SVOCs under this alternative are still expected to be sequestered within a solidified matrix.

An inner HBW would be installed to minimize contact of upgradient groundwater with the treated monolith. Details of the HBW (e.g., construction, materials, monitoring etc.) would be determined during design.

Following completion of ISS operations, curing, and removal of the temporary vented cover, a protective cover would be installed over the impoundments to prevent direct contact with treated material, control vapors as needed, and protect against flooding. For the purposes of this Proposed Plan, it has been assumed that this would consist of a low-permeability engineered cover with a vapor control component, however, the specific cover details would be established during the design phase.

The engineered cover would be maintained through routine inspections and implementation of corrective measures, as necessary. Vegetated areas would be maintained once annually, or as needed. Site inspections would include evaluating the site for evidence of erosion, cracking, sloughing, animal burrows, stressed vegetation, etc. Maintenance for the engineered cover during post-closure care would be performed semiannually in perpetuity.

Alternative 5 – Steam-Enhanced ISS Treatment, Excavation and Placement in CAMU, Protective Cover

Capital Costs	$62,900,000
Operation & Maintenance Costs	$1,700,000
Periodic Costs	$150,000
Total Present Value	$65,000,000
Construction Time Frame	30 months

This alternative involves using steam enhanced ISS to treat PTW in the impoundments, then removing the treated material and placing it in the on-site CAMU. Following removal, a protective cover would be installed over any remaining treated soil and clay materials impacted by OU8 impoundment material to minimize any potential future migration of COCs. The anticipated duration of field activities for Alternative 5 is 30 months. A comprehensive health and safety program and perimeter air monitoring program would be developed to ensure worker and community protection. In-situ treatment with steam would promote contamination mass reduction, improve material handling properties, and facilitate treated material removal for final disposal in the on-site CAMU. Following reduction of treated impoundment material, the berms would be backfilled and a protective cover would be installed.

Details - This alternative consists of the following major components:

- Steam-enhanced ISS treatment of impoundment material
- Excavation of treated materials and placement into the CAMU
- Additional treatment through ISS of soil and clay impacted by OU8 impoundment material exceeding PRGs
- Backfill with existing berm materials
- Installation of a protective cover

Steam-enhanced ISS would be applied to increase VOC mass reduction, adjust the pH of the impoundment material, and improve material handling properties to facilitate excavation and placement in the CAMU. This alternative will be designed to meet the performance criteria for the CAMU liner compatibility specified in the FFS.

Assuming a 5-day work week and 90 percent operating time (to account for severe weather and holidays), it would take approximately 12 months to complete the ISS mixing process in both impoundments.

After ISS operations are completed, treated material would be removed from the impoundments using conventional excavation methods and transported by truck to the on-site CAMU for final deposition. It is estimated that a rate of 500 cubic yards ($yd^{3)}$ per day (approximately 25 trucks) of treated materials would be excavated and placed in the CAMU. Odor and emissions would be controlled using a temporary fabric structure or suppressing foam, as needed.

Once transfer to the CAMU is completed, additional Portland cement is expected to be added to the treated material to further solidify the material and reduce hydraulic conductivity/leaching. As with other alternatives involving ISS or steam-enhanced ISS, the performance criterion for pH of the treated material is a non-corrosive pH (4 to 12 SU), and other performance criteria including treatment levels for contaminants established as part of 1998 ROD/CAMU for the Group III Impoundments would be adjusted to meet the requirements of the CAMU.

Following excavation of treated material, the remaining impoundment berms not requiring treatment (i.e., concentrations below the PRGs) would be folded down into the excavated area. Any soil or clay material impacted by OU8 impoundment material with concentrations exceeding the PRGs would be treated via ISS and closed in place.

A protective cover would then be installed over the impoundment areas, which would be maintained through routine inspections and implementation of corrective measures, as necessary. Vegetated areas would be maintained once annually, or as needed. Site inspections would include evaluating the impoundment area for evidence of erosion, cracking, sloughing, animal burrows, stressed vegetation, etc. Maintenance for the protective cover during post-closure care would be performed semiannually in perpetuity.

Alternative 6 – Excavation, Dewatering, Treatment/Destruction Off Site, Protective Cover

Capital Costs	$71,700,000
Operation & Maintenance Costs	$1,700,000
Periodic Costs	$150,000
Total Present Value	$74,000,000
Construction Time Frame	38 months

This alternative involves excavation and mechanical dewatering of impoundment material, followed by off-site treatment. The anticipated duration of field activities for Alternative 6 is 38 months. A robust health and safety program and perimeter air monitoring program would be developed to ensure worker and community protection. Excavated material would be dewatered, loaded to lined dump trailers and transported off site for destruction, preferably at a cement kiln. Soil and clay materials impacted by OU8 impoundment material within the impoundment floors and berm sidewalls with concentrations exceeding the PRGs would be treated via ISS. Existing berm materials not requiring treatment (i.e., concentrations below the PRGs) would be backfilled into the excavated area. A protective cover would be placed over the entire former impoundment area.

Details - This alternative consists of the following major components:

- Excavation and dewatering of impoundment material
- Emission and odor control
- Off-site shipment for treatment/destruction
- Treatment of soil and/or clay impacted by OU8 impoundment material with concentrations above PRGs via ISS
- Backfill with existing berm materials not requiring treatment
- Install a protective cover

Material from the impoundments would be excavated to the depth of the existing clay layer. This material would be sent through a machine referred to as a dewatering screw equipped with a conveyor belt system. The dewatering screw separates the tars (PTW) and liquids resulting in two waste streams: a semi-solid material which allows for shipping and an aqueous phase liquid which would be collected. Dewatered material would be transferred to a double plastic-lined dump trailer. Based on the results of bench-scale treatability tests, it is estimated that 44,700 tons of dewatered impoundment material would be transported to an off-site facility, preferably at a cement kiln, for destruction. An estimated 9,600 tons (2.3 million gallons) of aqueous phase liquid would be collected in a proper containment vessel (i.e., above ground storage tank or tanker truck) and stored prior to on-site treatment or transported to an off-site treatment facility.

