Virgin Island Chemical Site

St. Croix, U.S. Virgin Islands

EPA
Region 2

June 2001

MARK YOUR CALENDAR

June 27, 2001 - July 27, 2001: Public comment period on the Proposed Plan.

July 12, 2001 at 7:00 p.m.: Public meeting at Department of Education Curriculum Center, Centerline Road near St. Croix High School and the Territorial Court Building, Kingshill.

COMMUNITY ROLE IN SELECTION PROCESS

EPA and the Virgin Islands Department of Planning and Natural Resources (VIDPNR) rely on public input to ensure that the concerns of the community are considered in selecting an effective remedy for each U.S. Virgin Islands Superfund site. To this end, the Proposed Plan and other Site documents have been made available to the public for a public comment period which begins on June 27, 2001 and concludes on July 27, 2001.

A public meeting will be held during the public comment period at the Department of Education Curriculum Center, Centerline Road near St. Croix High School and the Territorial Court Building, Kingshill on July 12, 2001 at 7:00 P.M. to present the conclusions of the RI/FS, further elaborate on the reasons for recommending the preferred alternative, and to receive public comments.

PURPOSE OF THE PROPOSED PLAN

This Proposed Plan describes remedial alternatives considered for the soil and groundwater contamination at the Virgin Island Chemical Superfund Site (the Site) and identifies the preferred remedial alternative along with the rationale for this preference.

The Proposed Plan was developed by the U.S. Environmental Protection Agency (EPA), in consultation with VIDPNR. EPA is issuing the Proposed Plan as part of its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended, and Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The alternatives summarized here are described in the remedial investigation and feasibility study (RI/FS) reports and other documents contained in the Administrative Record file for this Site. EPA encourages the public to review the RI/FS reports and related documents to gain a more comprehensive understanding of the Site and Superfund activities that have been conducted at the Site.

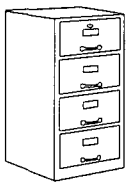
This Proposed Plan is being provided as a supplement to the RI/FS reports to inform the public of EPA's preferred remedy and to solicit public comments pertaining to this alternative.

EPA's preferred remedy consists of Alternative 3, a soil vapor extraction/air sparging (SVE/AS) system to treat soil and groundwater at the Aboveground Storage Tank (AST) area and MNA to address groundwater in the Former Process Pit (FFP) area and downgradient areas.

In addition, EPA is proposing to retain Alternative 4 as a contingency remedy. This Alternative includes the implementation of groundwater extraction and treatment at locations where MNA is proposed under Alternative 3. The contingency remedy would be implemented in the event that an analysis of future groundwater monitoring data indicates that it is needed.

The remedy described in this Proposed Plan is the preferred remedy for the Site. EPA, in consultation with the Virgin Islands Department of Planning and Natural Resources (VIDPNR), will select a final remedy for the Site after the public comment period. Changes to the preferred remedy may be made if public comments or additional data indicate that such a change will result in a more appropriate remedial action. The final decision regarding the selected remedy will be made and documented in a Record of Decision (ROD) after EPA has taken into consideration all comments from the public.

The administrative record file, which contains the information upon which the selection of the response action will be based, is available at the following locations:



Department of Planning and Natural Resources - Division of Environmental Protection
Bldg. 111 - Apartment 14A Water Gut Homes 1118
Christiansted, St. Croix, USVI 00820-5065
Contact: Mr. Syed Syedali
340-773-0565

U.S. Environmental Protection Agency
Federal Building & U.S. Court House
550 Veteran Drive, Room 142
St. Thomas, USVI 00802
Contact: Mr. Jim Casey, Virgin Islands Coordinator
340-714-2333

USEPA Region II, Superfund Records Center
290 Broadway, 18th Floor
New York, New York 10007-1866
(212) 637-4308
Hours: Mon. - Fri., 9 a.m. to 5 p.m.

The Proposed Plan and other Site documents are available at the Information Repository at:

The University of the Virgin Islands
St. Croix Campus Library
Kingshill, St. Croix, U.S. Virgin Islands, 00850
340-692-4130
Hours: Mon. - Thurs. 8 a.m. - 10 p.m.

Comments received at the public meeting, as well as written comments, will be documented in the Responsiveness Summary appended to the Record of Decision, the document which formalizes the selection of the remedy.

Written comments on this Proposed Plan should be addressed to:

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New York, NY 10007-1866
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SCOPE AND ROLE OF ACTION

This Proposed Plan constitutes the final response action for the Site and addresses soil and groundwater contamination in the Aboveground Storage Tank (AST) and Former Process Pit (FPP) areas at the Virgin Island Chemical Superfund Site. The proposed remedy will use a soil vapor extraction/air sparging (SVE/AS) system to treat groundwater, saturated soil, and unsaturated soil at the AST source area and monitored natural attenuation (MNA) for residual groundwater contamination; and an MNA remedy to address groundwater in the FPP area and downgradient areas. The planned action is necessary to protect human health and the environment.

SITE DESCRIPTION AND HISTORY

The Virgin Island Chemical Superfund Site includes a facility known as Plot 13Q (approximately 3.5 acres) of Estate Bethlehem Middle Works in the south-central portion of St. Croix in the U.S. Virgin Islands (see Figure 1). Site access is via Route 66, which traverses the island east and west and abuts the south-southwest boundary of the Site. Plot 13Q is bordered to the north and east by an intermittent stream, the River Gut, which originates north of the Site and drains to the Caribbean Sea. The River Gut joins the Bethlehem Gut approximately 800 feet southeast of the Site. They are collectively then called the Fairplain Gut. The groundwater underlying the Site flows predominantly to the south.

