8-23-1991

ROHM AND HAAS DVI, BRISTOL FACILITY
BRISTOL LANDFILL
STATEMENT OF BASIS

INTRODUCTION:

This Statement of Basis for the Rohm and Haas DVI Bristol Landfill (hereinafter the "Landfill") explains the preferred corrective measure alternatives (CMAs) which have tentatively been selected by the Environmental Protection Agency (EPA) for the Landfill which was used by the Rohm and Haas DVI Facility (Facility) from approximately 1952 through 1975. The Landfill is located on property owned by Rohm and Haas Delaware Valley Inc. (Rohm and Haas DVI) and on properties now owned by Chemical Properties, Inc. and Bristol Township Authority (BTA) at Route 413 and Old Route 13, Bristol. In addition, this Statement of Basis includes summaries of other CMAs which were analyzed for the Landfill. EPA will select a final CMA for the Landfill only after the public comment period has ended and the information submitted during the comment period has been reviewed and considered. The public comment period includes a public meeting. The public meeting is scheduled for 7:00 p.m., Thursday, September 19, 1991 and will be held at:

FDR Jr. High School
800 Coates Avenue
Bristol, PA 19007

The preferred CMAs which EPA has tentatively selected are listed below. The areas described below are depicted in Figure 1:

BTA Portion of Landfill Area A: Consolidate most wastes into Rohm and Haas DVI's portion of Landfill Area A (Corrective Measure Alternative BTA 3);

Remaining Portion of Landfill Area A (including Chemical Properties, Inc. property): Impermeable Cap, Complete Cutoff Wall with Diversion Trench, Groundwater Management and Enhanced Remediation of the Southeast Area (Corrective Measure Alternative A12);

Landfill Area B: Impermeable Cap and Complete Cutoff Wall with Groundwater Management (Corrective Measure Alternative B4); and

Landfill Area C: Soil Cap and Levee (Corrective Measure Alternative C2).

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Landfill Area C: Soil Cap and Levee (Corrective Measure Alternative C2).

Further information on the evaluation of these remedies is contained in the later part of this document.

This document summarizes information which can be found in greater detail in the Corrective Measures Study report, the Landfill Remedial Investigation Report Addendum and other reports and documents contained in the Administrative Record file for the Landfill, a copy of which is available for review at the Margaret R. Grundy Memorial Library, 680 Radcliffe Street, Bristol, Pennsylvania and the offices of EPA Region III, 841 Chestnut Building, Philadelphia, Pennsylvania. EPA encourages the public to review these other documents to gain a more comprehensive understanding of the Landfill and investigations which have been conducted there. Persons desiring more information regarding the corrective measure alternatives should consult the EPA Project Coordinator, Diane B. Schott, at the address/telephone number given on page 22 of this document.

EPA may modify the preferred CMAs or select another CMA based on new information or public comments. Therefore, the public is encouraged to review and comment on all alternatives, including alternatives not previously studied. The public can be involved in the CMA selection process by reviewing the documents contained in the Administrative Record file and attending the public meeting scheduled for 7:00, Thursday, September 19, 1991 at FDR Jr. High School located at 800 Coates Avenue, Bristol, PA. Comments on this document should be sent to the attention of Diane Schott.

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FACILITY BACKGROUND:

The Rohm and Haas DVI Facility (Facility) is an active manufacturing plant located adjacent to the Delaware River in Bucks County, Pennsylvania. The Facility, which has been in operation since 1917, has produced a variety of compounds including hydrosulfites, plexiglas, acrylate and methacrylate compounds, detergents and additives for hydraulic fluids and various pesticides. Plastics and emulsions are currently manufactured at the Facility. This Statement of Basis addresses the Landfill which was used by the Facility from approximately 1952 through 1975. The Landfill, depicted in Figure 1, is comprised of three landfill areas: Landfill Area A, Landfill Area B, and Landfill Area C. Hog Run Creek flows between Landfill Area A and Landfill Areas B and C. Portions of Landfill Area A are located at the Facility and on property currently owned by BTA and Chemical Properties, Inc..

In 1980, groundwater and surface water samples taken in the vicinity of the Landfill indicated the presence of several volatile and base neutral organic hazardous wastes and/or hazardous constituents. In April 1984, Rohm and Haas DVI submitted its first report on investigation of the Landfill to EPA. The report revealed contamination of the groundwater, surface water, and soil within the Landfill.

In 1985, EPA proposed the Rohm and Haas DVI Bristol Landfill for inclusion on the Superfund National Priorities List (NPL). At that time, facilities placed on the NPL were to be addressed pursuant to EPA's authorities under the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, (CERCLA, otherwise known as Superfund), 42 U.S.C. §§ 9601 et seq. However, in 1984, the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. §§ 6901 et seq., was amended to allow EPA to address contamination at certain hazardous waste facilities using RCRA authorities. Additionally, on June 24, 1988, EPA finalized the RCRA/NPL Listing Policy, which further defined EPA's ability to address NPL sites under RCRA. Such sites may be addressed under RCRA if the facility where the site is located ever is subject to Interim Status[1] to operate a hazardous waste facility under RCRA. As a result of these revisions to the RCRA statute and policy, Rohm and Haas DVI requested that the investigation of contamination and study of corrective measure alternatives be addressed using RCRA authorities.

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[1] Facilities which submitted a "Notification of Hazardous Waste Activity" and "Part A" of the application for operating a hazardous waste facility in 1980 are qualified for Interim Status under RCRA.

On February 6, 1989, EPA and Rohm and Haas DVI entered into a Consent Order pursuant to Section 3008(h) of RCRA, 42 U.S.C. § 6928(h). Under the terms of this Consent Order ("Order"), Rohm and Haas DVI was required to complete an investigation on the nature and extent of contamination and on various cleanup alternatives for the Landfill, as well as for the Facility. As a result of the transfer of oversight of the Landfill to the RCRA program, EPA deleted the Landfill from the proposed NPL under the CERCLA program in August, 1989.

For the purposes of facilitating an investigation of the entire Facility under the Order, the 800 acre property has been divided into five study areas identified as the Landfill, the Trailer Staging Area, the Ammonium Sulfate Area, the Manufacturing Area, and the Wastewater Treatment Plant. Rohm and Haas DVI has completed investigations for the Landfill and has submitted to EPA for approval a Corrective Measure Study (CMS) which evaluates Corrective Measure Alternatives (CMAs) for contaminant remediation for the Landfill. This Statement of Basis addresses the remediation of the Landfill only. When a tentative selection for remediation of the other study areas is made, public comments will be requested for those areas.

The Landfill occupies approximately 120 acres. Landfill Area A is approximately 38 acres in size and contains most of the refuse and process wastes generated by the Rohm and Haas Bristol and Croyden chemical manufacturing plants from 1952 to 1975 and some wastes from the Philadelphia chemical manufacturing plant. Some refuse from the Bristol Township community and sewage from the Levittown Sewage Treatment Plant and the BTA Sewage Treatment Plant is also contained in Landfill Area A. Waste was buried in Landfill Area A in trenches or in layers. Drums and other containers were crushed at the time of disposal. Currently, the BTA and Chemical Properties, Inc. own portions of the land where Landfill Area A exists. Rohm and Haas waste materials were deposited at the current location of the BTA portion of Landfill Area A from approximately 1952 to 1963. The wastes materials placed on the portion of Landfill Area A were oil additives filter cake, trickling filter sludge, and enzyme filter cake. In 1986 and 1987, approximately 11,700 cubic yards of waste and soil in from the BTA portion of Landfill Area A was moved within Landfill Area A to the Rohm and Haas DVI portion of Landfill Area A. The consolidation of waste onto the Rohm and Haas DVI property was completed to accomodate a planned expansion of the BTA sewage treatment plant on the BTA property.

Disposal records indicate that waste materials were placed in Landfill Areas B and C from approximately 1965 through 1975. Landfill Area B is approximately 11 acres in size and contains drummed and bulk emulsion wastes and drummed solution polymer wastes and still bottoms. An estimated 20,000 drums containing waste materials were placed uncrushed into Landfill Area B.

These wastes were disposed of in trenches in approximately 4.5 acres of Landfill Area B. Landfill Area C is approximately 8 acres in size. Liquid "white water" from the Rohm and Haas DVI wastewater treatment plant was placed in two shallow (1 foot) containment areas for evaporation and settling in Landfill Area C. In addition, coagulated sludge material from the Rohm and Haas wastewater treatment plant sand beds was placed in Landfill Area C along with some miscellaneous manufacturing debris. Waste material is present on the soil surface within Landfill Area C.

EPA developed the preferred remedies in the following manner. Various investigations which were previously completed by Rohm and Haas DVI were reviewed for content and quality of information. Subsequent additional investigation was completed under EPA oversight. Following completion of the investigation, a risk assessment of investigated areas was completed. Through the risk assessment, the Landfill's impact on public health and the environment was determined and the requirements for corrective measures were identified. Subsequently, corrective measure alternatives were identified and screened in a Corrective Measure Study. The various investigations conducted by Rohm and Haas DVI and reviewed by EPA show that:

1) Surface water drainage from the Landfill is received by Hog Run Creek or the Delaware River.

2) The Landfill is underlain by unconsolidated alluvial or water-deposited sediments which range between 20 and 60 feet in thickness. The unconsolidated sediments overlie Precambrian age Wissahickon schist bedrock. The top of the bedrock consists of weathered schist and is termed saprolite.

3) The water table depicted in Figure 2 ranges from 1 to 11 feet below the Landfill surface.

4) All groundwater flowing from the Landfill discharges either directly to the Delaware River or indirectly to the Delaware River via Hog Run Creek. The average landfill groundwater discharge volume has been calculated to be approximately 60 to 100 million gallons annually. It is estimated that approximately one-quarter of the annual groundwater discharge is to Hog Run Creek and the remaining three-quarters is directly to the Delaware River. A portion of groundwater in the northwest section of Landfill Area A discharges to the west for an undefined distance before migrating toward the Delaware River or Hog Run Creek. The groundwater is not known to be used for any purpose at the current time.