Excavation and dewatering is expected to be performed from March to November, at a rate aligned with acceptance rates at off-site treatment facilities. If temperatures remain consistently over 40 degrees Fahrenheit, the production season may be extended. It is estimated that excavation and dewatering would be conducted at a rate of 100 yd^3 per day.

Emissions and odors from excavation activities would be controlled using engineering controls such as suppressing foams, fiber-based sprays, and cement-based spray covers. Foam suppression sprays would be used as needed during active excavation and sprayed on the material in the excavator bucket and the open excavation area. Fiber-based and cement-based spray covers would be used as needed at the end of each workday as a daily cover. The surface of loaded dump trailers would be sprayed with a fiber-based or cement-based spray cover and covered with plastic. The trailer weather cover would then be secured for transport. A robust air monitoring system will be implemented to protect the community and on-site workers.

Dewatered material in the dump trailers would be shipped by a licensed transporter to a facility such as a cement kiln for destruction. For purposes of facility acceptance, cost and treatment estimations in this Proposed Plan, cement kilns were used as one facility option to receive this material. These outlets (in addition to incinerators) are permitted to receive waste from CERCLA sites and are permitted to process materials carrying the RCRA hazardous waste codes applicable to the impoundment material (e.g., D018 [benzene]). It is anticipated that more than 415 tons per week can be sent off site to these types of facilities. Overall, removal and off-site shipment of impoundment material is estimated to be completed within 3 years.

Following excavation and removal of the impoundment material, any remaining soil and/or clay material impacted by OU8 impoundment material with concentrations exceeding the PRGs would be treated via ISS. The impoundment berms not requiring treatment (i.e., concentrations below the PRGs) would be used as backfill. A protective cover would then be installed over the entire impoundment area. This protective cover may include a low-permeability engineered layer with a vapor control component, however, the specific cover details would be established during the design phase.

The cover would be maintained through routine inspections and implementation of corrective measures, as necessary. Vegetated areas would be maintained annually, or as needed. Site inspections would include evaluating the site for evidence of erosion, cracking, sloughing, animal burrows, stressed vegetation, etc. Maintenance for the protective cover during post - closure care would be performed semiannually for perpetuity.

EVALUATION OF ALTERNATIVES

Nine criteria are used to evaluate the different remediation alternatives individually and against each other in order to select a remedy (see table below, Evaluation Criteria for Superfund Remedial Alternatives). This section of the Proposed Plan describes the relative performance of each alternative against the nine criteria, noting how each compares to the other options under consideration. A detailed analysis of the alternatives can be found in the FFS Report.

1. Overall Protection of Human Health & the Environment

Alternative 1, No Action, would not be protective of human health and the environment since it does not include measures to prevent exposure to PTW and the contaminated soil used as part of the berms and possibly the underlying soil and clays. Alternatives 3 through 6 are expected to be protective of human health and the environment by addressing the PTW and soil and clay impacted by OU8 impoundment material within the impoundments which would improve the conditions within the floodplain area. More specifically, Alternatives 3 and 4 would result in PTW and COCs being treated and closed in place with a protective cover. These remedies are expected to comply with the RAOs, meet the PRGs, and would allow for the natural ecosystem within the floodplain to recover. Alternatives 5 and 6 also address the RAOs and meet PRGs by permanently removing almost all of the PTW from the impoundments and treating any soil and clay impacted by OU8 impoundment material.

2. Compliance with ARARs

With the exception of Alternative 1 (No Action), Alternatives 3 through 6 would comply with ARARs and therefore meet this threshold criterion. More specifically, the alternatives would comply with ARARs as follows:

• Floodplain – The proposed remedial activities would be implemented to comply with substantive federal and state regulations regarding remediation and filling in floodplains.
• Wetlands – Wetland mitigation would be conducted in areas adjacent to the impoundments areas or in access areas impacted by construction activities following construction. Consultation with federal and state authorities would occur prior to the start of work to establish compliance with substantive requirements.
• Hazardous waste management and disposal – The processing and disposal of waste material generated during implementation of these alternatives would comply with applicable or relevant and appropriate requirements of RCRA (i.e. CAMU-related), CERCLA, the Toxic Substances Control Act, and state waste management regulations. This includes activities associated with material left in place or transportation of hazardous materials.
• Air quality, Air Emissions – Monitoring and controls would be conducted during all phases of the selected remedy including any waste processing to ensure compliance with air emission limits.
• Storm-water – Erosion and sedimentation controls for construction activities would be addressed during the design phase. Consultation with state authorities would occur prior to the start of work to establish compliance with substantive requirements.

3. Long-Term Effectiveness and Permanence

Alternative 1 is not considered to be effective in the long term because PTW would not be actively treated. No reduction in the magnitude of residual risk would be achieved, and no additional controls would be implemented to control these risks. In contrast, Alternatives 3 through 6 would offer high long-term effectiveness and permanence, including protecting the impoundments from the impacts of potential flooding, as described below.

In Alternatives 3 and 4, ISS would result in treatment of PTW in the impoundments via reduction of contaminant mass and stabilization. The addition of steam enhancement to ISS operations in Alternative 4 would result in additional reduction of contaminant mass. In both alternatives, the stabilized impoundment material would remain in place and each of the performance criteria would be achieved, including adjustment of the material to a non-corrosive pH, reduction in COC leachability by greater than or equal to 90 percent, hydraulic conductivity less than or equal to 10^{-6}cm/s, and compressive strength greater than 40 psi. Compressive strength is an indicator of long-term durability. An engineered cover, which includes vapor control and treatment, would capture vapor phase COCs that are emitted, and would prevent contact of precipitation with the treated materials. A robust engineered cover would provide further protection against potential flooding.