Land use surrounding the Site is mostly industrial and commercial. A water service company and an undeveloped lot exist immediately to the west and northwest of the Site. A concrete batch plant and two automobile repair shops are located east-northeast of the Site, on the opposite side of the River Gut. Two paving companies are located north-northwest of the Site across the River Gut. The Henry Rohlsen Airport (formerly known as the Alexander Hamilton Airport) is situated about 1,500 feet south of the Site and a prison lies 0.25 mile to the northwest. Two residential properties are located about 0.33 mile north and 0.75 mile northwest of the Site, respectively.

The Site is owned by the CHS Holding Corporation and is currently unoccupied and overgrown with heavy vegetation. A chain-link fence was installed in Spring 2000 to encompass the facility boundary and secure the area.

Over half of the Site is covered by buildings and/or process equipment. The following structures remain on-Site (see Figure 2):

- laboratory/warehouse building
- maintenance building
- nine aboveground storage tanks (ASTs) identified as T-3 through T-11, an unlabeled AST, and 11 concrete pads at former AST locations
- production area which housed a centrifuge and dryer building
- stainless-steel and glass reactor areas
- loading dock (former location of laboratory pit)
- concrete storage pad adjacent to the loading dock and next to the scalehouse
- cooling towers

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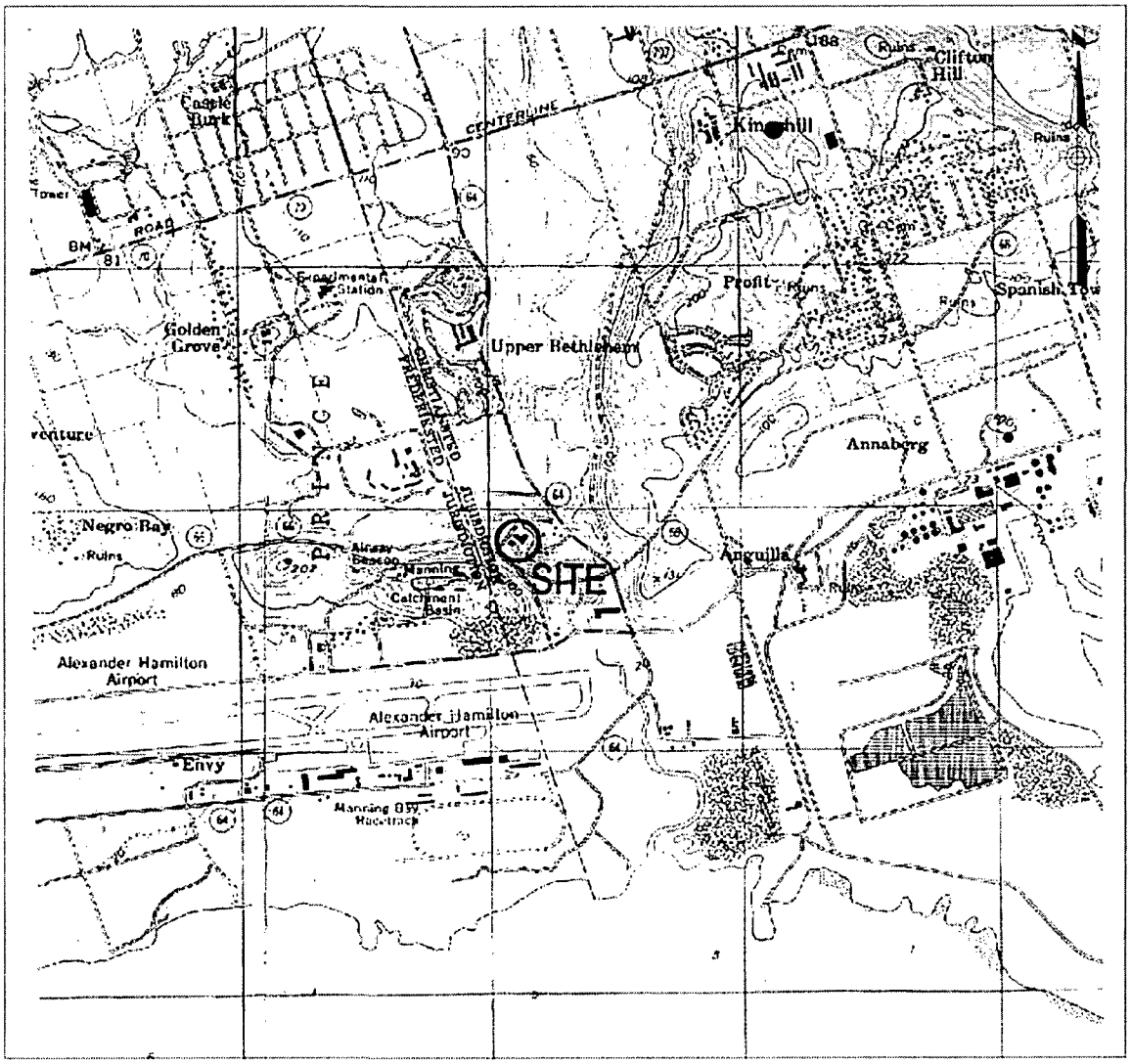

REFERENCE

1.) MAP TAKEN FROM U.S.G.S. 7.5 MINUTE QUADRANGLE OF CHRISTIANSTED, VIRGIN ISLANDS.