5) Three geophysical surveys consisting of a magnetic survey, a terrain conductivity survey and a radar survey provided information on the location and depth of waste materials in the Landfill. Test pits in November of 1984 confirmed the findings of the geophysical surveys on the location and depth of waste materials. Twelve of the 21 test pits in Area A contained drums. Of the approximately 44 drums found in the test pits of Area A, nine were intact. Three test pits in Area B contained drums. Of the approximately 24 drums found in the test pits in Area B, 23 were intact. No drums were found in any of the eight test pits in Area C. In test pits constructed in Area B in 1991 to determine if additional releases from the remaining intact drums would create an unacceptable risk, it was difficult to locate 40 intact drums to sample to calculate the risk.

6) Rohm and Haas DVI waste materials were found buried below the normal water table over approximately 28 percent of Landfill Area A owned by Chemical Properties, Inc.

7) Rohm and Haas DVI waste materials remain in the subsurface of the Bristol Township Authority (BTA) property.

8) Metals were detected in groundwater in concentrations which exceeded EPA Primary Drinking Water Standards (40 C.F.R. Part 141) at some groundwater wells in each Landfill Area, including the BTA portion of Landfill Area A.

9) Organic priority pollutant compounds were detected at concentrations ranging from trace to several thousand parts per billion in some groundwater wells in Landfill Areas A and B. In Landfill Area C, organic priority pollutant compounds were detected in low concentrations in a couple of groundwater wells. The following organic compounds were detected in groundwater in concentrations which exceeded Maximum Contaminant Levels (MCLs[2]) at the noted Landfill Areas:

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[2] MCLs are federally enforceable drinking water standards developed under the Safe Drinking Water Act, 42 U.S.C. §§ 300f et seq., and codified at 40 C.F.R. Part 141.

Compound	Landfill Area Exceeded
Benzene	A, B
1,2-Dichloroethane	B
Trichloroethylene	B
Vinyl Chloride	A, BTA

10) Ammonia, sulfates and oxygen-demanding substances, as measured by chemical oxygen demand and total organic carbon, are generally elevated throughout the groundwater in each landfill area.

11) The most concentrated area of groundwater contamination in the Landfill occurs in the shallow water table in the southeastern portion of Landfill Area A located adjacent to the Delaware River.

12) Elevated concentrations of priority pollutant volatile organic compounds, ammonia, surfactants, oil and grease and formaldehyde were detected in seep locations along Hog Run Creek.

13) Elevated concentrations of bis(2-chloroethyl)ether, di-n-butyl phthalate, ammonia, sulfate, surfactants, oil and grease and formaldehyde were detected in Hog Run Creek.

14) Air monitoring data collected in an investigation of air at the Landfill found that butyl acrylate and ethyl acrylate exist in the air at the Landfill surface in concentrations greater than the Philadelphia Department of Public Health, Air Management Service guidelines[3]. However, at sampling locations on the perimeter of the Landfill, the concentration of target organic compounds in the air is not above detectable limits of analytical methodologies.

Additional information regarding the characterization and distribution of contaminants in the Landfill, groundwater, surface waters and air may be found in the "Bristol Landfill

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[3] The ambient air quality standards which are applicable to Bucks County are the National Ambient Air Quality Standards established in 40 C.F.R. Part 50. The National Ambient Air Quality Standards do not include standards which can be applied to releases from the Landfill to the air. Therefore, releases from the Landfill to the air are not greater than the National Ambient Air Quality Standards or ambient air standards applicable to Bucks County. The Air Quality Guidelines promulgated by the Philadelphia Department of Public Health, Air Management Service do include standards which can be applied to releases from the Landfill.

Remedial Investigation Addendum, March, 1988" and related reports referenced within the Addendum. All of these documents are contained in the Administrative Record described in the Introduction Section of this document.

RISK ASSESSMENT OF INVESTIGATED AREAS:

In Volume III of the "Bristol Landfill Remedial Investigation Addendum, March, 1988", analyses are presented to estimate the health and/or environmental problems which could result if the contamination at and resulting from the Landfill is not cleaned up. For fresh water aquatic life in the Delaware River, an environmental risk assessment indicated that at a depth of six (6) feet in the River, calculated concentrations exceeded the acceptable concentration for five chemicals: bis(2-ethylhexyl)phthalate, manganese and compounds, inorganic mercury, cyclohexadiene, and tetraethyl diphosphoric acid. The calculated concentrations are based on maximum concentrations found in the groundwater entering the River during a period of low flow. The acceptable concentrations are based on the application of uncertainty factors[4] to the lowest concentration found in literature searches to cause an adverse effect to freshwater aquatic life. The methodology which was used is based on the procedure developed by EPA's Office of Toxic Substances (OTS), Environmental Effects Branch, for estimating levels of concern for chemicals in the aquatic environment (USEPA 1984). Based on an evaluation of the available toxicity data for the five chemicals listed above, the calculated concentrations pose a potential chronic health effect[5] to aquatic life. Acute health effects (such as death of aquatic life) are not expected as a result of releases from the Landfill.

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[4] A number (equal or greater than one) used to divide the values of the "no observable adverse effect level" (NOAEL) or the "lowest observable adverse effect level" (LOAEL) derived from measurements in animals or small groups of humans, in order to estimate a NOAEL value for the whole population. Uncertainty factors account for such considerations as variation in sensitivity within a species, the uncertainty in extrapolating data to other species, the uncertainty in extrapolating from data obtained in a study which is of less-than-lifetime exposure, and the uncertainty in using data where a NOAEL was not identified.

[5] Chronic health effects are adverse effects on a human or animal body with symptoms which develop slowly over a long period of time or which recur frequently. Chronic health effects do not include cancer, birth defects or death from toxicity.

In conducting the public health risk assessment, the focus was on the health effects which could result from exposure through direct contact and ingestion of water from Hog Run Creek; direct contact, ingestion and inhalation of water from the Delaware River; and direct contact with surface soil. Separate calculations were made for those substance which can cause cancer and for those which can cause other health effects. Potential human receptors which were modeled in the assessment were dirt bike riders, outside contractors a the BTA portion of Landfill Area A, local residents who use the Delaware River as their domestic water supply, local fishermen who fish in the Delaware River and their families, and recreational swimmers who use the Delaware River. Other potential human receptors were not modeled in the assessment because their risks were judged to be less than or equal to risks calculated for the receptors listed above.

A worst-case analysis was determined to be an individual who spends 70 years of his/her life in the Bristol-Croyden area engaging in <u>all</u> of the assessed activities (i.e., dirt biking on the Bristol Landfill as a teenager and using the Delaware River as a source of fish, domestic water and recreation) and is exposed to contaminants believed to have been disposed of at the Landfill which could impact Hog Run Creek and the Delaware River. Contaminants believed to have been disposed of at the Landfill is available through records, interviews and contaminants identified in releases from the Landfill. The probability for an individual to develop cancer from engaging in <u>all</u> of the above activities for a life span of 70 years was calculated to be three cases of cancer per one million people (a risk of 3×10^{-6} or 0.000003). EPA generally considers risks in the range of 1×10^{-4} to 1×10^{-6} (1 in 10,000 to 1 in 1,000,000 chance of cancer) acceptable and may choose not to require remediation for those media in which the concentration of chemicals and exposure represents a risk less than 1×10^{-4} (1 in 10,000 chance of cancer). The calculated risks were based on the concentration of Landfill constituents observed in the groundwater through five years of groundwater monitoring. If the concentrations in the groundwater increase, the risk will be recalculated.

With the exception of outside contractors at the BTA property, no chronic or acute health effects (non-cancer health effects) would be expected for on-site dirt bikers or local residents who use the Delaware River as their domestic water source, or for fishing or swimming. However, potential exposure of unprotected outside contractors to non-carcinogenic contaminants during manual excavation around tanks and pipes at the BTA property was estimated to be above safe levels. The estimated dose which would result from potential inhalation and dermal absorption of 2,4-dimethylphenol during such work was significantly greater than the acceptable daily intake level for 2,4-dimethylphenol.

In an additional investigation for Landfill Area B, the risk was calculated for the hypothetical release at one time of the contents of all remaining drums in the Area. This investigation was conducted to determine if additional releases from the remaining intact drums would create an unacceptable risk. The results of this investigation are based on the "Drummed Waste Investigation Results for Landfill Section B" and are contained in the "Assessment of Off-Site Public Health Risks Posed by a Hypothetical Catastrophic Release from Drummed Materials in Section B of the Rohm and Haas DVI Bristol Landfill." The results of this investigation showed that if such an event occurred, the risk of contracting cancer would be less than one person in a million (1×10^{-6}) through the pathways described above for the public health risk assessment. In addition, the investigation showed that there would be no chronic or acute health effects (non-cancer health effects) associated with such a release through the pathways described above.

IDENTIFICATION OF CORRECTIVE MEASURE REQUIREMENTS AS A RESULT OF INVESTIGATION AND RISK ASSESSMENT:

As a result of the conditions at the Landfill and existing exposure pathways, Rohm and Haas DVI developed the following general objectives for corrective measures for releases from the Landfill: the corrective measures should be protective of human health and the environment as noted in Section 3008(h) of RCRA; the corrective measures should control further release of any hazardous waste and hazardous constituents which exceed current MCLs; the corrective measures should attain media cleanup standards; and the corrective measures should comply with standards for management of wastes. In addition to the above noted general objectives, the following additional site-specific objectives were developed for selection of the preferred CMAs:

1. The preferred CMA should achieve long-term protection of the community and environment.

2. Eliminate harmful impacts attributable to the Landfill on drinking water, the Delaware River, or fish.

3. Persons walking on the Landfill perimeter should breathe air meeting the current Philadelphia Department of Public Health, Air Management Service air quality guidelines.