In Alternative 5, PTW would be treated, excavated, and disposed of in the CAMU. Steam-enhanced mixing would result in enhanced VOC mass reduction, reducing the concentration of these contaminants in the impoundment material. ISS treatment would result in adjustment of the material to a non-corrosive pH and significantly reduce COC leachability. Following treatment, PTW would be placed in the CAMU, which would permanently contain the treated waste over the long term. The CAMU has a multi-layer leachate collection system and would include an impermeable cover upon closure. Testing demonstrates that the CAMU's liner material is compatible with leachate potentially generated from the treated materials. In this alternative, most of the PTW would be removed from the floodplain. Soil and clay impacted by OU8 impoundment material within the berm sidewalls and impoundment floor that exceed the PRGs would be treated through ISS and the treated materials, along with the materials not requiring treatment, would be graded into the existing impoundment and entirely capped with a protective cover similar to the cover envisioned for Alternatives 3 and 4.

In Alternative 6, almost all of the PTW would be excavated, removed and treated off site, resulting in a permanent and irreversible remediation of those impoundment materials. In this alternative, PTW would be removed from the floodplain. Soil and clay impacted by OU8 impoundment material within the berm sidewalls and impoundment floor that exceed the PRGs would be treated through ISS and the treated materials, along with the materials not requiring treatment, would be graded into the existing impoundment and entirely capped with a protective cover similar to the cover envisioned for Alternatives 3 and 4.

4. Reduction of Toxicity, Mobility, and Volume of Contaminants through Treatment

Alternative 1 does not include any treatment and would not reduce the toxicity, mobility, or volume (TMV) of contaminants. The remaining Alternatives would all offer varying degrees of reduction in TMV.

In Alternatives 3 and 4 implementing the ISS technology would effectively and irreversibly reduce the leachability (i.e., mobility) of COCs associated with PTW in the impoundments. ISS would also reduce mobility of COCs potentially present as non-PTW in the inner berm edges and an approximately 2-foot-thick layer of soil located below the existing clay impoundment liners and above the groundwater table. As demonstrated during the pilot test, Alternative 3 would result in some permanent removal of VOCs during the ISS mixing process (approximately 25 percent mass reduction). Alternative 4

EVALUATION CRITERIA FOR SUPERFUND REMEDIAL ALTERNATIVES
Overall Protectiveness of Human Health and the Environment evaluates whether and how an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
Compliance with ARARs evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements that are legally applicable, or relevant and appropriate to the site, or whether a waiver is justified.
Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.
Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, the community, and the environment during implementation.
Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
Cost includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.
State/Support Agency Acceptance considers whether the State agrees with the EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.

would result in additional VOC mass removal relative to ISS alone due to the addition of steam during the homogenization/ mixing process.

As in Alternative 4, steam-enhanced ISS in Alternative 5 would result in VOC mass removal prior to excavation of the treated PTW and placement in the CAMU. ISS would also reduce mobility of COCs potentially present in the inner berm edges and in an approximately 2-foot-thick layer of soil located below the existing clay impoundment liners and above the groundwater table.

In Alternative 6, almost all of the PTW will be removed from the site. Treatment of the PTW at a facility like a cement kiln would irreversibly destroy not only the VOC mass in the impoundment material, but also the SVOC mass and the organic tar material itself. This would result in the greatest possible reduction in TMV. Additional treatment through ISS on the soil and clay that remain within the impoundments that were impacted by OU8 Impoundment material, would also reduce mobility of COCs potentially present in the inner berm edges and in an approximate 2-foot-thick layer of soil located below the existing clay impoundment liners and above the groundwater table.

5. Short-Term Effectiveness

Short-term effectiveness is not applicable to Alternative 1 since it does not include any active remediation work. The times to achieve the RAOs for Alternatives 3 through 6 are similar to one another in all cases (around 2 to 3 years), but the alternatives vary in their degree of protection of the community, workers, and environment during remedial action. There is increased risk of exposure for alternatives that involve excavation (Alternatives 5 and 6) relative to the alternatives that involve treatment and closure-in-place (Alternatives 3 and 4). Because of this, Alternatives 3 and 4 are expected to provide slightly favorable more short term effectiveness than Alternatives 5 and 6.

For Alternatives 3 through 5, engineered controls implemented during ISS and steam-enhanced ISS operations for vapor control would provide a high degree of protection to the community, workers, and the environment. These engineered controls include use of a shrouded auger, maintenance of a water cap, installation of stone plenum layer (vented as needed), and treatment of actively collected vapors with a thermal oxidizer and caustic scrubber. In addition, fixed equipment would be staged on an equipment bench constructed at an elevation that would provide protection in the case of a catastrophic flood. In the event of such a flood, transportable equipment and reagents would be moved.

For Alternatives 3 and 4 only, treated materials would be closed in place and there would be no potential exposure of the community, workers, or the environment associated with excavation, transportation, and placement of the material, as it would be managed in place. The air emissions would be lower overall than with an excavation approach. A benefit of Alternatives 3 and 4 is reduced potential for exposure to the community because the wastes are treated. However, the material remains closed in-place.

Alternative 5 is similar to Alternatives 3 and 4 in short-term effectiveness during ISS activities. However, additional engineering controls such as use of vapor suppression foams or temporary fabric structures may be required to protect workers and the community during excavation and transport of the treated material to the on-site CAMU. Some risk may be encountered during transport of treated material to the CAMU, but the material would have reduced concentrations of COCs because of prior steam-enhanced ISS treatment (reducing potential VOC emissions) and would be partially stabilized, increasing ease of handling. The transport distance would be approximately 1.5 miles. Work at the CAMU to further stabilize this material, prior to final placement, would require further engineering controls due to the nearby residents' homes.