2000 0 2000
scale feet

JOB No.: 003-6016	SCALE: AS SHOWN	**SITE LOCATION MAP**	
DSN BY: AM	DATE: 11/07/00		
CHK BY:	FILE No.: USOI-029		
REV BY:	DR SUBFILE: 03		
Golder Associates	VIRGIN ISLAND CHEMICAL SITE	FIGURE	1

Figure 1 - Site Location Map

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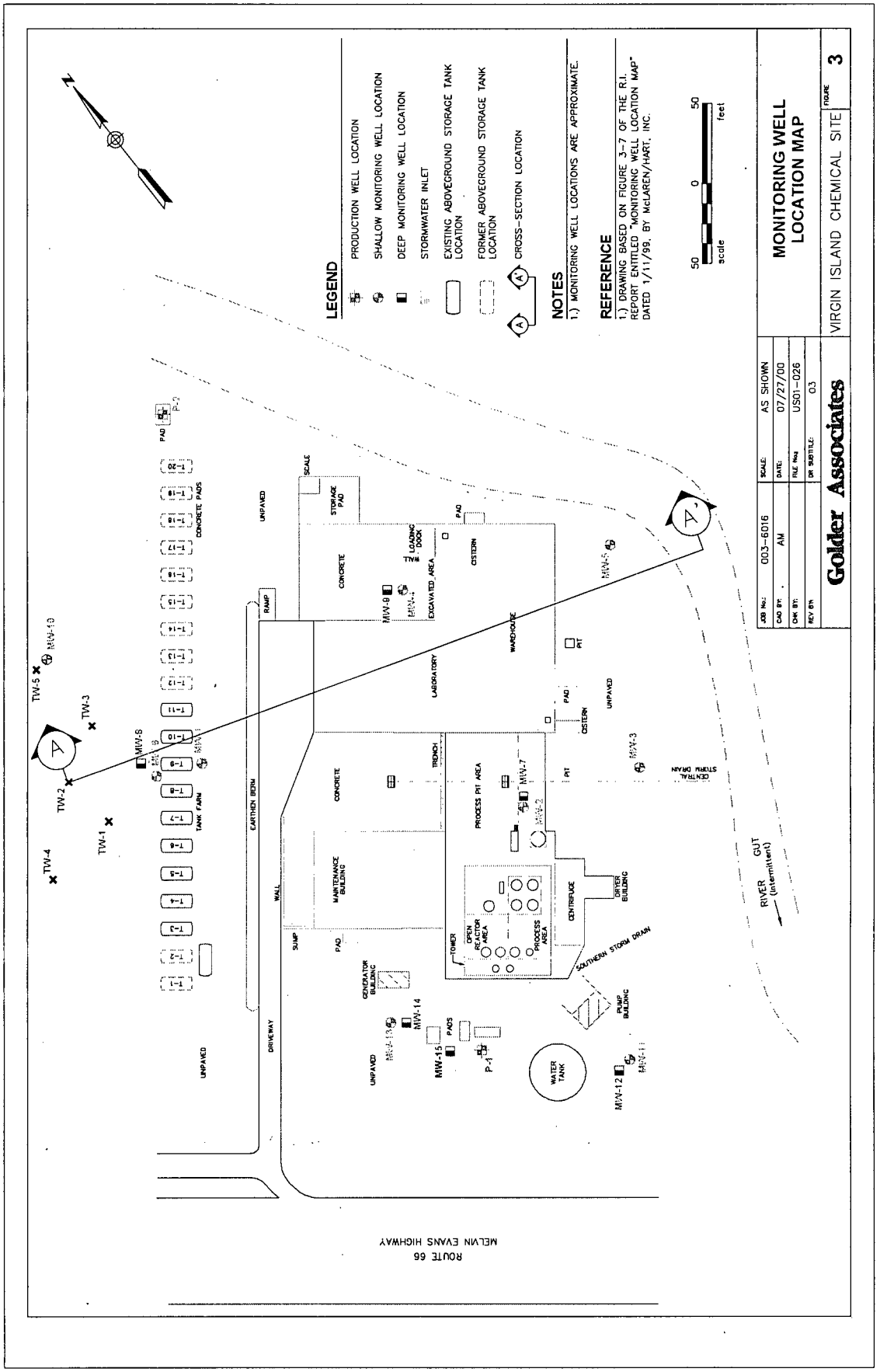

Figure 2 - Site Map

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- generator building
- generator and fire pump building
- two production wells originally used for process water and for the fire fighting system
- one 250,000-gallon fire water AST.

Two storm drains are located on-Site. The Central Storm Drain runs beneath the paved area between the laboratory and maintenance buildings. The Southern Storm Drain, where observed, is a concrete-lined depression along the southern wall of the maintenance building and the edge of the reactor area. Both storm drains discharge to the River Gut.

From 1968 to 1982, the Site was used for a variety of pharmaceutical manufacturing and blending operations under a number of different corporate entities. In general, toluene, pyridine, and quinidine (chemicals used by many of the occupants) represent the historically largest volume spills or other releases at the Site.

In October 1982, EPA was notified of the facility's impending closure and off-Site removal of waste materials. Between 1984 and 1991, several investigations were conducted at the Site by EPA and a former tenant, Island Chemical Company which was acquired by Berlex Laboratories Inc. (Berlex). This investigative work identified six areas of potential environmental concern:

(1) Laboratory and Warehouse Building
(2) Aboveground Storage Tank (AST) Area
(3) Former Process Pit (FPP) Area
(4) Loading Dock/Former Laboratory Pit Area
(5) Soil Beneath Concrete Pad Near ASTs (northern corner of the Site), and
(6) Concrete Storage Pad (north of the laboratory and warehouse buildings).

During the initial assessment stages of the Site by regulatory agencies, both EPA and Berlex conducted several response activities. These activities included soil excavation with on-Site treatment (e.g., drying trays) or off-Site disposal, drum removals, and off-Site disposal of AST contents. On January 31 and February 1, 1989, EPA conducted a removal action at the Site. At that time, the laboratory/warehouse building on-Site was found to contain approximately 400 drums (some extremely deteriorated), leaking cylinders of chlorine and hydrogen chloride, and over 800 containers of laboratory reagents that included sodium metal, potassium cyanide, and ethyl ether. EPA removed 354 drums containing 14,720 gallons of various chemicals and 8,061 pounds of lab pack chemicals from the laboratory/warehouse building.

