Chem Solv File

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REGION III, EPA
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# RECORD OF DECISION

# FOR THE CHEM-SOLV, INC. SITE

# CHESWOLD, KENT COUNTY, DELAWARE

March 1992

# RECORD OF DECISION
# CHEM-SOLV, INC.

## DECLARATION

### SITE NAME AND LOCATION

Chem-Solv, Inc.
Cheswold, Kent County, Delaware

### STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Chem-Solv, Inc. Site, in Cheswold, Kent County, Delaware, which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, 42 U.S.C. § 9601 et seq., and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300. This decision document explains the factual and legal basis for selecting the remedy for this Site. The information supporting this remedial action decision is contained in the Administrative Record file for this Site.

The State of Delaware concurs with the selected remedy.

### ASSESSMENT OF THE SITE

Pursuant to duly delegated authority, I hereby determine, pursuant to Section 106 of CERCLA, 42 U.S.C. § 9606, that actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

### DESCRIPTION OF THE SELECTED REMEDY

This remedy addresses ground water contamination in the uppermost aquifer beneath the Site, the only medium which the United States Environmental Protection Agency (EPA) has determined needs to be addressed. The ground water, which is contaminated with volatile organic contaminants (VOCs) and manganese, will be collected from the aquifer through a series of recovery wells and treated to remove the contaminants until the cleanup levels are achieved. The ground water cleanup levels for this Site are the Maximum Contaminant Levels (MCLs) and non-zero Maximum Contaminant Level Goals (MCLGs) of the Safe Drinking Water Act for those contaminants for which they exist. Health-based cleanup levels were developed for contaminants with no associated MCLs or MCLGs.

The selected remedy includes the following major components:

1. Collection of contaminated ground water using recovery wells until cleanup levels are achieved

2. Discharge of extracted ground water to the local Publicly Owned Treatment Works (POTW) via the Kent County sewer system or, if an agreement with the POTW cannot be reached, a contingency remedy for onsite treatment of extracted ground water and discharge to local surface water

3. Continued ground water monitoring of domestic, recovery and monitoring wells until cleanup levels are achieved

4. Provisions for an alternate water supply for residences whose wells may become contaminated before the remedial action is complete

5. Institutional controls restricting ground water use until cleanup levels are achieved throughout the entire contaminated area by establishing and enforcing a State ground water restriction zone and property deed restrictions regarding the installation of wells in the restriction zone

6. Removal of existing recovery wells onsite.

**DECLARATION OF STATUTORY DETERMINATIONS**

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable, and it satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

Although EPA believes that the selected remedy will achieve the cleanup levels, it may become apparent during implementation or operation of the ground water treatment system that contaminant levels are remaining constant at levels higher than the cleanup levels. In that event, a reevaluation of the system performance standards and/or the remedy may be necessary. Assuming that the cleanup levels set forth in this ROD will be met, no hazardous substances will remain at the Site above levels that would allow unlimited use and unrestricted exposure after completion of the selected remedy. The cleanup levels, however, may require five or more years to attain. Hazardous substances, therefore, may remain at the Site above levels that allow for unlimited use and

unrestricted exposure for five years or longer from initiation of the remedial action. Because the selected remedy may not allow for unlimited use and unrestricted exposure within five years of initiation of the remedial action, a policy review of the Site will be conducted within five years of the initiation of the remedial action in accordance with EPA guidance set forth in "Structure and Components of Five-Year Reviews," May 23, 1991, OSWER Directive 9355.7-02, to ensure that the remedy continues to provide adequate protection to human health and the environment. Such policy reviews will be conducted every five years thereafter until EPA determines that the cleanup levels set forth in this ROD have been achieved, or that the hazardous substances remaining on the Site do not prevent unlimited use and unrestricted exposure at the Site.

Bruce P. Smith for

Edwin B. Erickson
Regional Administrator
Region III

3/31/92
Date

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES
& ENVIRONMENTAL CONTROL
DIVISION OF AIR & WASTE MANAGEMENT
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OFFICE OF THE DIRECTOR

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March 31, 1992

Mr. Edwin B. Erickson
Regional Administrator
U.S. EPA Region III
841 Chestnut Building
Philadelphia, PA 19107

RE: Concurrence With The Record Of Decision For The Chem-Solv, Inc. Superfund Site, Cheswold, Kent County, Delaware

Dear Mr. Erickson:

Through the coordinated efforts of DNREC and EPA, the Department believes that an appropriate remedy has been selected for the Chem-Solv, Inc. Superfund site. The selected remedy is to pump the contaminated ground water and discharge to Kent County POTW (if they don't object); otherwise, treat the extracted ground water on site using filtration and an air stripper and discharge the treated water to a local sewer system. The selected remedy is consistent with the various federal and state regulations and identified ARARs.