In Alternative 6 engineering controls would be needed to protect the community, workers, and the environment during implementation due to an increased risk of exposure associated with material excavation, dewatering, and transport. Vapor suppression foams that have been successfully utilized at other sites with similar PTW would be used on surfaces to control vapor emissions and if needed additional vapor control measures would be implemented. Lined dump trailers would be used to transport dewatered PTW off site for treatment. During design an evaluation would be conducted to ensure that any short-term impacts to the community and environment from the passing of trucks from the site to the off-site facility would be minimized.

Overall, excavation, dewatering, and transport of impoundment materials would pose a moderate degree of risk; however, this risk would be mitigated by a robust emission suppression program and engineering controls. As with Alternatives 3 through 5, it is assumed that fixed equipment would be staged on an equipment bench constructed at an elevation required to provide protection in the case of a catastrophic flood. In the event of such a flood, transportable equipment would be moved.

Alternative 6 also has the longest implementation time frame at 38 months, as opposed to 20 to 30 months for the other active alternatives. The implementation time frame is longer primarily because, one, the excavation process would need to occur slowly to reduce the potential for air emissions and, two, the off-site facilities for treatment/destruction of the excavated and dewatered material can only process a limited amount of material at a time.

In summary, because the time to achieve the RAOs is similar for Alternatives 3 through 6, a primary difference between these alternatives is the degree of short-term protection of the community, workers, and the environment. Engineering controls would be designed and implemented to protect these entities.

6. Implementability

Alternatives 1 and 3 are both clearly implementable. In the case of Alternative 1, because no remedial actions would be implemented there would be no challenges associated with contractors, specialty equipment, etc. In the case of Alternative 3, the primary remedial component, ISS, is a proven, reliable, and implementable technology and its effectiveness can be monitored. ISS has been applied in the remediation of VOCs, SVOCs and PTW at more than 30 federal- or New Jersey state-lead projects. ISS worked successfully on the site's contaminants during the 2014 OU8 pilot study. The engineered cover and inner HBW would help minimize exposure risk. This alternative is administratively feasible, and services and materials are readily available. A disadvantage is that stabilization would reduce the ease of undertaking additional remedial actions, if necessary, because the remaining monolith would require a large scale operation and heavy duty equipment to break down the material in order to prepare it for further corrective efforts.

Alternatives 4 and 6 are also implementable. In the case of Alternative 4, the ISS portion of the alternative would be straightforwardly implementable, as described above for Alternative 3. The addition of steam-enhanced mixing prior to ISS, however, has not been used as often and would require specialized equipment and operations. Fewer contractors are available with experience implementing steam-enhanced ISS. As with Alternative 3, a disadvantage is that stabilization would reduce the ease of undertaking additional remedial actions, if necessary. For Alternative 6, excavation and dewatering are, in general, commonly performed remediation activities. Use of this approach on the acid tar impoundment materials is an emerging technology that has been successfully implemented at a few sites. The determination that this alternative is considered implementable is based on experience with dewatering and successful treatment/destruction off-site of similar acid tar material from another Superfund site in EPA Region 2; however, dewatering acid tar (while successfully performed during a lab treatability study in 2016) is site-specific and may require special operational procedures. Several off-site cement kilns have been identified that can accept the dewatered acid tars. The ease of closing the impoundments is high, as most of the toxic materials would be removed from the site. This alternative is administratively feasible, and services are available. Additional remedial actions at the impoundments' remaining footprints, if necessary, could be undertaken with ease.

Alternative 5 is expected to be implementable but comes with some challenges. The ISS portion of the alternative would be easily implementable, as described for Alternative 3. Similar to Alternative 4, however, steam-enhanced mixing prior to ISS has not been used as often and would require specialized equipment and operations. Implementation of Alternative 5 would involve multiple processes involved with in-place treatment, removal, additional treatment and engineering controls at the CAMU, then placement of the material in the CAMU. Fewer contractors are available with experience implementing steam-enhanced ISS. Excavation equipment is readily available; however, emission controls at the point of excavation and placement (CAMU location) may be challenging. This alternative is administratively feasible, and services and materials are available. Additional remedial actions, if necessary, could be undertaken with ease in the impoundment area, but it would be difficult to undertake additional actions on the material once placed in the CAMU.

In accordance with CERCLA, no permits would be required for on-site work (although such activities would comply with substantive requirements of otherwise required permits). Permits would be obtained as needed for off-site work.

7. Cost

The total estimated present value cost for each retained alternative is presented below.

- Alternative 1 – $0
- Alternative 3 – $48,000,000
- Alternative 4 – $60,000,000
- Alternative 5 – $65,000,000
- Alternative 6 – $74,000,000

These cost estimates have been developed based on the design assumptions and are presented primarily for comparing the alternatives. The final costs of the selected remedy will depend on actual labor and material costs, competitive market conditions, final project scope, the implementation schedule, and other variables. Consistent with EPA guidance, the cost estimates are order-of-magnitude estimates with an intended accuracy range of plus 50 to minus 30 percent of present value.

The primary cost difference between Alternatives 3 and 4 is for the additional steam component which would need associated materials and safety precautions. While Alternative 5 is similar to Alternative 4 in the treatment of the PTW within the impoundments, the additional cost is attributed to the removal, transportation and additional solidification actions at the CAMU prior to placement. Alternative 6 is entirely different from the other four. Its costs are the highest but it provides the most permanent solution to the PTW and addresses any remaining contamination within the OU8 footprint. The costs of protective cover installation and maintenance, even in perpetuity, for all the alternatives are comparable.

8. State acceptance

The State of New Jersey concurs with the preferred alternative presented in this Proposed Plan.

9. Community acceptance

Community acceptance of the preferred alternative will be addressed in the Record of Decision following review of comments received on the Proposed Plan.

PREFERRED ALTERNATIVE

EPA's preferred alternative is Alternative 6, Excavation, Dewatering, Treatment/Destruction Off Site, Protective Cover. Alternative 6 has the following key components: excavation, dewatering, off-site treatment/destruction, ISS treatment of remaining impoundment materials, and a protective cover.