4. Eliminate direct contact exposure to waste in the Landfill.

5. Ammonia levels in Hog Run Creek should be controlled to meet proposed regulations for protection of fish.

The following Landfill conditions were identified as requiring response actions to meet the above stated objectives:

1. Discharge of contaminated groundwater as well as seepage to Hog Run Creek and the Delaware River from Landfill Areas A and B;

2. Discharge of contaminated groundwater west of the northwest section of the BTA Portion of Landfill Area A;

3. Elevated groundwater contamination in the southeast area of Landfill Area A;

4. Infiltrating precipitation through the unsaturated fill/soil at Landfill A and B and its resulting contribution to leachate generation;

5. Potential release of drummed waste materials from Landfill Area B into soil and groundwater; and

6. Surface soil contamination in Landfill Area C and subsurface soil contamination at the BTA property.

DESCRIPTION AND EVALUATION OF THE CORRECTIVE MEASURE ALTERNATIVES:

In its CMS Report, Rohm and Haas DVI evaluated four (4) Corrective Measure Alternatives (CMAs) for the Bristol Township Authority (BTA) Portion of Landfill Area A, twelve (12) CMAs for the remaining portion of Landfill Area A, nine (9) CMAs for Landfill Area B, and eight (8) CMAs for Landfill Area C. Since actively used and environmentally important structures are located on the BTA property, the BTA portion of Landfill Area A is being evaluated separately from the remaining portion of Landfill Area A.

Recycling of the drummed waste material in Landfill Area B was additionally investigated by EPA. After review by EPA's Office of Research and Development and various experts in the field, recycling of the material was determined not to be economically feasible. This determination is based on the wide variety of polymeric materials in the landfill, many of which cannot be easily depolymerized.

The alternatives which were evaluated are listed below. EPA's preferred CMAs are highlighted in **bold**.

BTA Portion of Landfill Area A:

Alternative BTA 1:	No Action.
Alternative BTA 2:	Groundwater Management.
Alternative BTA 3:	**Consolidate most wastes into Rohm and Haas BVI's portion of Landfill Area A.**
Alternative BTA 4:	Complete Excavation, Disposal at a RCRA Landfill.

Remaining Portion of Landfill Area A (including the Chemical Properties, Inc. Site):

Alternative A1:	No Action, Groundwater Monitoring.
Alternative A2:	Impermeable Cap[1].
Alternative A3:	Impermeable Cap and Partial Excavation.
Alternative A4:	Impermeable Cap and Partial Cutoff Wall[2] with Diversion Trench.[3]
Alternative A5:	Impermeable Cap and Complete Cutoff Wall with Diversion Trench.
Alternative A6:	Impermeable Cap, Complete Cutoff Wall with Diversion Trench and Groundwater Management[4].
Alternative A7:	Groundwater Management.
Alternative A8:	Complete Cutoff Wall with Diversion Trench and Groundwater Management.
Alternative A9:	Complete Excavation, and Disposal at a RCRA Landfill[5].
Alternative A10:	Complete Excavation, Off-site Incineration, and Disposal at a RCRA Landfill.
Alternative A11:	Complete Excavation, On-site Incineration, and Disposal at a RCRA Landfill.
Alternative A12:	**Impermeable Cap, Complete Cutoff Wall with Diversion Trench, Groundwater Management and Enhanced Remediation of the Southeast Area[6]. See Figure 3.**

Landfill Area B:

Alternative B1:	No Action.
Alternative B2:	Impermeable Cap.
Alternative B3:	Impermeable Cap and Complete Cutoff Wall.
Alternative B4:	**Impermeable Cap and Complete Cutoff Wall with Groundwater Management. See Figure 4.**
Alternative B5:	Groundwater Management.
Alternative B6:	Complete Excavation, Off-site Incineration and Disposal at a RCRA Landfill.
Alternative B7:	Complete Excavation, On-site Incineration and Disposal at a RCRA Landfill.

Alternative B8: Drum Excavation, Off-site Incineration, Impermeable Cap, Complete Cutoff Wall and Groundwater Management.

Alternative B9: Drum Excavation, On-site Incineration, Impermeable Cap, Complete Cutoff Wall and Groundwater Management.

Landfill Area C:

Alternative C1: No Action.

Alternative C2: Soil Cap and Levee[7]. See Figure 6.

Alternative C3: Low Permeability Cap and Levee.

Alternative C4: Low Permeability Cap and Levee with Groundwater Management

Alternative C5: Partial Excavation, Consolidation into Rohm and Haas DVI Landfill Area A, Soil Cap Remaining Waste.

Alternative C6: Partial Excavation, Disposal at a RCRA Landfill, Soil Cap Remaining Waste.

Alternative C7: Complete Excavation, Consolidation into Rohm and Haas DVI Landfill Area A.

Alternative C8: Complete Excavation, Disposal at a RCRA Landfill.

Table 1 contains a summary of the description of each alternative and a summary of the evaluation of each alternative against seven criteria: performance, reliability, implementability, safety, overall protection of human health and the environment, institutional requirements and cost. To the maximum extent practicable, all remedies were evaluated on their ability to reduce the mobility, toxicity, and volume of waste. A detailed description of each alternative and of each evaluation of each alternative is contained in the Corrective Measure Study Report in the Administrative Record. An evaluation of the alternatives is provided below.

BTA Portion of Landfill Area A:

None of the alternatives will provide full protection to future contractors conducting manual excavation at the BTA Portion of Landfill Area A. Alternatives BTA 1 and BTA 2 will not prevent the discharge of contaminated groundwater or seeps to Hog Run Creek, the Delaware River or the area west of the northwest section of this portion of Landfill Area A. Alternatives BTA 3 and BTA 4 offer greater protection to future contractors than Alternatives BTA 1 and BTA 2. Alternative BTA 4 is no more protective of the BTA Portion of Landfill Area A than BTA 3. However, Alternative BTA 4 costs ten times greater than BTA 3. Therefore, Alternative BTA 3 is the preferred alternative.

Remaining Portion of Landfill Area A (including the Chemical Properties, Inc. Site):

Alternatives A1, A2, A3, and A4 will not eliminate the discharge of contaminated groundwater from the Landfill Area to Hog Run Creek, the Delaware River or west of the northwest portion of Landfill Area A. Alternatives A1, A2, A3, A4, A5 will not prevent groundwater releases through the bedrock. Alternatives A1, A2, A4, A5, A6, A7 and A8 do not address the elevated groundwater contamination in the southeast area of Landfill Area A. Alternatives A1, A7 and A8 do not prevent precipitation from contributing to leachate generation. Alternatives A6, A9, A10, A11 and A12 will address groundwater discharge to all areas, infiltration of precipitation, and the elevated groundwater contamination in the southeast area. However, Alternatives A9, A10, and A11 will result in a long-term community exposure to dusts, odors and airborne contaminants. Alternatives A9 and A10 will also substantially increase truck traffic through the community. In addition, Alternatives A9, A10 and A11 will take substantially longer to implement than Alternative A12. Alternative A12 is the most protective alternative in the short-term and provides protection as great in the long-term as any of the other alternatives. Therefore, Alternative A12 is the preferred alternative.

Landfill Area B:

Alternatives B1 and B2 will not eliminate the discharge of contaminated groundwater from the Landfill Area to Hog Run Creek, the Delaware River or west of the northwest portion of Landfill Area A. Alternatives B3 will not prevent groundwater releases through the bedrock. Alternatives B1, B2, and B3 will not contain the potential release of drummed materials. Alternatives B1 and B5 do not prevent precipitation from contributing to leachate generation. Alternatives B4, B6, B7, B8, and B9 will prevent groundwater discharge to all areas, infiltration of precipitation, and the release of drummed materials. However, Alternatives B6, B7, B8, and B9 will result in short-term community exposure to dusts, odors and airborne contaminants. Alternatives B6 and B8 will also substantially increase truck traffic through the community. In addition, Alternatives B6, B7, B8 and B9 will take longer to implement and are much more costly than Alternative B4. Alternative B4 is the most protective alternative in the short-term and provides protection as great in the long-term as any of the other alternatives. Therefore, Alternative B4 is the preferred alternative.

Landfill Area C:

Alternative C1 will not prevent exposure to surface soil contamination in Landfill Area C. Alternatives C2, C3, C5, C6, C7 and C8 will prevent exposure to surface soil contamination in

Landfill Area C. As discharge of contaminated groundwater from this area and the contribution of precipitation to leachate generation are not a known concern for this area, Alternative C2 provides protection as great in the short- and long-term as any of the other alternatives. Alternative C2 is the least expensive among the acceptable alternatives. Therefore, Alternative C2 is the preferred alternative.

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1. An impermeable cap would have a permeability of equal to or less than 1×10^{-7} centimeters per second.

2. Slurry cutoff walls would consist of subsurface trenches excavated into the upper few feet of bedrock and subsequently filled with an impermeable slurry. The slurry, typically a soil-bentonite or cement-bentonite mixture, acts to hydraulically shore the trench, and, at the same time, forms a filter cake on the trench walls to prevent fluid losses into the surrounding soil and groundwater. The composition of the wall, either soil-bentonite or cement-bentonite, will be determined through laboratory testing utilizing on-site soil and groundwater samples. The purpose of the laboratory testing procedures is to determine the ability of on-site soils in the final slurry mixture to achieve a permeability range of 1×10^{-5} centimeters per second (cm/sec) to 1×10^{-8} cm/sec and compatibility with the landfill leachate.

3. To reduce the force of groundwater across the cutoff wall, a diversion trench would be constructed which would convey upgradient groundwaters around the cutoff wall to Hog Run Creek and/or the Delaware River.

4. Groundwater will be pumped from within the slurry wall at a rate which will ensure that the lateral flow of groundwater, if any, is into the containment area thereby eliminating all migration of any contaminated landfill groundwater beyond the slurry wall. Recovery or pumping wells, interceptor trenches or a combination of both will be used to maintain the inward groundwater gradient. The extracted groundwater may be treated either at an off-site treatment facility, at an existing on-site treatment plant or at a potential on-site treatment plant built exclusively for the treatment of the groundwater.

5. A RCRA landfill is a specially designed protective landfill which is permitted to accept hazardous waste. Some wastes placed in such landfills are subject to land disposal restrictions which require treatment such as incineration prior to placement in the RCRA landfill. Wastes in Landfill Area B may require such treatment.

6. Methods of enhanced remediation which may be selected include, but are not limited to, groundwater flushing and treatment, waste stabilization (including in-situ), vacuum extraction, waste or groundwater bioremediation and excavation. The method of enhanced remediation which will be selected will be determined during the design of the final remedy and will be subject to EPA review and approval.