On January 18, 1994, the Site was placed on the National Priorities List. On October 6, 1994, EPA entered into an Administrative Order on Consent (AOC), Index No. II CERCLA-94-0401, with Berlex and Island Chemical Company. Pierrel S.p.A. later signed on as a Respondent to this AOC. The AOC required the performance of a Remedial Investigation/Feasibility Study (RI/FS) at the Site.

The primary objectives of the RI were to collect the data needed to adequately support human health and ecological baseline Risk Assessments, and to provide a basis on which a subsequent, cost-effective, remedial action plan would be recommended. The following specific data requirements were addressed:

- Background concentrations of inorgainc contaminants in surface soil through sampling and analysis;
- Nature and extent of potential surface and subsurface soil impacts on-Site through sampling and analysis;
- Nature and extent of potential groundwater impacts through monitoring well installation and sampling and analysis;
- Site-specific geologic and hydrogeologic conditions through lithologic evaluation, water level measurements, etc.; and
- Nature and extent of potential soil/sediment contamination in the Gut System (i.e., River, Bethlehem, and Fairplain Guts) through sampling and analysis.

All six areas of potential concern were investigated during the initial assessment and the subsequent RI. Based on the data collected, only the AST and FPP areas were determined to require remediation.

RESULTS OF REMEDIAL INVESTIGATION

Surface Soil

Surface soils were compared to EPA's Soil Screening Levels (SSLs) for protection of groundwater with a Dilution Attenuation Factor of 10, risk-based levels, and site background concentrations. Arsenic was detected (Non-detected to 8.8 part per million (ppm)) above its risk-based level (3.83 ppm), iron was detected (18,100 ppm to 63,400 ppm) above twice the Site background concentration (31,933 ppm), and manganese was detected (311 ppm to 2,100 ppm) above its risk-based level (1,600 ppm) in several samples.

Subsurface Soil

Subsurface soil samples were compared to EPA's SSLs for the migration to groundwater pathway and site background concentrations. Based on these comparisons and the groundwater data collected during the RI, metals and SVOCs were not considered to be a significant concern. The predominant contaminants determined to have

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impacted subsurface soils in the AST area were ethylbenzene (7 parts per billion (ppb) to 320,000 ppb) and xylene (2 ppb to 2,000,000 ppb). The impacted subsurface soils generally encompass an on-Site area between Tanks 3 and 10. The zone of impact was estimated to be approximately 7,800 square feet (sf) in area and to extend from the ground surface to the water table interface (approximately 25 feet below ground surface). The SSLs for ethylbenzene and xylene are 6,500 ppb and 90,000 ppb, respectively.

While concentrations of chloroform were not detected above the SSL of 600 ppb (maximum concentration of chloroform was 410 ppb), this chemical was included as a contaminants of potential concern (COPC) based upon its detection in groundwater. The subsurface soils within a 400-square-foot area, from 20 to 25 feet bgs, near Monitoring Well 2 (MW-2; location where highest concentrations of chloroform were detected in groundwater) were conservatively assumed to be impacted with chloroform.

Groundwater

The following VOCs were detected above the federal Maximum Contaminant Levels (MCLs) in groundwater: ethylbenzene, xylene, and chloroform.

On-Site groundwater quality in the AST area was determined to be impacted by ethylbenzene (700 ppb to 23,000 ppb) and xylene (27,000 ppb to 110,000 ppb). The MCLs for ethylbenzene and xylene are 700 ppb and 10,000 ppb, respectively. In 1998, the area and depth of impact above MCLs were estimated to be approximately 14,000 sf and 50 to 60 feet bgs, respectively, as determined based upon the results of groundwater samples collected from shallow monitoring wells MW-1, MW-6 and MW-10, deep monitoring well MW-8, and multiple geoprobe and temporary well sampling locations. The most recent results from groundwater sampling completed during the period of March to May 2000 indicated that the groundwater plume is not expanding.

On-Site groundwater quality in the FPP area was determined to be impacted by chloroform. In 1998, the area and depth of impact above the MCL of 100 ppb was estimated to be approximately 3,000 sf and 50 to 60 feet bgs, respectively, as determined based upon the results of groundwater samples collected from shallow monitoring wells MW-2 and MW-11, deep monitoring well MW-7, and multiple geoprobe and temporary well sampling locations (96 ppb to 3,800 ppb). The most recent results from groundwater sampling completed during the period of March to May 2000 indicated that chloroform concentrations (38 ppb to 76 ppb) had decreased below its MCL, excluding the localized area of temporary well FPP-VMP-1D.

Chloroform was not detected in any off-Site wells, indicating that chloroform does not appear to be migrating off-Site into local production wells. No other VOCs (i.e., ethylbenzene, xylene) were detected in any of the existing off-Site groundwater wells.

Gut System

Several metals were detected at the upstream reference location (RG-2) in the River Gut. The distribution of these metals was generally variable throughout the Gut System. However, a slight increase in the concentration of certain metals was noted at several locations down stream of the facility and at one location in the Bethlehem Gut.

These elevated concentrations in the River Gut are likely the result of the depositional nature of the locations. No contaminants were detected above EPA SSLs and are not of concern.

Fate and Transport

Although the potential for migration of VOCs of potential concern toward public supply wells exists, natural attenuation of dissolved contaminants is expected to prevent future off-Site migration. The existing data support that VOCs are attenuating as a result of natural processes. Existing groundwater data also support that the AST and FPP area plumes are not expanding.

SUMMARY OF SITE RISKS

Based upon the results of the RI, a baseline risk assessment was conducted to estimate the risks associated with current and future Site conditions. A baseline risk assessment is an analysis of the potential adverse human health and ecological 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.

Human Health Risk

An evaluation was made of all potential exposure routes which could cause exposure to chemicals of potential concern at the Site for people living or working in the area.