Alternative 6 involves excavation and mechanical dewatering of the majority of PTW within the OU8 impoundments, followed by destruction off site. Any remaining soil and clay impacted by the OU8 impoundment materials will undergo ISS treatment, followed by backfilling with berm remnants and a protective cover that will be installed over the entire OU8 footprint.

Alternative 6 is a treatment and containment-based alternative consisting of proven technologies that would be effective in dramatically reducing the risks associated with the exposure pathways identified at the site. By excavating and dewatering PTW and eventually destroying the material off-site resulting in the most permanent solution, this preferred alternative holds the most favorable approach. In addition, implementing a proven ISS technology on the remaining impacted soil and clay materials followed by an engineered capping system would effectively control direct contact, eliminate the release of contaminants into the air and address potential movement of contaminants beyond the OU8 impoundment footprint. ISS would further reduce contaminant mass through media transfer (enhanced desorption), capture of the emissions, and destruction in a vapor treatment system, and also serve to reduce mobility of contaminants through the binding of treated mass and limiting infiltration through the less permeable, treated waste material.

The preferred alternative will protect human health and the environment by addressing all the RAOs and will meet PRGs by permanently removing almost all of the PTW from the impoundments and effectively treating any soil and clay impacted by OU8 impoundment materials. Treatment of the waste at a facility such as a cement kiln or incinerator would irreversibly destroy not only the VOC mass in the impoundment material, but also the presence of SVOC mass and the organic tar material itself resulting in the greatest possible reduction in toxicity, mobility and volume.

Alternative 6 would be implementable using common excavation activities and through the use of an emerging dewatering technology. This approach is developed based on experience with the successful implementation and destruction off-site of similar acid tar material from another Superfund site in EPA Region 2. While the cost to perform this alternative is the highest, it provides the most permanent solution to the highly toxic nature of the material in these impoundments, with an estimated implementation timeframe of 38 months.

The remedy would also be effective in reducing the risk of impoundment contents that remain in the floodplain from being compromised by any flooding.

Based on the information currently available, EPA believes the preferred alternative meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing criteria. EPA expects the preferred alternative to satisfy the following statutory requirements of CERCLA Section 121(b), 42 U.S.C. § 9621(b): 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost effective; 4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and 5) satisfy the preference for treatment (via the existing groundwater treatment system) as a principal element. EPA will assess the two modifying criteria of state acceptance and community acceptance in the ROD to be issued following the close of the public comment period.

COMMUNITY PARTICIPATION

EPA encourages the public to gain a more comprehensive understanding of the site and the Superfund activities that have been conducted there.

The dates for the public comment period, the date, location and time of the public meeting, and the locations of the Administrative Record files, are provided in the text box entitled, “Mark Your Calendar” located on the front page of this Proposed Plan. Instructions for submitting written comments on the Proposed Plan are provided in the highlight box, below.

EPA Region 2 has designated a public liaison as a point-of-contact for the community concerns and questions about the federal Superfund program in New York, New Jersey, Puerto Rico, and the U.S. Virgin Islands. To support this effort, the Agency has established a 24-hour, toll-free number (1-888-283-7626) that the public can call to request information, express their concerns, or register complaints about Superfund.

For further information on the American Cyanamid Superfund Site, please contact:

Mark Austin	Melissa Dimas
Remedial Project Manager	Community Involvement Coordinator
(212) 637-3954	(212) 637-3677
austin.mark@epa.gov	dimas.melissa@epa.gov

Written comments on this Proposed Plan should be mailed to Mr. Austin at the address below or sent via email.

U.S. EPA
290 Broadway, 19th Floor
New York, New York 10007-1866

The public liaison for EPA’s Region 2 is:

George H. Zachos
Regional Public Liaison
Toll-free (888) 283-7626
(732) 321-6621

U.S. EPA Region 2
2890 Woodbridge Avenue, MS-211
Edison, New Jersey 08837-3679

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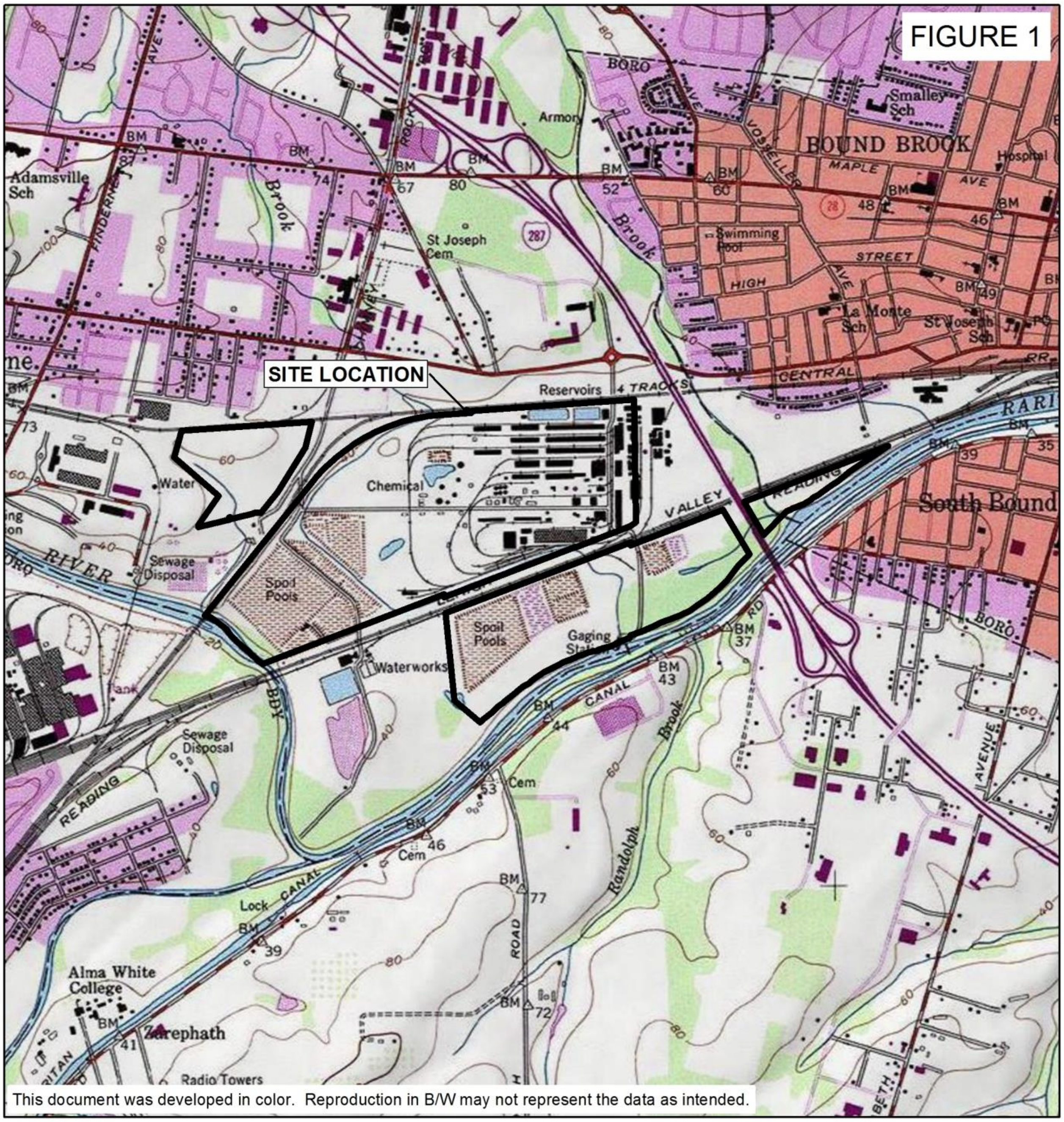

PLOT DATE: 12/12/2011 DRK

ADAPTED FROM: BOUND BROOK, NEW JERSEY USGS QUADRANGLE

MAP LOCATION

WYETH HOLDINGS CORPORATION
AMERICAN CYANAMID
SUPERFUND SITE
SITE-WIDE FEASIBILITY STUDY

N

SITE LOCATION

0 1,000 2,000 4,000 6,000 8,000

Feet

DECEMBER 2011
4529/47194

1:24,000

O'BRIEN & GERE

Figure 2

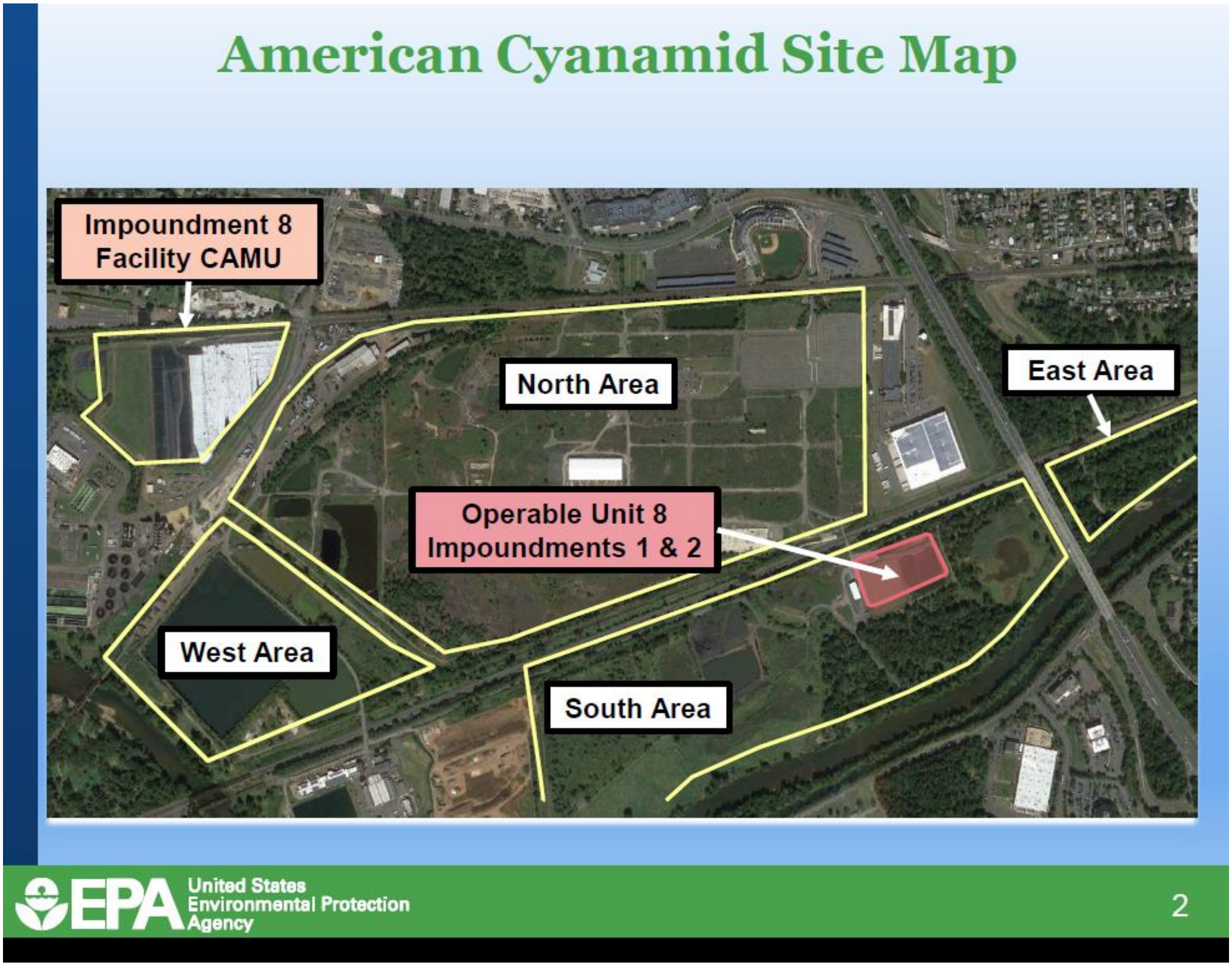
American Cyanamid Site Map
Impoundment 8
Facility CAMU
North Area
East Area
Operable Unit 8
Impoundments 1 & 2
West Area
South Area
EPA United States Environmental Protection Agency
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Figure 3