7. Levees are earthen embankments which function as flood protection structures in areas subject to inundation from tidal flow or riverine flooding. Levees create a barrier to confine floodwaters and to protect materials and structures behind the barrier. They are generally constructed of compacted impervious clean fill and often require special structures to drain the area behind the embankment. To provide adequate flood protection, levees should be constructed to a height capable of containing a 100-year frequency flood, depicted in Figure 5.

PREFERRED CORRECTIVE MEASURE ALTERNATIVES AND EPA'S RATIONALE FOR PRELIMINARY IDENTIFICATION OF THESE ALTERNATIVES:

Rohm and Haas DVI has recommended corrective measure alternatives (CMAs) BTA3, A12, B4, and C2 as the remedies to be implemented. Implementation of these alternatives will meet the following above stated objectives: human health and the environment will be protected as noted in Section 3008(h) of RCRA; further release of any hazardous wastes and hazardous constituents which exceed current MCLs will be controlled; harmful impacts attributable to the Landfill on drinking water, the Delaware River, or fish will be eliminated; persons walking on the Landfill perimeter will breathe air meeting the current Philadelphia Department of Public Health, Air Management Service air quality guidelines; direct contact exposure to wastes in the Landfill will be eliminated; and ammonia levels in Hog Run Creek will be controlled to meet proposed regulations for protection of fish.

These alternatives (BTA3, A12, B4, and C2) are acceptable to EPA because they utilize proven technologies and are protective of human health and the environment. EPA is confident that these corrective measures can be effectively employed to eliminate migration of contaminants from the Landfill and isolate the waste from human and environmental exposure. Implementation of these alternatives will attain the Media Protection Standards described below and will comply with applicable standards for management of wastes. Based on the decision criteria which are identified above, EPA has determined that these remedies are protective of human health and the environment.

EPA notes that implementation of these technologies requires perpetual maintenance. Rohm and Haas DVI has indicated commitment to the required perpetual maintenance if the property is ever sold. With this understanding, EPA is confident that the selected alternatives will achieve long-term performance so the community and environment are not subject to unacceptable risk.

The paragraphs below further describe EPA's rationale for selection of these alternatives:

BTA Portion of Landfill Area A Corrective Measure Alternative BTA 3: Consolidate most wastes into Rohm and Haas DVI's portion of Landfill Area A.

Contaminated soil located below structures and around pipes on the BTA property will not be excavated. The selection of this alternative will eliminate most subsurface soil contamination at the BTA Portion of Landfill Area A. The selection of this alternative will additionally prevent precipitation from contributing to leachate generation and subsequent contaminated groundwater and surface water. Evaluation of this alternative against the other alternatives, the corrective measure objectives and the criteria of performance, reliability, implementability, safety, overall protection of human health and the environment, ability to obtain institutional requirements and cost demonstrates that this is the preferred alternative. Potential additional remedies will be evaluated for BTA portion of Area A if excavation of accessable areas is not protective of groundwater.

Remaining Portion of Landfill Area A (including Chemical Properties, Inc. property) Corrective Measure Alternative A12: Impermeable Cap, Complete Cutoff Wall with Diversion Trench and Groundwater Management and Enhanced Remediation of the Southeast Area.

The selection of this alternative will prevent the release of contaminated groundwater and seepage from Landfill Area A to Hog Run Creek and the Delaware River. The selection of this alternative will help to eliminate the discharge of contaminated groundwater west of the northwest section of the BTA Portion of Landfill Area A. The selection of this alternative will additionally prevent precipitation from contributing to leachate generation. Enhanced remediation of the southeast area will further prevent the potential for elevated contaminants in the southeast area to impact the Delaware River. Evaluation of this alternative against the other alternatives, the corrective measure objectives and the criteria of performance, reliability, implementability, safety, overall protection of human health and the environment, ability to

obtain institutional requirements and cost demonstrates that this is the preferred alternative.

Landfill Area B Corrective Measure Alternative B4: Impermeable Cap and Complete Cutoff Wall with Groundwater Management.

The selection of this alternative will prevent releases from the drummed waste materials in Landfill Area B from migrating into the soil and groundwater. The selection of this alternative will prevent the release of contaminated groundwater and seepage from Landfill Area B to Hog Run Creek and the Delaware River. The selection of this alternative will additionally prevent precipitation from contributing to leachate generation. Evaluation of this alternative against the other alternatives, the corrective measure objectives and the criteria of performance, reliability, implementability, safety, overall protection of human health and the environment, ability to obtain institutional requirements and cost demonstrates that this is the preferred alternative.

Landfill Area C Corrective Measure Alternative C2: Soil Cap and Levee.

The selection of this alternative will prevent contact with surface soil contamination in Landfill Area C. If discharge of contaminated groundwater from this area or the contribution of precipitation to leachate generation become a concern for this area, the corrective measure for this area will be reevaluated. Alternative C2 provides protection as great in the short- and long-term as any of the other alternatives. Evaluation of this alternative against the other alternatives, the corrective measure objectives and the criteria of performance, reliability, implementability, safety, overall protection of human health and the environment, ability to obtain institutional requirements and cost demonstrates that this is the preferred alternative.

COMPLIANCE MONITORING:

A. Media Protection Standards

Media Protection Standards (MPS) established for the groundwater, surface waters, sediments and soil must be achieved by the preferred CMAs. The MPS include chemical specific standards and biological standards. The MPS will ensure that releases from the Landfill which may be discharged into soil, sediments, and the Delaware River will not adversely impact human

health or the environment at any time in the future. With respect to the goals for enhanced remediation of the southeast area of Landfill Area A, the levels of contaminants in the groundwater shall be reduced to levels which are similar to those in groundwater in the rest of Landfill Areas A and B.

The chemical specific MPS (CSMPS) are being developed by identifying the chemicals of concern, determining action levels for those chemicals and by combining the action levels with a site-specific exposure factor to calculate a CSMPS for groundwater located immediately outside of the individual landfill areas. Existing MCLs, current toxicological data and Water Quality Criteria for chronic health effects to fresh water fish are being used to identify the action levels. The site-specific exposure factors will take into account dilution from the nearest and most sensitive receptor (aquatic or human). The CSMPS are being developed by Rohm and Haas DVI and EPA with guidance from and review by EPA. In cases where the analytical detection limit is greater than the calculated chemical specific CSMPS, the analytical detection limit will be used as the CSMPS. The CSMPS presented in Volume 1 of the Corrective Measures Study (CMS) Report and Appendix E of Volume 3 of the CMS Report are not yet finalized and are subject to further review and revision by EPA.

The biological MPS (BMPS) are to mitigate any existing impact from releases from the Landfill. The BMPS were developed by EPA Region III's Biological Assessment Workgroup. An initial benchmark biological, chemical and physical characterization will be completed by Rohm and Haas DVI to characterize any existing impact. A large portion of the information required for the benchmark characterization was developed through previous investigations by Rohm and Haas DVI. The benchmark characterization will be completed for impacted areas and at locations upstream and downstream of the impacted areas in the Delaware River, Hog Run Creek and any soil around the southeast area where the cap is eliminated for enhanced remediation.

The chemicals which shall be characterized shall be those listed in the CSMPS. In addition, the chemical and physical parameters listed in Attachment 1 "Surface Water and Sediment Investigation: Chemical Physical/Parameters" shall be characterized. The biological characterization shall include a chronic bioassay and tissue analysis of vulnerable benthic organisms for both water and sediment samples at all sampling points where possible. Chronic bioassays shall be carried out with on-site and off-site soils in the vicinity of areas where a cap is not placed and the soil contamination levels are elevated.

During construction of the selected remedies, the river and creek shall be monitored to identify any additional degradation caused by construction activity. A contingency plan will be

developed to mitigate any damage caused by construction. After construction, any impacted areas will be resurveyed and a biologist will review the results to determine whether the previously existing impact has been mitigated. If no improvement is shown, a decision on additional remediation shall be made at that time.

B. Operations and Maintenance

The caps, slurry cutoff walls, diversion trenches and levees, as well as the groundwater monitoring and extraction system and potential on-site treatment system will be regularly inspected and repaired. An "Operations and Maintenance Plan" will be developed during the design phase to assure the integrity of the structures. The Plan will include a schedule for monitoring the MPS in groundwater immediately outside of the individual landfill areas.

Rohm and Haas DVI, the Bristol Township Authority, and Chemical Properties, Inc. shall include in any deed, lease, contract or similar document transferring any interest in the Landfill or the Dredged Material Basin (See Figure 1) to any successor(s) in interest, provisions: (a) prohibiting actions which would compromise the effectiveness of any corrective measures being constructed under this decision; (b) prohibiting any use of groundwater at the Landfill or the Dredged Material Basin without the approval of EPA; (c) requiring disclosure of the environmental conditions at the Landfill and Dredged Material Basin to every prospective successor in interest prior to settlement; (d) permitting EPA, Rohm and Haas DVI, BTA, Chemical Properties, Inc. and their respective contractors and representatives to enter upon the Landfill and the Dredged Material Basin for purposes of effectuating all terms of the decision; (e) containing an agreement that successor(s) in interest shall not interfere with or disturb the work to conduct the corrective measures and any future remedial activities (including operation and maintenance) which may be performed; and (f) containing an agreement to inform any person or entity that subsequently acquires any title, easement, or other interest in the Landfill or the Dredged Material Basin, or any portion thereof, of the requirements, conditions, and operative effect of these requirements. The restrictions and obligations described above shall run with the land and shall be binding upon any and all persons or entities that acquire any title, easement, or other interest in the Landfill or the Dredged Material Basin or any portion thereof. Accordingly, any changes at or construction on the Landfill or the Dredged Material Basin shall require prior approval from EPA.