Under a future land use scenario, the cumulative carcinogenic risk estimates for exposure to groundwater for the industrial/commercial worker (9×10^{-4}), the adult resident (8×10^{-4}) and the child resident (4×10^{-4}) exceed EPA's target risk range. These exposure scenarios assumed that the on-Site groundwater would be used as a potable water source for drinking and bathing. Inhalation of volatilized chloroform accounts for most of the cumulative risk for this medium. Although the maximum detected concentrations of ethylbenzene and xylene exceeded their respective MCLs in the AST area, the results of the human health risk assessment showed that exposure to these two COPCs over time did not present unacceptable risks or hazards to human health based upon their levels of detection throughout the entire Site.

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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 used for assessing site-related human health risks for reasonable maximum exposure scenarios.

Hazard Identification: In this step, the contaminants of potential concern (COPCs) at a site in various media (i.e., soil, groundwater, surface water, and air) are identified based on such factors as toxicity, frequency of occurrence, 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. Factors relating to the exposure assessment include, but are not limited to, the concentrations that people might be exposed to and the potential frequency and duration of 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 (dose) and severity of adverse effects (response) are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other noncancer health effects, 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 effects.

Risk Characterization: This step summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site risks. 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 explained in the Exposure Assessment. Current Superfund guidelines for acceptable exposures are an individual lifetime excess cancer risk in the range of 10^{-4} to 10^{-6} (corresponding to a one-in-ten-thousand to a one-in-a-million excess cancer risk) with 10^{-6} being the point of departure. For noncancer health effects, a "hazard index" (HI) is calculated. An HI represents the sum of the individual exposure levels compared to their corresponding reference doses. The key concept for a noncancer HI is that a "threshold level" (measured as an HI < 1) exists below which noncancer health effects are not expected to occur.

For the evaluation of noncancer human health hazards, potential future industrial/commercial and residential groundwater use exceeded EPA's target hazard index of 1. For the industrial/commercial worker exposure and both residential scenarios, chloroform was the major contributor. Both adult and child residential Hazard Indices (HI) exceeded 1 (255 and 600, respectively), as did the industrial/commercial worker (330). Ingestion and inhalation of chloroform contributed to virtually all of the noncancer hazard for the industrial/commercial worker and residential groundwater use scenario. Ingestion of iron and manganese also contributed less significantly to the hazard estimates.

On-Site surface soil and soil/sediment in the Gut System did not demonstrate carcinogenic risks for the adult industrial/commercial worker, adult and pre-adolescent trespassers and construction workers above the EPA's target risk range. Noncancer hazards were near or below EPA's HI 1. For the construction worker scenario, the total HI was 1.2, although no individual chemical exceeded the HI of one. Arsenic, iron and manganese were included in the human health risk assessment. However, all risks and hazards associated with exposure to these chemicals are within EPA's acceptable levels and are not considered to be a health concern.

In summary, chloroform in the groundwater is the main risk and hazard driver for the industrial/commercial worker and the adult and child resident for the future land use scenario, with methylene chloride and arsenic contributing to the risk as well. Other noncancer hazard drivers include manganese and iron in the groundwater. Ethylbenzene and xylene did not significantly contribute to the calculated risks, as described above; however, these compounds exceed their respective MCLs in groundwater in the AST area and therefore present a human health risk in the AST area.

Environmental Concerns

A Screening Ecological Risk Assessment (SERA) focused on the drainage channels adjacent and downstream of the Site, including the River Gut (which serves as the northeastern and southeastern Site boundary), Bethlehem Gut, and Fairplain Gut. The SERA was developed using data obtained through a surface soil/sediment sampling program conducted within the three drainage channels.

In general, aluminum exposure may potentially impact herbivorous, insectivorous, and piscivorous wildlife foraging in the River, Bethlehem, and Fairplain Guts. Aluminum, chromium, vanadium and zinc, identified for plants, measured adjacent to or downstream of the Site were found at similar or lower concentrations to that measured at the upstream reference location (RG-2). This finding suggests that the contaminants of potential ecological concern have been transported from upgradient sources. Historical (1986)

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and current (1997) data for soil collected from the Central and Southern Storm Drains suggest that several metals (e.g., aluminum, manganese, and zinc) may have been historically discharged to downstream areas of the River Gut (near sample location RG-13).

Ecological Risk Assessment

A four-step process is used for assessing site-related ecological risks for a reasonable maximum exposure scenario:

Problem Formulation: A qualitative evaluation of contaminant release, migration, and fate; identification of chemicals of concern, receptors, exposure pathways, and known ecological effects of the contaminants; and selection of endpoints for further study.

Exposure Assessment: A quantitative evaluation of contaminant release, migration, and fate; characterization of exposure pathways and receptors; and measurement or estimation of exposure point concentrations.

Ecological Effects Assessment: Literature reviews, field studies, and toxicity tests, linking contaminant concentrations to effects on ecological receptors.

Risk Characterization: Measurement or estimation of both current and future adverse effects.

The potential contribution of aluminum has decreased over the years, as evidenced by the substantial reduction in concentrations measured in 1997, as compared to 1986. In addition, the aluminum concentrations measured in soil from the storm drains collected in 1997 were similar to those measured in soil collected from the River Gut upstream of the drain discharge points. Therefore, a current on-Site source of aluminum to the River Gut is unlikely. The Bethlehem Gut, which contained the second highest concentration of aluminum, also is a potential source of exposure in the Fairplain Gut. A bauxite plant is located in close proximity to the Site and serves as a likely source of the aluminum concentrations detected on-Site and off-Site. Furthermore, the aluminum concentrations in soil within the guts were within the range of concentrations found worldwide.