By signing this letter, DNREC formally expresses its concurrence with the selected remedy.

Sincerely,

Phillip G. Retallick
Director

PGR:DRH/mlb
DRH2155

cc: Edwin H. Clark II, Secretary
N. V. Raman, Program Manager II
Stephen N. Williams, Program Manager I
Dilip R. Hansalia, Project Officer

## DECISION SUMMARY

### 1.0 SITE NAME, LOCATION AND DESCRIPTION

The Chem-Solv, Inc. (Chem-Solv) site is located in Cheswold, Kent County, Delaware, approximately 3 miles north of Dover on the west side of U.S. Route 13 (Dupont Highway) just south of Delaware Route 42 (Figure 1). The Chem-Solv facility occupied the southern third of a 1.5 acre property and consisted of a one-story concrete block building, a distillation process building, and a concrete pad. A concrete-paved skateboard park was formerly located adjacent to the office building, but was partially dismantled in 1988. A two-story wood frame apartment building, a storage barn, and a wood shed occupy the northern two thirds of the property (Figure 2).

The total population of Cheswold, Delaware is approximately 300. Surrounding land use is agricultural, residential, and commercial (Figure 3). Strip development consisting of commercial establishments and private residences is found on both sides of Route 13 in the vicinity of the site.

To the south and west of the site is an abandoned field that was part of a former drive-in theatre. A truck stop/restaurant/fueling establishment previously operated immediately north of the property, adjacent to Route 13. Three underground storage tanks (USTs) were removed from this property in May 1988. The tanks reportedly contained diesel fuel, gasoline and fuel oil. An antique furniture/refinishing store is located north of the former truck stop on the southwest corner of the intersection of Routes 13 and 42.

On the north side of Route 42 west of Route 13 is a gasoline station/convenience store where leaking USTs were replaced in May 1990. In the past, gasoline stations operated on both the northeastern and southeastern corners of the intersection of Routes 13 and 42 as well, each of which had USTs located on the premises. Three USTs on the property on the southeast corner were cracked when removed in April 1987.

Private homes are located along Route 42 proceeding east from Route 13. A roofing business, a private home, and a used truck business are all located across Route 13 from Chem-Solv.

Geology - The Chem-Solv site is located within the Coastal Plain Physiographic Province, which is characterized as a series of unconsolidated or partially consolidated layers of sand, gravel, silt, and clay. These sediments form a wedge that dips and thickens to the southeast. The thickness of the Coastal Plain sediments is approximately 3,300 feet in the vicinity of the

site. This section of sediments consists of the Miocene Calvert Formation of the Chesapeake Group overlaid by the surficial Pleistocene Columbia Formation (Figure 9). The thickness of the Columbia Formation in the vicinity of the site is approximately 50 feet. The formation is locally characterized by unconsolidated, moderately to poorly sorted, coarse-to-fine, brown-to-orange quartz sand. Thin clay, silt, and gravel interbeds are common within the formation. The Chesapeake Group which immediately underlies the Columbia Formation is characterized by gray to bluish-gray silts with some sand that are commonly fossiliferous. The Cheswold aquifer is found within the Chesapeake Group in the vicinity of the site.

**Soils** - Soil at the site is classified as Sassafras sandy loam by the United States Department of Agriculture Soil Conservation Service. The Sassafras consists of deep, well-drained, friable, moderately coarse textured sandy soils with 0 to 5 percent slopes. The hazard of erosion is slight because of the small slopes. The pH of these soils is in the range of 4 to 5.5. The soils retain moisture moderately well and are good for farm and nonfarm use.

**Stratigraphy** - The uppermost geologic unit beneath the site, the Columbia Formation, ranges in thickness from 20 to greater than 40 feet in the vicinity of the site. Wells and borings at the site shown in Figure 4 have encountered a low permeability silt layer approximately 1 to 6 feet thick at approximately 18 to 23 feet below grade. This layer separates the shallow and intermediate zones of the Columbia aquifer. It is present beneath the Chem-Solv property and extends beyond the property boundary to the eastern side of Route 13 in the vicinity of wells 8A and 8B. A second silt layer was encountered at shallower depths, approximately 14 feet below grade, at borings CSB-3 and CSB-5 and well MWS-6-25. This layer is not laterally contiguous with the silt layer encountered beneath the former Chem-Solv facility. Figure 5 shows the geologic cross section of the site.

**Hydrogeology** - In the vicinity of the site, the Columbia Formation functions as a thin water-table aquifer. The average depth to ground water at the site is approximately 8 feet. Because of its limited saturated thickness, only domestic supply needs can be met from this aquifer. However, the Columbia Formation is a source of recharge for the deeper artesian aquifers between the Columbia and the underlying Cheswold aquifer of the Chesapeake Group. In the vicinity of the site, the top of the Cheswold aquifer is present approximately 100 feet below grade.