PUBLIC INVOLVEMENT/PROCEDURAL REQUIREMENTS:

EPA is requesting comments from the public on the corrective measure alternatives (CMAs) and on EPA's preliminary identification of CMAs BTA3, A12, B4, and C2 as the preferred CMAs to protect human health and the environment from risks arising as a result of Landfill conditions. The public comment period will last thirty (30) calendar days from the date that this matter is publicly noticed in a local newspaper. The public comment period includes a public meeting. The public meeting is scheduled for 7:00 p.m. Thursday, September 19, 1991 and will be held at **location.** At the public meeting, EPA will present a summary of the Statement of Basis, answer questions and accept both oral and written comments.

In addition to the public meeting, comments on the Corrective Measures Study and/or EPA's preliminary identification of preferred CMAs may be submitted to EPA in writing. Written comments shall be submitted to:

Diane Schott
U.S. EPA Region III
841 Chestnut Building
Philadelphia, PA 19107
Attn: 3HW61

The Administrative Record file contains all of the information which EPA gathered and considered when making this preliminary identification of preferred CMAs. The administrative record file is available at the following locations:

Margaret R. Grundy Memorial Library
680 Radcliffe Street
Bristol, PA 19007
(215) 788-7891/2
Hours:

To Friday, August 30, 1991:
11:00 a.m. to 9:00 p.m. Monday through Friday
After Monday, September 2, 1991:
11:00 a.m. to 9:00 p.m. Monday through Thursday
11:00 a.m. to 6:00 p.m. Friday
10:00 a.m. to 4:30 p.m. Saturday

and

U.S. EPA Region III
841 Chestnut Building, 8th Floor
(NE Corner of Ninth and Chestnut Streets)
Philadelphia, PA
Office of Diane Schott
(215) 597-0130
Hours: Mon-Fri, 8:30 a.m. - 4:30 p.m.

Following the thirty (30) calendar day public comment period, EPA will prepare a final decision which will address all written comments and any substantive comments generated at a public meeting if such a meeting is held. This final decision will be incorporated into the Administrative Record. If the comments are such that significant changes are made in the CMAs identified by EPA, EPA will seek public comments on the revised CMAs.

AUG 23 1991

Thomas Voltaggio, Director
Hazardous Waste Management Division

Rohm and Haas Bristol Landfill

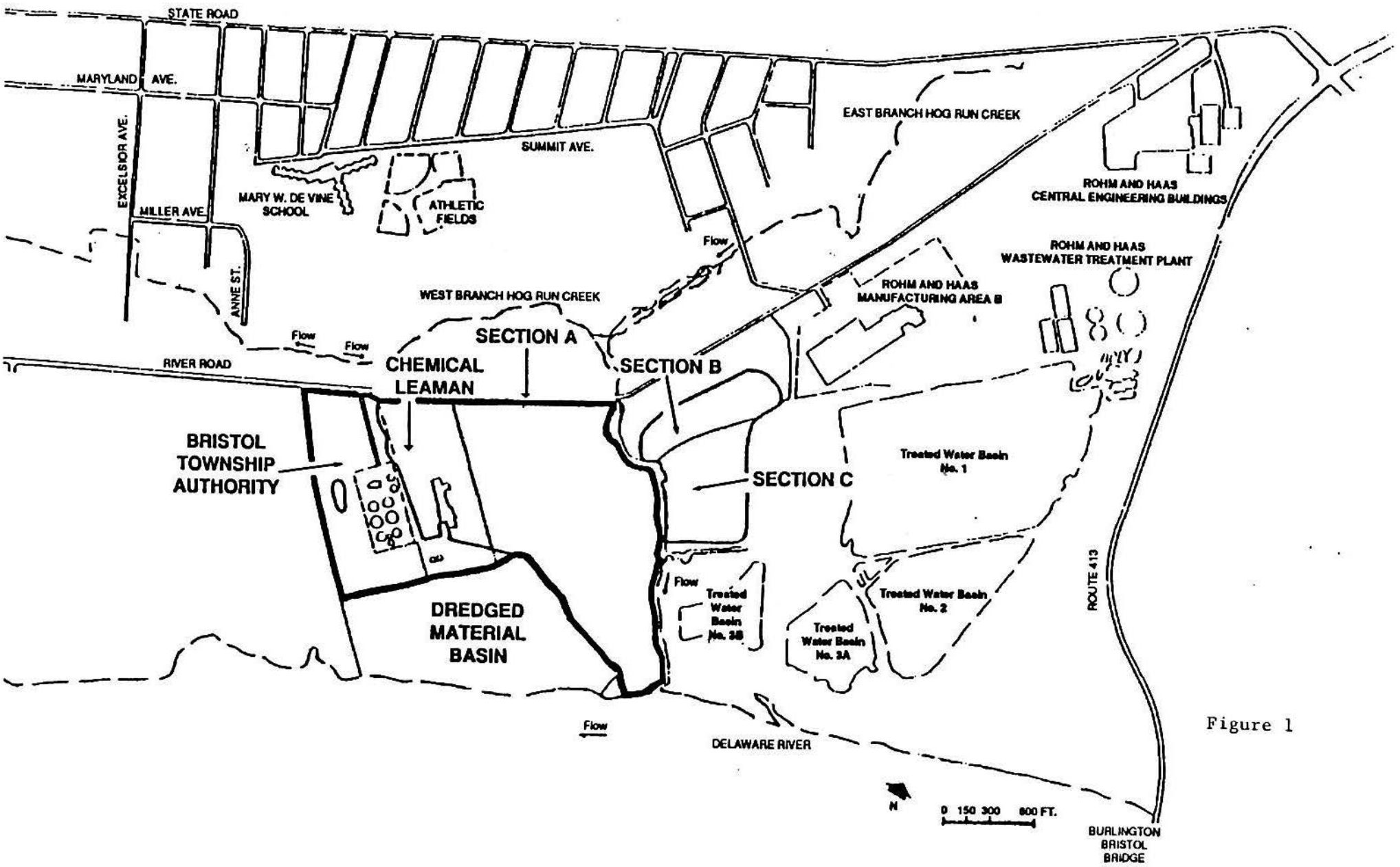

Figure 1

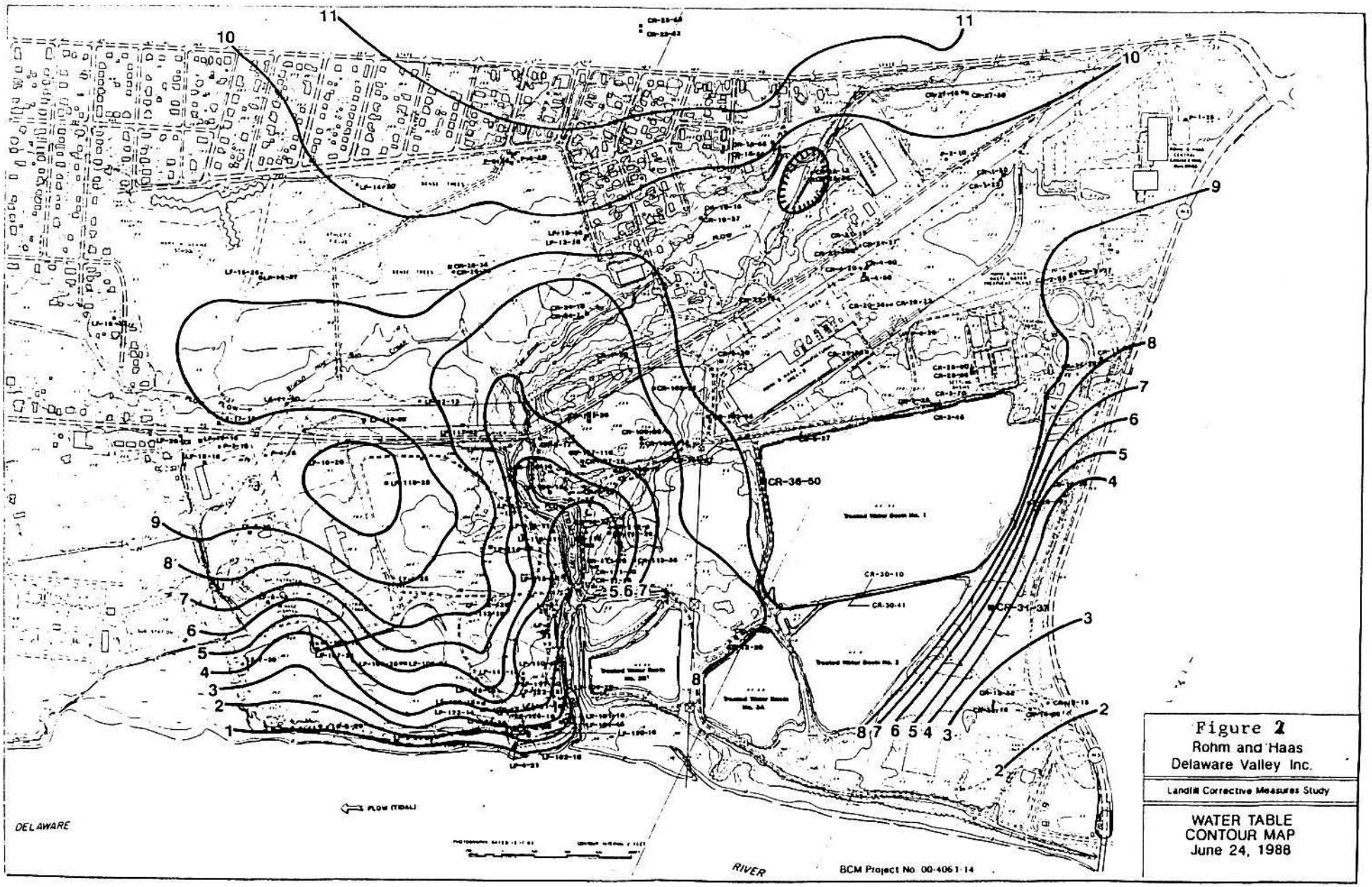

Figure 2
Rohm and Haas
Delaware Valley Inc.