REMEDIAL ACTION OBJECTIVES

This Proposed Plan addresses soil and groundwater contamination in the Aboveground Storage Tank (AST) and Former Process Pit (FPP) areas at the Virgin Island Chemical Site. The Remedial Action Objectives (RAOs) for the Site are to:

- Mitigate the toxicity, mobility, and/or volume of VOCs (notably ethylbenzene and xylene) in soils in the AST area so as to minimize continued leaching to groundwater;
- Mitigate the toxicity, mobility, and/or volume of VOCs (notably ethylbenzene and xylene) in shallow groundwater in the AST area and downgradient so as to achieve MCL's and protect potential future groundwater users;
- Mitigate the toxicity, mobility, and/or volume of chloroform in shallow groundwater in the FPP area and downgradient so as to achieve MCL's and protect future potential groundwater users;
- Restrict groundwater use on-Site for potable purposes until the quality is restored to MCLs; and,
- Restrict the use of the Site to non-residential purposes until the soil and groundwater quality are restored.

SUMMARY OF ALTERNATIVES

Based on the results of the RI, EPA evaluated five alternatives that would address soil and groundwater contamination at the Virgin Island Chemical Site.

As part of evaluating alternatives, an SVE/AS pilot study was performed during the spring of 2000 at both the AST and FPP areas to better assess the effectiveness of SVE/AS treatment in these areas. The results of the pilot test supported the following conclusions:

- SVE/AS would be effective technology for removing ethylbenzene and xylene from the AST source area soils and groundwater. AS treatment would also enhance the conditions for aerobic biodegradation of these contaminants.
- SVE/AS would not be effective for treatment of the FPP area, based upon the low air permeability of soils and the low chloroform concentrations remaining in the soils and groundwater in this area. The results of groundwater samples collected prior to, during, and after SVE/AS testing further indicated that the chloroform concentration in groundwater has decreased since 1998 to below its MCL as a result of natural attenuation, excluding a localized area near temporary monitoring well FPP-VMP-1D.

Following completion of the pilot study, five alternatives were developed for evaluation. One alternative evaluated monitored natural attenuation (MNA). Two alternatives evaluated soil vapor extraction/air sparging (SVE/AS), combined with MNA in one case and groundwater extraction and treatment in the other case. Groundwater extraction and treatment with MNA was evaluated as the remaining alternative. All of these alternatives included institutional controls. As required by CERCLA, a No Further Action alternative was evaluated as a basis for comparison with the

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other active cleanup methods. The following section describes the alternatives considered.

Alternative 1: No Further Action

Under the No Further Action alternative, no new response actions would be initiated at the Site. The security fence installed in Spring 2000 would remain and be maintained, but the existing SVE/AS system installed for the treatability study in Spring 2000 would be rendered non-operational. The potential risks associated with the contamination would not be minimized by this action.

- Incurred capital costs of existing fence: $45,000
- Estimated present worth O&M costs: $12,000
- Total estimated present worth cost: $57,000

Based upon 30 years of maintenance

Alternative 2: Monitored Natural Attenuation (MNA) with Institutional Controls

Alternative 2 would include MNA for COPCs in groundwater in the AST area and FPP area.

Under this alternative, shallow groundwater conditions would be monitored over a period of 15 years using existing wells at the Site, plus additional monitoring wells would be installed at the AST and FPP areas.

The following parameters would be monitored: ethylbenzene and xylene isomers (AST area only), chloroform and dichloromethane (FPP area only), dissolved oxygen, reduction/oxidation (redox) potential, total organic carbon, ferrous iron, sulfate, sulfide, and methane. The monitoring frequency is assumed to consist of quarterly sampling for Year 1, semiannual sampling for Years 2 and 3, and annual sampling thereafter to Year 15.

Institutional controls, which would be implemented at the Site to reduce the potential for human exposure to contaminants, will restrict groundwater use until MCLs are achieved.

- Estimated capital costs: $116,560
- Estimated present worth O&M costs: $545,530
- Total estimated present worth cost: $662,000

Alternative 3: Source Control via Soil Vapor Extraction/Air Sparging (SVE/AS) with MNA and Institutional Controls

In addition to the institutional controls identified in Alternative 2, this alternative includes:

The existing SVE/AS system to treat groundwater, saturated soil, and unsaturated soil at the AST source area.

For the AST area, Alternative 3 includes using the existing air sparging system for volatilizing VOCs in shallow groundwater and the soil vapor extraction system to capture sparged vapors from the groundwater and to remove VOCs in the soils above the water table. Additional air sparging /soil vapor extractions wells may be installed to remediate contaminated groundwater and soil in the AST area.

This alternative includes periodic monitoring of the SVE/AS system. Alternative 3 assumes one year of SVE/AS operation to achieve the SSLs in soils and three years of groundwater monitoring in the AST area to assure that MCLs are achieved in groundwater.

For the FPP area, MNA would be implemented for low-level residual VOC contamination in groundwater. Alternative 3 includes the same sampling scheme for groundwater monitoring as stated in Alternative 2 for an assumed 15 years.

- Incurred capital costs: $ 565,000
- Estimated additional capital costs: $ 285,760
- Estimated present worth O&M costs: $ 565,860
- Total estimated present worth cost: $1,416,620

Alternative 4: SVE/AS with Groundwater Extraction and Treatment and Institutional Controls

In addition to the institutional controls identified in Alternative 2, this alternative includes:

SVE/AS to treat groundwater, saturated soil, and unsaturated soil at the AST source area and

A groundwater extraction and treatment system to treat impacted groundwater at the FPP area.

The SVE/AS portion of the remedy in the AST area would be the same as described in Alternative 3.

At the FPP area, the groundwater extraction system would be comprised of two extraction wells located approximately 70 feet apart. Each well would be equipped with a submersible pump. The primary extraction well would be located in the area where the highest concentrations of chloroform in groundwater were historically encountered. The secondary extraction well would be located downgradient of the first well. The combined capture zone from both wells would encompass the FPP area and the historic extent of the chloroform plume.

The treatment system would consist of a storage/equalization tank, from which groundwater would be pumped to a low profile air stripper for removal of chloroform. Treated water would be discharged via pipeline to the River Gut.