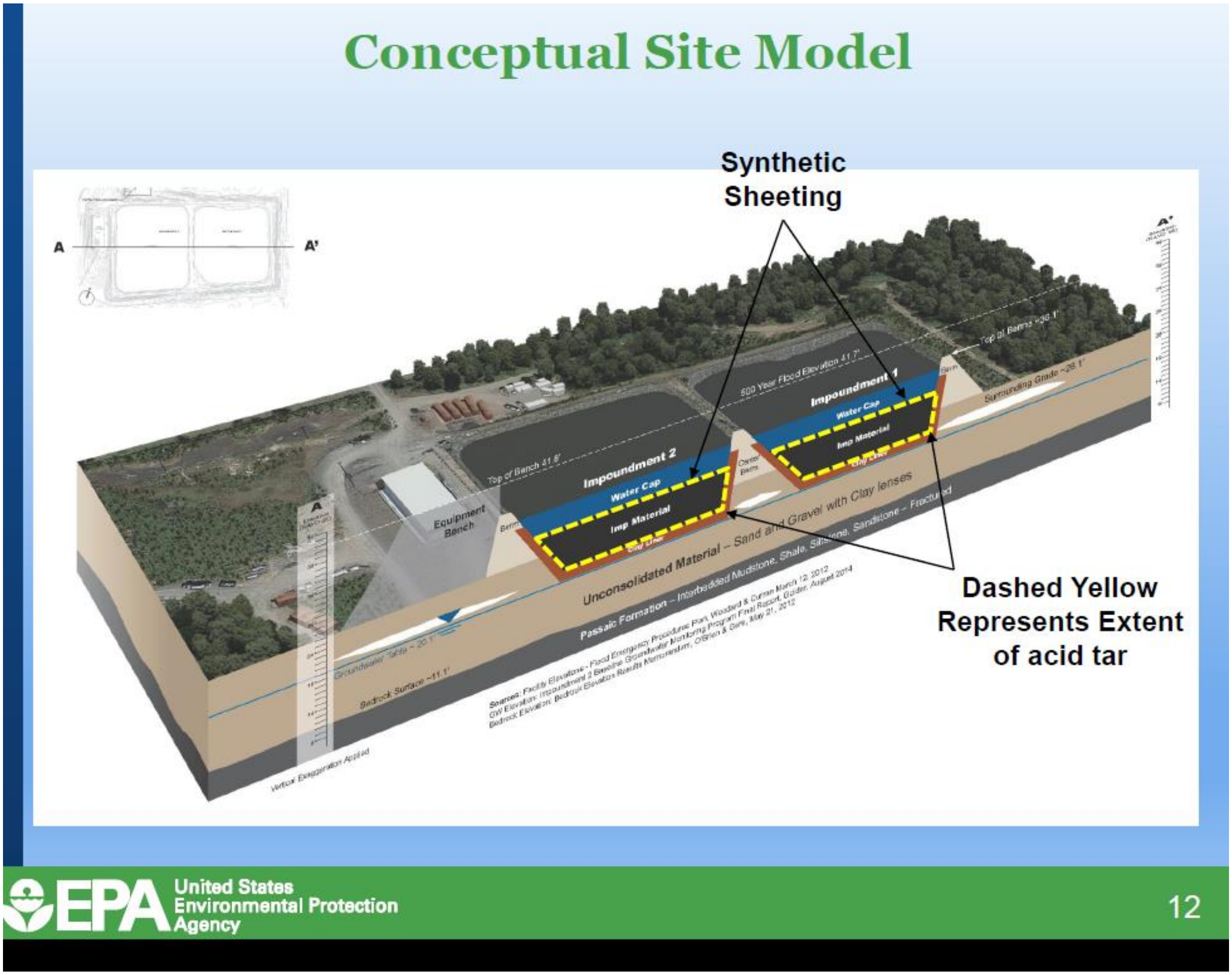
Conceptual Site Model
Synthetic Sheeting
Dashed Yellow Represents Extent of acid tar
A
A'
Top of Berms ~36.1'
500 Year Flood Elevation 41.7'
Surrounding Grade ~28.1'
Impoundment 1
Water Cap
Imp Material
Clay Liner
Top of Bench 41.8'
Impoundment 2
Center Berm
Berm
Equipment Bench
Unconsolidated Material – Sand and Gravel with Clay lenses
Passaic Formation – Interbedded Mudstone, Shale, Siltstone, Sandstone – Fractured
Groundwater Table ~20.1'
Bedrock Surface ~11.1'
Vertical Exaggeration Applied
United States Environmental Protection Agency
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Table 1. Impoundment Composition

Material Type	Impoundment 1	Impoundment 2
VR (upper Layer)	900 yd^3	10,900 yd^3
Mixed VR and HC (middle layer)	-	6,500 yd^3
HC (lower layer)	13,700 yd^3	12,900 yd^3
CL (mixed)	2,700 yd^3	-
SSL (mixed)	1,900 yd^3	-
CA (mixed)	5,000 yd^3	-
Total Volume	24,200 yd^3	30,300 yd^3

yd^3 – cubic yards

Key:

VR – Viscous Rubbery
HC – Hard Crumbly
CL – Clay-Like
SSL – Sand & Silt-Like
CA – Coal Aggregate