Landfill Corrective Measures Study

WATER TABLE
CONTOUR MAP
June 24, 1988

TABLE 1-A

CORRECTIVE MEASURES ALTERNATIVE SCREENING
ROHM AND HAAS BRISTOL LANDFILL
SECTION A

	No Action (A1)	Cap (A2)	Cap and Partial Excavation (A3)	Cap, Partial Cutoff Wall with Trench (A4)	Cap, Complete Cutoff Wall with Trench (A5)
Description	- Groundwater Monitoring - Continued Maintenance of in-place site restrictions	- PADER/RCRA Cap System - Continued maintenance of in-place site restrictions.	- PADER/RCRA Cap System - Excavation of wastes from elevated groundwater concentration areas - Groundwater monitoring - Continued maintenance of in-place site restrictions.	- PADER/RCRA Cap System - Installation of Partial Cutoff Wall and Diversion Trench to reduce Groundwater Infiltration - Groundwater Monitoring - Continued maintenance of in-place site restrictions.	- PADER/RCRA Cap System - Installation of Complete Cutoff Wall and Diversion Trench to Reduce Groundwater Infiltration - Groundwater Monitoring - Continued maintenance of in-place site restrictions. - Groundwater recovery and treatment system
Short-Term Performance (during implementation)	- Level of response will be met as soon as wells are installed and sampled	- Acceptable soil and groundwater levels may not be achieved in short-term since some waste will be relocated and groundwater will not be collected	- Removal of potentially concentrated waste and groundwater will achieve acceptable levels in short-term	- Disturbance of soils for cutoff wall may not allow for acceptable soil levels - Partial installation of cutoff wall should achieve acceptable groundwater levels in short-term	- Significant soil disturbance for cutoff wall may not allow for acceptable soil levels - Installation of complete cutoff wall will achieve acceptable groundwater levels on short-term
Long-term Performance	- Acceptable risk if groundwater concentrations remain constant or decrease - No reduction in potential risk by intrusive activities.	- Acceptable risk if groundwater concentrations remain constant or decrease - Reduces potential risk by intrusive activities	- Groundwater risk probably reduced as concentrations will probably decrease	- Acceptable risk if groundwater concentrations remain constant or decrease - Reduces potential risk by intrusive activities	- Long-term groundwater release would most likely occur due to bedrock groundwater infiltration. - Reduces potential risk by intrusive activities
Reliability	- Minimum O&M requirements	- Yearly maintenance surveys will be required.	- Yearly maintenance surveys will be required.	- Yearly maintenance surveys will be required.	- Yearly maintenance surveys will be required.
Implementatility	- Easily implementable technologies	- Easily implementable technologies	- Easily implementable technologies	- Technology is well proven and applicable to site conditions	- Technology is well proven and applicable to site conditions

Table 1-A (Continued)

	Cap, Complete Cutoff Wall with Trench, Groundwater Management (A6)	Groundwater Management (A7)	Complete Cutoff Wall with with Trench, Groundwater (A8)	Complete Excavation RCRA Landfill (A9)	Complete Excavation, Offsite Incineration, RCRA Landfill (A10)	Complete Excavation, Onsite Incineration, RCRA Landfill (A11)
Description	- PADER/RCRA Cap System - Installation of Complete Cutoff Wall and Diversion Trench to Reduce Groundwater Infiltration - Groundwater Monitoring - Continued maintenance of in-place site restrictions. - Groundwater recovery and treatment system	- Groundwater recovery and treatment system	- Installation of complete cutoff wall and diversion trench to reduce Groundwater Infiltration - Groundwater Recovery and Treatment System - Groundwater Monitoring - Continued maintenance in-place site restrictions	- Excavation of waste and contaminated soil - Disposal in RCRA permitted facility	- Excavation of waste and contaminated soil - Treatment in RCRA permitted facility - Hazardous ash disposal in RCRA permitted faciljty	- Excavation of waste and contaminated soil - Treatment in on-site mobile unit - Hazardous ash disposal in RCRA permitted facility
Short-Term Performance (during implementation	- Significant soil disturbance will delay achieving acceptable soil levels - Installation of cutoff wall and groundwater will provide acceptable groundwater	- Unsaturated soil will be unchanged - Since percolation will continue, acceptable groundwater levels may not be achieved in short-term	- Unsaturated soil will not reach level of response - Groundwater management with cutoff wall will enhance acceptable groundwater levels in short-term	- Since all waste will be disturbed and shipped, acceptable soil levels will probably not be achieved - Extraction of groundwater will occur with excavation and will be favorable for groundwater response levels	- Acceptable soil levels will not be achieved in short-term since all waste will be excavated and repackaged - Acceptable groundwater levels may be obtained since groundwater will be removed during waste excavation	- Acceptable soil levels will not be obtained in short-term with extensive excavation and repackaging - Since groundwater will be removed during excavation acceptable groundwater results may be obtained
Long-Term Performance	- Will significantly reduce all future offsite releases - Proven construction elements with good long-term performance record - Reduces potential risk by intrusive activities	- Will significantly reduce future groundwater releases - No reduction in risk by intrusive activities	- Increased leachage production over Alternative A6	- Removal of wastes will eliminate exposure to any hazardous constituents	- Removal of wastes will eliminate exposure to any hazardous constituents	- Removal of wastes will eliminate exposure to any hazardous constituents
Reliability	- High O&M requirement due to operation of groundwater recovery and treatment system	- High O&M requirement due to operation of groundwater recovery and treatment system	- High O&M requirement due to operation of groundwater recovery and treatment system	- No long-term O&M requirement	No long-term O&M requirement	- No long-term O&M requirement

Table 1-A (Continued)

	Cap, Complete Cutoff Wall with Trench, Groundwater Management (A6)	Groundwater Management (A7)	Complete Cutoff Wall with with Trench, Groundwater (A8)	Complete Excavation RCRA Landfill (A9)	Complete Excavation, Offsite Incineration, RCRA Landfill (A10)	Complete Excavation, Onsite Incineration, RCRA Landfill (A11)
Implementability	- Technology is well proven and applicable to site conditions	- Technology is well proven and applicable to site conditions	- Technology is well proven and applicable to site conditions	- May be difficult to implement because of RCRA LBRs - Sorting and materials handling will be difficult - Long-term difficult exposure	- Sorting and materials handling will be difficult - Long-term community exposure	- Sorting and materials handling will be difficult - Long-term community exposure
Safety	- Onsite workers required to wear protective clothing/equipment; site-specific HASP required - May increase community exposure to dust and contaminants during excavation phase	- Onsite workers required to wear protective clothing/equipment; site-specific HASP required	- Onsite workers required to wear protective clothing/equipment; site-specific HASP required - May increase community exposure to dust and contaminants during excavation phase	- Will substantially increase community exposure to dusts, odors and airborne contaminants - Long period to implement - Will substantially increase truck traffic in community - Site-specific HASP required	- Will substantially increase community exposure to dusts, odors and airborne contaminants - Long period to implement - Will substantially increase truck traffic in community - Site-specific HASP required	- Will substantially increase community exposure to dusts, odors and airborne contaminants - Long period to implement - Site-specific HASP required
Overall Protection of Human Health and the Environment	- Eliminates migration of contaminants from site - Isolates waste from human and environmental exposure	- Eliminates migration of contaminants from site as long as system is operating	- Eliminates migration of groundwater contaminants from site - Does not isolate waste	- Increases potential, short-term exposure to waste constituents - Eliminates long-term exposure to waste constituents	- Increases potential short-term exposure to waste constituents - Eliminates long-term exposure to waste constituents	- Increases potential short-term exposure to waste constituents - Eliminates long-term exposure to waste constituents
Institutional Requirements	- Meets PADER capping requirements - Meets RCRA requirement to minimize/control release	- Meets RCRA requirement to minimize/control release	- Meets RCRA requirement to minimize/control release	- Meets RCRA requirement to minimize/control release	- Meets RCRA requirement to minimize/control release	- Meets RCRA requirement to minimize/control release
Estimated Time to Implement	- 1.5-2 years	- 0.5-1.0 years	- 1.0-1.5 years	- 4.0-4.5 years	- 49-50 years	- 9.0-9.5 years
Estimated Time to Beneficial Results (after implementation	- Less than 5 years for both soil and groundwater	- No benefit for soil, less than 5 years for groundwater	- No benefit for soil, less than 5 years for groundwater	- Less than 5 years for both soil and groundwater	- Less than 5 years for both soil and groundwater	- Less than 5 years for both soil and groundwater

Table 1-A (Continued)

	Cap, Complete Cutoff Wall with Trench, Groundwater Management (A6)	Groundwater Management (A7)	Complete Cutoff Wall with with Trench, Groundwater (A8)	Complete Excavation RCRA Landfill (A9)	Complete Excavation, Offsite Incineration, RCRA Landfill (A10)	Complete Excavation, Onsite Incineration, RCRA Landfill (A11)
nstruction st 989 $'s)	$8,801,000	$2,256,000	$3,948,000	$446,311,000	$1,525,363,000	$823,698,000
M Costs 989 $'s) ears 2-30)	$ 102,400	$ 266,800	$ 194,300	$ 22,600	$ 22,600	$ 22,600

Table 1-A (Continued)

	Cap, Complete Cutoff Wall with Division Trench Groundwater Management and Remediation of Southeast Corner (A12)
Description	- Groundwater flushing and treatment, in situ waste stabilization, vacuum extraction, bioremediation, or excavation of wastes from southeast corner of Section A - PADER/RCRA Cap System - Installation of complete cutoff wall and diversion trench to reduce groundwater infiltration - Groundwater recovery and treatment system - Groundwater monitoring - Continued maintenance of in-place site restrictions
Short-Term Performance (during implementation)	- Significant soil disturbance will delay achieving acceptable soil levels. Enhanced remediation of southeast corner and installation of cutoff wall will provide acceptable groundwater
Long-Term Performance	- Will significantly reduce all future offsite releases - Proven construction elements with good long-term performance record - Reduces potential risk by intrusive activities
Reliability	- High O&M requirement due to operation of groundwater recovery and treatment system
Implementability	- Technology is well proven and applicable to site conditions
Safety	- Onsite workers required to wear protective clothing/ equipment - Site-specific HASP required - May increase community exposure to dust and contaminants during wall construction phase
Overall Protection of Human Health and the Environment	- Eliminates migration of contaminants from site - Isolates waste from human and environmental exposure
Institutional Requirements	- Meets PADER capping requirements - Meets RCRA requirement to minimize/control release
Estimated Time to Implement	- 2.0-2.5 years
Estimated Time to Beneficial Results (after implementation)	- Less than 5 years for both soil and groundwater
Construction Cost (1989 $'s)	- $9,000,000 - $30,000,000(*)
O&M Costs (1989 $'s) (Years 2-30)	- $ 102,400+

(*) Construction costs presented represent range for implementation of the techniques listed under Description. Table 5-11A details cost of $11,308,000 for implementation of A12 including in situ waste stabilization.