The groundwater treatment and extraction would operate for a five-year period.

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Alternative 4 includes the following monitoring scheme:

- Pre- and post-air stripper water sampling to evaluate removal efficiency in the air stripper and compliance with surface water discharge limits;
- Periodic air flow monitoring to ensure sufficient air flow from the blower for mass transfer in the stripper;
- Monitoring of differential pressure across the air stripper, in addition to periodic visual inspection of the trays to evaluate whether fouling or other impediments to air flow have occurred;
- Calculation of mass emissions from the air stripper by using the measured concentrations of chloroform in the influent water and treated water and the flow rate from the storage tank to the stripper.
- Assessment of the cone of depression and extent of capture zone induced by the extraction wells by measuring water levels at new and existing groundwater monitoring wells.

Alternative 4 includes the same sampling scheme for groundwater monitoring described in Alternative 2. It was assumed that monitoring would continue through the operation of the extraction system (i.e., until the attainment of MCLs), plus two years of post-shutdown monitoring.

- Incurred capital costs: $ 565,000
- Estimated additional capital costs: $ 654,240
- Estimated present worth O&M costs: $ 877,330
- Total estimated present worth cost: $2,096,570

Alternative 5: Groundwater Extraction and Treatment with MNA and Institutional Controls

In addition to the institutional controls identified in Alternative 2, this alternative includes:

MNA for impacted groundwater in the FPP area, and a groundwater extraction and treatment system to capture and treat impacted groundwater at the AST area.

At the FPP area, the MNA portion of the remedy would be the same as described in Alternative 2.

At the AST area, the groundwater extraction system would consist of two extraction wells located within the zone of highest xylene and ethylbenzene impacts. The expected combined capture zones of these wells would encompass the entire AST area and the extent of the xylene and ethylbenzene plumes.

The treatment system would be comprised of the same components and be subject to the same monitoring scheme as described in Alternative 4. Treated water would be discharged to the River Gut at a location northeast of the AST area.

Alternative 5 includes the same sampling scheme for groundwater monitoring as identified in Alternative 2. In the FPP area, the assumed duration of monitoring would be 15 years. In the AST area, the duration of monitoring would be seven years (i.e., five years during extraction system operation and two years of post-shutdown monitoring).

- Incurred capital costs: $ 565,000
- Estimated additional capital costs: $ 556,480
- Estimated present worth O&M costs: $1,030,370
- Total estimated present worth cost: $2,151,850

EVALUATING REMEDIAL ALTERNATIVES

In selecting its preferred alternative, EPA uses nine NCP criteria to evaluate the viable remedial alternatives developed in the FS for the Site. The detailed analysis consists of an assessment of the individual alternatives against each of the nine evaluation criteria and a comparative analysis focusing upon the relative performance of each alternative against those criteria.

COMPARATIVE ANALYSIS

The following section presents a comparative analysis of the remedial alternatives based upon seven of the NCP evaluation criteria. Territory and community acceptance will be addressed during the public comment period.

Overall Protection of Human Health and the Environment

The No Further Action alternative does not address risks to future on-Site workers.

All of the remaining alternatives include a monitoring component to evaluate the protectiveness of the remedy. Although natural attenuation would still occur under the No Further Action alternative, there would be no verification or measure of the extent to which these processes are occurring.

Alternative 3 would be more effective than MNA alone (Alternative 2) in overall protection of human health, since the inclusion of SVE/AS would remove mass from the AST source area more quickly and reduce the amount of time to achieve MCLS and SSLs. Similarly, Alternative 3 would be more effective than Alternative 5 in three ways: (1) SVE would rapidly remove and reduce the contaminant source in the unsaturated zone, whereas groundwater extraction alone would not address the unsaturated zone; (2) AS is expected to be more effective at removing contaminated groundwater than conventional groundwater extraction and treatment based upon the localized nature of contaminant distribution, higher silt/clay content of the Site soils, and poor yield of the shallow aquifer. AS would also better facilitate aerobic biodegradation processes via introduction

of air; and (3) SVE/AS would be more readily implemented considering that a system is already in place from the pilot study.

With respect to Alternative 4, the existing groundwater data support that cleanup via groundwater extraction and treatment in the FPP area would occur no more rapidly than via natural attenuation (included as a component in Alternatives 1, 2, 3, and 5). The groundwater data from Spring 2000 indicate that only one temporary monitoring point exhibits chloroform concentrations above its MCL. These findings support that natural attenuation is adequately protective without the need for any active extraction system.

Compliance with ARARs

The No Further Action alternative does not include a monitoring component to verify compliance with chemical specific ARARs for groundwater or soil. Alternatives 1 and 2 would not achieve compliance with chemical-specific ARARs in the AST area within a timeframes that is comparable to that offered by other active remedial alternatives based upon the presence of a residual source. All other alternatives can be implemented to achieve and verify compliance with ARARs.

Long-Term Effectiveness and Permanence

Alternatives 1 and 2 will not provide long-term protection against the risks posed by contaminated groundwater and soils in the AST area. Also, Alternative 1 does not provide a monitoring component to verify the long-term effectiveness of natural attenuation. Alternative 2 will allow Site contaminants to remain in the AST area for a greater period of time than Alternatives 3, 4 and 5. However, off-Site risks to human health and the environment are not expected with any alternative. A permanent remedy will be achieved more quickly by Alternatives 3 and 4, since contaminant mass will be removed more quickly from the AST area soil and groundwater, rather than by reliance on solely natural biological and physical processes. Alternatives 3, 4 and 5 are expected to perform similarly in the FPP area over the long-term, based upon the low concentrations of chloroform remaining in soil and groundwater.

Reduction of Toxicity, Mobility, and Volume through Treatment

Alternatives 1 and 2 do not include remedies that involve active treatment in the AST or FPP areas. Therefore, these alternatives would not actively reduce contaminant toxicity, mobility, or volume. Passive reduction would occur in both areas as a result of natural attenuation processes.