Table 2. Impoundment 1 Organics Summary

Parameter	CAS #	Valid Samples	Unique Samples	Detects	Units	Minimum Detected	Maximum Detected	Mean	Standard Deviation	Mean + 1 Std. Dev
Benzene	71-43-2	25	24	25	µg/kg	78,500	207,000,000	47,762,304	58,054,409	105,816,713
Toluene	108-88-3	25	25	25	µg/kg	1,440	40,700,000	11,425,122	12,264,223	23,689,345
Naphthalene	91-20-3	25	25	25	µg/kg	5,010	12,600,000	3,111,321	3,172,052	6,283,373
Xylene (Total)	1330-20-7	25	25	25	µg/kg	4,500	6,910,000	2,400,192	2,142,678	4,542,870
Nitrobenzene	98-95-3	25	23	23	µg/kg	29	6,600,000	1,169,016	1,599,540	2,768,556
1,2-Dichlorobenzene	95-50-1	25	24	25	µg/kg	3,390	2,550,000	761,381	687,954	1,449,335
Aniline	62-53-3	25	25	25	µg/kg	189	36,707	672,158	1,237,244	1,909,402
Chlorobenzene	108-90-7	25	16	17	µg/kg	233	2,400,000	499,194	640,422	1,139,616
1,3,5-Trimethylbenzene	108-67-8	25	24	24	µg/kg	2,300	1,110,000	347,202	320,227	667,429
Isopropylbenzene	98-82-8	25	25	25	µg/kg	6,580	1,710,000	531,564	531,072	1,062,636
Benzoic acid	65-85-0	25	18	18	µg/kg	285	1,410,000	298,767	410,639	709,406
1,3-Dichlorobenzene	541-73-1	25	5	5	µg/kg	153	1,200,000	292,545	332,982	625,527
Cyclohexane	1735-17-7	25	2	2	µg/kg	1,000	1,200,000	301,640	328,184	629,824
Acetophenone	98-86-2	25	25	25	µg/kg	94	1,190,000	275,708	341,652	617,360
MethylCyclohexane	108-87-2	25	6	6	µg/kg	2,400	1,200,000	303,129	326,802	629,931
1,4-Dichlorobenzene	106-46-7	25	18	18	µg/kg	197	850,000	195,197	283,453	478,650
Carbon Disulfide	75-15-0	25	14	14	µg/kg	100	1,200,000	195,466	262,019	457,485
Methanol	67-56-1	25	2	2	µg/kg	2,000	275,000	154,504	83,508	238,012
2-Methylnaphthalene	91-57-6	25	25	25	µg/kg	506	678,000	174,110	171,242	345,352
Ethylbenzene	100-41-4	25	25	25	µg/kg	1,480	529,000	168,443	155,607	324,050

Data excerpt from O'Brien & Gere (OBG). 2010a. Former American Cyanamid Site Impoundments 1 and 2 Characterization Program Summary Report. November.

Table 3. Impoundment 2 Organics Summary

Parameter	CAS #	Valid Samples	Unique Samples	Detects	Units	Minimum Detected	Maximum Detected	Mean	Standard Deviation	Mean + 1 Std. Dev
Benzene	71-43-2	28	28	28	ug/kg	16,700,000	183,000,000	52,246,429	39,882,369	92,128,798
Toluene	108-88-3	28	28	28	ug/kg	3,930,000	40,200,000	11,867,857	8,700,937	20,568,794
Naphthalene	91-20-3	28	28	28	ug/kg	1,040,000	13,700,000	4,879,643	3,408,717	8,288,360
Chlorobenzene	108-90-7	28	13	28	ug/kg	18,200	13,000,000	823,157	2,407,139	3,230,296
Methyl Acetate	79-20-9	28	4	4	ug/kg	55,000	6,500,000	597,929	1,254,329	1,852,258
Xylene (total)	1330-20-7	28	25	27	ug/kg	970,000	6,950,000	2,344,286	1,442,152	3,786,438
Acetone	67-64-1	28	1	1	ug/kg	110,000	12,500,000	842,536	2,302,436	3,144,972
Cyclohexane	1735-17-7	28	4	4	ug/kg	23,000	6,500,000	413,786	1,202,826	1,616,612
Chloromethane	74-87-3	28	11	11	ug/kg	24,600	6,500,000	384,021	1,206,098	1,590,119
1,3-Dichlorobenzene	541-73-1	28	19	19	ug/kg	15,300	6,500,000	359,782	1,216,478	1,576,260
Carbon Disulfide	75-15-0	28	27	27	ug/kg	37,100	6,500,000	330,771	1,211,285	1,542,056
1,2-Dichlorobenzene	95-50-1	28	24	27	ug/kg	500,000	6,500,000	1,863,429	1,169,362	3,032,791
Isopropylbenzene	98-82-8	28	26	27	ug/kg	163,000	6,500,000	634,107	1,191,127	1,825,234
MethylCyclohexane	108-87-2	28	6	6	ug/kg	65,000	6,500,000	485,429	1,207,970	1,693,399
1,3,5-Trimethylbenzene	108-67-8	28	24	27	ug/kg	102,000	6,500,000	487,071	1,188,025	1,675,096
1,4-Dichlorobenzene	106-46-7	28	23	27	ug/kg	50,800	6,500,000	376,336	1,202,024	1,578,360
Ethylbenzene	100-41-4	28	25	27	ug/kg	74,600	1,250,000	225,339	237,350	462,689
2-Methylnaphthalene	91-57-6	28	27	28	ug/kg	65,600	656,000	246,050	155,315	401,365
Acetophenone	98-86-2	28	28	28	ug/kg	34,600	652,000	241,450	129,977	371,427

Data excerpt from O’Brien & Gere (OBG). 2010a. Former American Cyanamid Site Impoundments 1 and 2 Characterization Program Summary Report. November.