Table 1-8

CORRECTIVE MEASURES ALTERNATIVE SCREENING
ROHM AND HAAS BRISTOL LANDFILL
SECTION B

	No Action (B1)	Cap (B2)	Cap and Complete Cutoff Wall (B3)	Cap, Complete Cutoff Wall and Groundwater Management (B4)	Groundwater Management (B5)
Description	- Groundwater Monitoring - Continued Maintenance of in-place site restrictions	- PADER/RCRA Cap System - Groundwater Monitoring - Continued Maintenance of in-place site restrictions	- PADER/RCRA Cap System - Installation of Complete Cutoff Wall - Continued Maintenance of in-place site restrictions	- PADER/RCRA Cap System - Installation of Complete Cutoff Wall - Groundwater recovery and - treatment system - Continued Maintenance of in-place site restrictions	- Groundwater Recovery and treatment system - Groundwater Monitoring - Continued maintenance of in-place site restrictions
Short-term Performance (during implementation)	- Level of response will be met as soon as wells are installed and sampled	- Acceptable soil and groundwater levels may not be achieved in in short-term since some waste will be relocated and groundwater will not be collected	- Significant soil disturbance for cutoff wall may not allow for acceptable soil levels - Installation of complete cutoff wall will achieve acceptable groundwater levels in short-term	- Significant soil disturbance will delay achieving acceptable soil levels - Installation of cutoff wall and groundwater management system will provide acceptable groundwater levels	- Unsaturated soil will be unchanged - Since percolation will continue, acceptable groundwater levels may not be achieved in short-term
Long-term Performance	- Acceptable risk if groundwater concentrations remain constant or decrease - No reduction in potential risk by intrusive activities	- Acceptable risk if groundwater concentrations remain constant or decrease	- Long-term release would most likely occur due to bedrock groundwater infiltration - Reduces potential risk by intrusive activities - Quality of leachate may degrade cutoff wall in long-term	- Will significantly reduce all future offsite releases - Proven construction elements with good long-term performance record - Reduces potential risk by intrusive activities	- Will significantly reduce future groundwater releases - No reduction in risk by intrusive activities
Reliability	- Minimum O&M requirements	- Yearly maintenance surveys will be required	- Yearly maintenance surveys will be required	- High O&M requirement due to operation of groundwater recovery and treatment system	- High O&M requirement due to operation of groundwater recovery and treatment system
Implementability	- Easily implementable technologies	- Easily implementable technologies	- Technology is well proven and applicable to site conditions	- Technology is well proven and applicable to site conditions	- Technology is well proven and applicable to site conditions
Safety	- Poses minimal risk to onsite personnel, would require site-specific HASP	- Poses minimal risk to onsite personnel, would require site-specific HASP	- Onsite workers required to wear protective clothing/ equipment; site-specific HASP requ[illegible]	- Onsite workers required to wear protective clothing/ equipment; site-specific HASP required	- Onsite workers required to wear protective clothing/equipment; site-spec[illegible] HASP required

Table 1-8 (Continued)

	No Action (B1)	Cap (B2)	Cap and Complete Cutoff Wall (B3)	Cap, Complete Cutoff Wall and Groundwater Management (B4)	Groundwater Management (B5)
Overall Protection of Human Health and the Environment	- Would not meet RCRA groundwater protection standards - Does not prevent future groundwater releases	- Would not meet RCRA groundwater protection standards - Isolates waste from human and environmental exposure	- On short-term basis eliminates migration of contaminants from site; long-term may result in future releases - Isolates waste from human and environmental exposure	- Eliminates migration of contaminants from site - Isolates wastes from human and environmental exposure	- Eliminates migration of contaminants from site as long as system is working
Institutional Requirements	- Does not meet current PADER hazardous waste landfill closure criteria	- Meets PADER capping requirements - Does not meet current PADER hazardous waste landfill closure criteria	- Meets PADER capping requirements - May not meet RCRA requirement to minimize/control release	- Meets PADER capping requirements - Meets RCRA requirement to minimize/control release	- Meets RCRA requirement to minimize/control release - Does not meet current PADER capping requirements
Estimated time to implement	- 0-0.5 yrs	- 1.0-1.5 yrs	- 1.5-2.0 yrs	- 1.5-2.0 yrs	- 0.5-1.0 yrs
Estimated time to beneficial results (after implementation)	- No Benefit for both soil and groundwater	- Greater than 5 years for soil and groundwater	- Greater than 5 years for soil and groundwater	- Less than 5 years for soil and groundwater	- No benefit for soil, less than 5 years for groundwater
Construction Cost (1989 $'s)	$20,000	$1,318,000	$1,677,000	$1,825,000	$908,000
O&M Costs (1989 $'s) (Years 2-30)	$ 6,900	$ 13,700	$ 13,000	$ 42,400	$ 78,200

Table 1-8 (Continued)

	Complete Excavation, Offsite Incineration, and RCRA Landfill (D6)	Complete Excavation, Onsite Incineration, RCRA Landfill (B7)
Description	- Excavation of drummed and bulk wastes and contaiminated soil - Treatment in RCRA-permitted facility - Hazardous ash disposal in RCRA-permitted facility	- Excavation of drummed and bulk wastes and contaminated soil - Treatment in onsite, permitted mobile unit - Hazardous ash disposal in RCRA-permitted facility
Short-Term Performance (during implementation)	- Acceptable soil levels will not be achieved in short-term since all waste will be excavated and repackaged - Acceptable groundwater levels may be obtained since groundwater will be removed during waste excavation	- Acceptable soil levels will not be obtained in short-term with extensive excavation and repackaging - Since groundwater will be removed during excavation, acceptable groundwater results may be obtained - Potential operational problems of the onsite may be encountered
Long-Term Performance	- Removal of wastes will eliminate exposure to any hazardous constituents	- Removal of wastes will eliminate exposure to any hazardous constituents
Reliability	- No long-term O&M requirement	- No long-term O&M requirement
Implementability	- Sorting and materials handling will be difficult - Long-term community exposure	- Sorting and materials handling will be difficult - Long-term community exposure
Safety	- Will substantially increase community exposure to dusts, odors and airborne contaminants - Long period to implement - Will substantially increase truck traffic in community - Site-specific HASP required	- Will substantially increase community exposure to dusts, odors and airborne contaminants - Long period to implement - Site-specific HASP required
Overall Protection of Human Health and the Environment	- Increases potential short-term exposure to waste constituents - Eliminate long-term exposure to waste constituents	- Increases potential short-term exposure to waste constituents - Eliminates long-term exposure to waste constituents
Institutional Requirements	- Meets RCRA requirement to minimize/ control release	- Meets RCRA requirement to minimize/ control release
Estimated time to implement	- 5.5-6 yrs.	- 2.5-3 yrs

Table 1-8 (Continued)

	Complete Excavation, Offsite Incineration, and RCRA Landfill (B6)	Complete Excavation, Onsite Incineration, RCRA Landfill (B7)
Estimated time to beneficial results (after implementation)	- Less than 5 yrs for both soil and groundwater	- Less than 5 yrs for both soil and groundwater
Construction Cost (1989 $'s)	$134,817,000	$63,742,000
O&M Costs (Years 2-30) (1989 $'s)	$ 6,900	$ 6,900

Table 1-B (Continued)

	Drum Excavation, Offsite Incineration, Cap, Complete Cutoff Wall, and Groundwater Management (B8)	Drum Excavation, Onsite Incineration Cap, Complete Cutoff Wall, and Groundwater Management (B9)
Description	- Excavation of drummed wastes - Treatment and ash disposal in RCRA-permitted facility - PADER/RCRA Cap System - Installation of complete cutoff wall - Groundwater recovery and treatment system - Continued maintenance of in-place site restrictions	- Excavation of drummed wastes - Treatment in onsite, permitted mobile unit - Hazardous ash disposal in RCRA-permitted facility - PADER/RCRA Cap System - Installation of complete cutoff wall - Groundwater recovery and treatment system - Continued maintenance of in-place site restrictions
Short-term Performance (during implementation)	- Significant soil disturbance will delay achieving acceptable soil levels - Installation of cutoff wall and groundwater management system will provide acceptable groundwater levels	- Significant soil disturbance will delay achieving acceptable soil levels - Installation of cutoff wall and groundwater management system will provide acceptable groundwater levels
Long-term Performance	- Drum removal will remove concentrated waste materials - Will significantly reduce all future offsite releases - Proven construction elements with good long-term performance record - Reduces potential risk by intrusive activities	- Drum removal will remove concentrated waste materials - Will significantly reduce all future offsite releases - Proven construction elements with good long-term performance record - Reduces potential risk by intrusive activities
Reliability	- High O&M requirement due to operation of groundwater recovery and treatment system	- High O&M requirement due to operation of groundwater recovery and treatment system
Implementability	- Removal of drums may be difficult with long-term community exposure - Technologies are well proven and applicable to site and conditions	- Removal of drums may be difficult with long-term community exposure - Technologies are well proven and applicable to site conditions
Safety	- Will increase community exposure to dusts, odors, and airborne contaminants - Onsite workers required to wear protective clothing/equipment; site-specific HASP required	- Will increase community exposure to dusts, odors, and airborne contaminants - Onsite workers required to wear protective clothing/equipment; site-specific HASP required

Table 1-8 (Continued)