For Alternatives 3 and 5, active source control and contaminant mass removal would occur via SVE/AS or groundwater extraction in the AST area, but would not occur in the FPP area. Alternative 4 would control and

NCP Evaluation Criteria

(1) Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each exposure pathway (based on a reasonable maximum exposure scenario) are eliminated, reduced, or controlled through treatment, engineering methods, or institutional controls (e.g. access restrictions).

(2) Compliance with applicable or relevant and appropriate requirements (ARARs) addresses whether or not a remedy would meet all of the applicable or relevant and appropriate requirements of other federal and state environmental statutes and regulations or provide grounds for invoking a waiver.

(3) Long-term effectiveness and permanence refer to the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met. It also addresses the magnitude and effectiveness of the measures that may be required to manage the risk posed by treatment residuals and/or untreated wastes.

(4) Reduction of toxicity, mobility, and volume through treatment is the anticipated performance of the treatment technologies, with respect to these parameters, a remedy may employ.

(5) Short-term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

(6) Implementability is the technical feasibility (e.g., the difficulty of the alternative to construct and operate) and administrative ease (e.g., the amount of coordination with other government agencies) of a remedy, including the availability of necessary materials and services.

(7) Cost includes estimated capital and operation and maintenance costs, and net present-worth costs.

(8) Territory acceptance indicates whether, based on its review of the RI/FS reports and the Proposed Plan, the Territory concurs with, opposes, or has no comment on the preferred remedy at the present time.

(9) Community acceptance will be assessed in the Record of Decision, and refers to the public's general response to the alternatives described in the Proposed Plan and the RI/FS reports.

remove contaminant mass at both the FPP and AST areas using SVE/AS treatment and groundwater extraction and treatment, respectively. However, the relative reduction achieved in the FPP area by Alternative 4 would be comparable to that offered by natural attenuation under Alternatives 1, 2, 3, and 5, based upon the low concentrations and limited mass of contamination present in the FFP area.

Alternatives 3 and 4 would also provide secondary reduction of toxicity, mobility, and volume through treatment by enhancing natural biodegradation processes that will reduce ethylbenzene and xylene mass in the AST area.

Short-Term Effectiveness

The relative short-term effectiveness provided by Alternatives 1 and 2 is comparable and greater that provided by Alternatives 3, 4 and 5, because Alternatives 1 and 2 do not involve the completion of intrusive remedial construction work within areas containing contaminated groundwater or soils.

Alternatives 3, 4 and 5 include the construction of an active remediation systems in the AST and/or FPP areas. A limited amount of intrusive construction work (i.e., new SVE/AS wells, groundwater extraction wells, new monitoring wells/points) will be required for these alternatives, within areas containing contaminated groundwater and/or soils, to complete remedial system installation. This work can be completed using conventional construction equipment and techniques and standard measures to ensure worker health and safety. The relative short-term effectiveness achieve by Alternatives 3 is greater than that achieved by Alternatives 4 and 5, because a pilot SVE/AS system is already in-placed and would only require minor modifications for full-scale implementation. The relative effectiveness provided by Alternatives 4 and 5 is comparable, since both require the installation of groundwater extraction and treatment systems.

Implementability

In general, all five alternatives are implementable. Alternative 1 is the simplest to implement, followed in order of ease by Alternatives 2, 3, 5, and 4, considering that an operational SVE/AS system for Alternative 3 already exists at the Site. However, materials, services, and equipment associated with the implementation of each remedial alternative are generally available on the U.S. mainland and on larger islands, such as Puerto Rico. Certain units, such as the low profile air stripper (i.e., Alternatives 4 and 5) and associated spare parts are somewhat less widely available, and would need to be manufactured and shipped from the U.S. mainland, necessitating a longer lead time. Also, Alternatives 3, 5, and 4 (in that order) are increasingly more intensive in terms of operation and maintenance than Alternatives 1 and 2. Finally, although a security fence is present at the Site and would be maintained under all alternatives, vandalism and theft are significant concerns. Thus the potential for theft of equipment installed under Alternatives 3, 4, and 5 could inhibit the implementability of these alternatives.

Cost

Costs for each remedial alternative increase in the following order: Alternative 1, Alternative 2, Alternative 3, Alternative 5, and Alternative 4. However, most of the capital costs for the SVE/AS system associated with Alternatives 3 and 4 have already been incurred as a result of the pilot SVE/AS system.

EPA'S PREFERRED ALTERNATIVE

In summary, based on the information available at this time, EPA is proposing Alternative 3, Source Control via Soil Vapor Extraction/Air Sparging with Monitored Natural Attenuation and Institutional Controls. This alternative is preferred because it represents the best balance of tradeoffs among the other alternatives with respect to the NCP criteria. EPA believes the preferred alternative will provide overall protection of human health and the environment; afford a permanent remedy; be readily implemented given that an operational SVE/AS system for Alternative 3 already exists, and offer a cost-effective solution that meets the cleanup goals for the Site.

In addition, EPA is proposing to retain Alternative 4 as a contingency remedy. This alternative includes the implementation of groundwater extraction and treatment at locations where Monitored Natural Attenuation is proposed under Alternative 3. The contingency remedy would be implemented in the event that the analyses of future groundwater monitoring data indicate that it is needed.

NEXT STEPS

EPA will present the results of the RI and FS as well as the preferred alternative at the public meeting on July 12, 2001. Questions and comments received at the public meeting and during the public comment period will be addressed in a Responsiveness Summary. Based upon these public comments, EPA, in consultation with VIDPNR, may modify the preferred alternative or select another remedial alternative presented in this Proposed Plan. The Responsiveness Summary will be appended to a Record of Decision for the Site, which will reflect EPA's final decision regarding the selected remedy.

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