	Drum Excavation, Offsite Incineration, Cap, Complete Cutoff Wall, and Groundwater Management (B8)	Drum Excavation, Onsite Incineration Cap, Complete Cutoff Wall, and Groundwater Management (B9)
Overall Protection of Human Health and the Environment	- Increases potential short-term exposure to waste constituents - Eliminates long-term migration of contaminants from site - Isolates wastes in long-term from human and environmental exposure	- Increases potential short-term exposure to waste constituents - Eliminates long-term migration of contaminants from site - Isolates wastes in long-term from human and environmental exposure
Institutional Requirements	- Meets PADER capping requirements - Meets RCRA requirement to minimize/control release	- Meets PADER capping requirements - Meets RCRA requirement to minimize/control release
Estimated Time to Implement	- 2-2.5 yrs	- 2-2.5 yrs
Estimated time to Beneficial Results (after implementation)	- Less than 5 yrs for both soil and groundwater	- Less than 5 yrs for both soil and groundwater
Construction Cost (1989 $'s)	- $15,856,000	- $11,750,000
O&M Costs (1989 $'s)	- $ 42,400	- $ 42,400

TABLE 1-C

CORRECTIVE MEASURES ALTERNATIVE SCREENING
ROHM AND HAAS BRISTOL LANDFILL
SECTION C

	No Action and Levee (C1)	Soil Cap and Levee (C2)	Cap and Levee (C3)	Cap and Levee With Groundwater Management (C4)	Partial Excavation, Rohm and Haas Landfill, Cap Remaining Waste (C5)
Description	- Groundwater Monitoring - Construction of 100-year flood protection levee - Continued maintenance of in-place site restrictions	- Groundwater Monitoring - Soil Cap System - Construction of 100-year flood protection levee - Continued maintenance of in-place site restrictions	- Groundwater Monitoring - PADER/RCRA Cap System - Construction of 100-year flood protection levee - Continued maintenance of in-place site restrictions	- Construction of 100-year flood protection levee - PADER/RCRA Cap System - Continued maintenance of in-place site restrictions - Groundwater recovery and treatment system	- Excavate waste from 100-year floodplain; - Disposal in Landfill Section A - PADER/RCRA Cap System over remaining waste - Groundwater Monitoring - Continued Maintenance of in-place site restrictions
Short-term Performance (during implementation)	- Level of response will be met as soon as wells are installed and sampled	- Acceptable levels should be obtained in short-term since waste will be minimally disturbed and levee will reduce runon, erosion	- Acceptable levels should be met in short-term and levee will reduce erosion	- Acceptable levels should be obtained within short-term	- Removal of flood plain waste will achieve acceptable soil and groundwater levels in short-term
Long-Term Performance	- Acceptable risk if groundwater concentrations remain constant or decrease - Monitoring will provide indication of groundwater changes - No reduction in potential risk to exposed surface waste	- Acceptable risk if groundwater concentrations remain constant or decrease - Monitoring will provide indication of groundwater changes - No reduction in potential risk to exposed surface waste	- Acceptable risk if groundwater concentrations remain constant or decrease - Monitoring will provide indication of groundwater changes - No reduction in potential risk to exposed surface water - Reduces potential exposure by intrusive activities	- Will eliminate future offsite releases	- Acceptable risk if groundwater concentrations remain constant or decrease - Monitoring will provide indication of groundwater changes - Reduces potential exposure by intrusive activities
Reliability	- Minimum O&M requirements	- Minimum O&M requirements	- Yearly maintenance surveys will be required	- High O&M requirement due to operation of groundwater recovery and treatment system	- Yearly maintenance surveys will be required

Table 1-C (Continued)

	No Action and Levee (C1)	Soil Cap and Levee (C2)	Cap and Levee (C3)	Cap and Levee With Groundwater Management (C4)	Partial Excavation, Rohm and Haas Landfill, Cap Remaining Waste (C5)
Implementability	- Easily implemented	- Easily implemented	- Easily implemented	- Easily implemented	- Easily implemented
Safety	- Poses minimal risk, if any, to onsite personnel	- Poses minimal risk, if any, to onsite personnel	- Poses minimal risk, if any, to onsite personnel	- Poses minimal risk, if any, to onsite personnel	- Onsite workers required to wear protective clothing/ equipment; site-specific HASP required
Overall Protection of Human Health and the Environment	- Current groundwater concentrations meet RCRA groundwater protection standards	- Current groundwater concentrations meet RCRA groundwater protection standards - Eliminates exposure to surface waste	- Current groundwater concentrations meet RCRA groundwater protection standards - Eliminates exposure to surface waste	- Eliminates future groundwater releases - Eliminates exposure to surface waste	- Eliminates waste from 100-year floodplain and potential exposure risk - Will increase short-term community exposure to dusts, odors, and airborne contaminants - Current groundwater concentrations meet RCRA groundwater protection standards
Institutional Requirements	- Does not meet current PADER hazardous waste landfill closure criteria - Protects waste from 100-year storm	- Does not meet PADER cap requirements criteria - Protects waste from 100-year storm	- Meets PADER cap requirements - Eliminates waste from 100-year storm	- Meets PADER cap requirements - Meets RCRA requirement to minimize/control release - Eliminates waste from 100-year storm	- Meets PADER cap requirements - Eliminates waste from 100-year floodplain
Estimated time to implement	- 0-0.5 yrs	- 1.0-1.5 yrs	- 1.5-2.0 yrs	- 1.5-2.0 yrs	- 1.0-1.5 yrs
Estimated time to beneficial results (after implentation)	- No benefit for both soil and groundwater	- Less than 5 yrs for soil, no increased benefit for groundwater	- Less than 5 yrs for soil and groundwater	- Less than 5 yrs for both soil and groundwater	- Less than 5 yrs for soil and groundwater
Construction Cost (1989 $'s)	$224,000	$1,015,000	$1,848,00	$3,527,000	$4,928,000
O&M Costs (Years 2-30) (1989 $'s)	$ 4,800	$ 4,800	$ 17,300	$ 304,900	$ 17,300

Table 1-C (Continued)

	Partial Excavation, RCRA Landfill, Cap Remaining Waste (C6)	Complete Excavation, Rohm and Haas Landfill (C7)	Complete Excavation, RCRA Landfill (C8)
Estimated time to implement	- 1.0-1.5 years	- 1.0-1.5 years	- 1.0-1.5 years
Estimated time to beneficial results (after implementation)	- Less than 5 years for soil and groundwater	- Less than 5 years for soil and groundwater	- Less than 5 year for soil and groundwater
Construction Cost (1989 $'s)	$38,312,000	$7,510,000	$60,794,000
O&M Costs (Years 2-30) (1989 $'s)	$ 17,300	$ 4,800	$ 4,800

TABLE 1-DIA

CORRECTIVE MEASURES ALTERNATIVE SCREENING
ROHM AND HAAS BRISTOL LANDFILL
BRISTOL TOWNSHIP AUTHORITY SITE

	No Action (DIA 1)	Groundwater Management (DIA)2	Complete Excavation, Rohm and Haas Landfill (DIA 3)	Complete Excavation, RCRA Landfill (DIA 4)
Description	- Groundwater Monitoring - Continued Outside Contractor use of protective clothing/ equipment	- Groundwater recovery and treatment system - Groundwater monitoring - continued outside Contractor use of protective clothing/equipment	- Excavation of accessible waste and contaminated soil - Disposal in Landfill Section A - Continued Outside Contractor use of protective clothing/equipment	- Excavation of accessible waste and contaminated soil - Disposal in RCRA permitted facility - Continued Outside Contractor use of protective/equipment
Short-term Performance (during implementation)	- Level of response will be met as soon as wells are installed and sampled	- Unsaturated soil will be unchanged - Since percolation will continue, acceptable groundwater levels may not be achieved in short-term	- Acceptable soil and groundwater levels should be obtained in short-term with limited waste excavation	- Acceptable soil and groundwater levels should be obtained in short-term with limited waste excavation
Long-term Performance	- No reduction in potential risk by intrusive activities into outlying waste areas	- No reduction in potential risk by intrusive activities - Reduces offsite groundwater releases	- Eliminates exposure to waste in outlying areas	- Eliminates exposure to waste in outlying areas
Reliability	- Minimum O&M requirements	- High O&M requirement due to operation of groundwater and treatment system	- No long-term O&M requirement	- No long-term O&M requirement
Implementability	- Easily implementable technologies	- Technology is well proven and applicable to site conditions	- Easily implementable technology - Short timeframe (approx. 3 months)	- Easily implementable technology - Short timeframe (approx. 3 months)
Safety	- Poses minimal risk to samplers, would require site-specific HASP	- Poses minimal risk to samplers, would require site-specific HASP	- Site-specific HASP required - No community exposure based on 1906/07 excavation	- Site-specific HASP required - No community exposure based on 1906/07 excavation
Overall Protection of Human Health and the Environment	- Does not minimize future exposure or releases to groundwater from outlying areas	- Does not minimize future exposure in outlying areas	- Eliminates future exposure and releases to groundwater in outlying areas	- Eliminates future exposure and releases to groundwater in outlying areas
Institutional Requirements	- Does not meet RCRA requirement to minimize/control	- Meets RCRA requirement to minimize/control release	- Meets RCRA requirement to minimize/control release	- Meets RCRA requirement to minimize/control release

Table 1-BTA (Continued)

	No Action (BTA 1)	Groundwater Management (BTA)2	Complete Excavation, Rohm and Haas Landfill (BTA 3)	Complete Excavation, RCRA Landfill (BTA 4)
Estimated time to implement	- 0-0.5 years	- 0.5-1 year	- 0.5-1 year	- 0.5-1 year
Estimated time to beneficial results (after implementation)	- No benefit for both soil and groundwater	- No benefit for soil less than 5 years for groundwater	- Less than 5 years for both soil and groundwater	- Less than 5 year for both soil and groundwater
Construction Cost (1989 $'s)	$17,000	$1,576,000	$634,000	$6,358,000
O&M Costs (Years 2-30 (1989 $'s)	$ 4,400	$ 199,400	NA	NA

List of Acronyms

BTA -- Bristol Township Authority

HASP -- Health and Safety Plan

LBRs -- Land Ban Restrictions

O&M -- Operation and Maintenance

PADER -- Pennsylvania Department of Environmental Resources

RCRA -- Resource Conservation and Recovery Act