Ground water flow directions for both shallow and intermediate zones of the Columbia aquifer are generally to the northeast. In the shallow zone, the average hydraulic conductivity has been calculated to be 31 ft/day. Ground water gradients and flow

velocities in the Columbia Formation are non-uniform as a result of the heterogeneous nature of the sediments. In 1990 and 1991, flow velocities for the shallow zone were estimated to be as high as 2.9 ft/day assuming a porosity of 15 percent. Because the thickness of the intermediate zone was not determined, no calculation of flow velocities could be made. The Alston Branch of the Leipsic River, which is located 0.4 miles north of the site, is the probable discharge point for ground water from the site.

**Surface Features** - The principal regional surface water features include the Leipsic River, Garrisons Lake, Massey's Millpond, the Fork Branch of the St. Johns River, and Silver Lake (Figure 6). The Leipsic River is located 1.3 miles north of the site. The Alston Branch is approximately 0.4 miles from the site. Massey's Millpond and Garrisons Lake are located along the Leipsic River approximately 2.5 miles and 1.5 miles northwest of the site, respectively.

Although the site is not located in a wetlands area, wetlands do exist 1 to 1.5 miles north of the site surrounding the Leipsic River and some of its tributaries. Except for occasional transient individuals, no federally-listed or proposed endangered species are known to exist in the vicinity of the site. The site is not located within the 100-year floodplain.

Site topography is fairly flat. A surface depression runs east-west along the southern site boundary. This depression resulted from the excavation and processing of 1300 cubic yards of soil during site soil remediation activities in 1985. Because this soil has been mechanically reworked, it has different physical characteristics from the surrounding undisturbed soil. As a result, surface water runoff tends to collect in this depression after rain.

The Delaware Department of State, Division of Historical and Cultural Affairs, has evaluated the property on which the Chem-Solv facility operated to determine whether historical or archaeological resources exist in the area. According to the Beers' Atlas of the State of Delaware (1868), the Chem-Solv property appears to have been part of a farmstead which once existed in the area. The apartment building and wood shed presently located on the property appear to be outbuildings which were associated with the main residence which no longer exists and the location of which is unknown. Because these buildings and the property may exhibit some historical or archaeological significance, the potential effects of the remedial action for the site on these resources will have to be evaluated further during the implementation of the selected remedy.

## 2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 History and Previous Investigations - The Chem-Solv facility was in operation from approximately 1981 to 1984. At the facility, spent industrial solvents were distilled and purified. The recovered product was then returned to the original generator for reuse. The residues generated during the distillation process, referred to as "still bottoms", were collected in 55 gallon drums. These drums were stored on the concrete pad behind the distillation building, awaiting offsite disposal as hazardous waste. Chem-Solv was, therefore, classified as a hazardous waste storage facility and had obtained Resource Conservation and Recovery Act (RCRA) interim status.

On September 7, 1984, an explosion and fire occurred at the facility which resulted in solvents running off the concrete pad and into the soil. The Delaware Department of Natural Resources and Environmental Control (DNREC) was notified and immediately initiated an investigation to determine the nature and extent of potential soil and ground water contamination. At the time of the incident, DNREC conducted air monitoring and collected soil samples. Based on soil sampling analysis, DNREC concluded that the soil contamination consisted primarily of the following volatile organic compounds (VOCs): trichloroethene (TCE); 1,1,1-trichloroethane (TCA); 1,2-dichloroethane (1,2-DCA); 1-chloroethane; ethylbenzene and toluene.

As a result of a detailed analysis of the waste and material handling practices at Chem-Solv, DNREC concluded that the facility had other violations of Delaware's regulations governing hazardous waste. Consequently, DNREC issued a Cessation of Operation Order (Order) to Chem-Solv dated September 21, 1984. The Order outlined DNREC's belief that spillage of hazardous wastes onto the ground had occurred during the fire on September 7, 1984, and at other times previous to that incident. DNREC ordered Chem-Solv to halt all hazardous waste handling operations with the exception of those associated with cleanup of the site. In addition, the Order required Chem-Solv to remove contaminated soil from the site and to initiate a ground water monitoring program. DNREC initiated a soil and ground water investigation after the owners of Chem-Solv failed to comply with the Order. In August 1985, DNREC terminated Chem-Solv, Inc.'s interim status under RCRA and denied Chem-Solv, Inc.'s request for a RCRA Part B permit to store hazardous waste.

In 1985 DNREC removed a large portion of the drum storage pad and excavated 1300 cubic yards of contaminated soil to the depth of the water table. Figure 2 shows the approximate area of excavation. The soil was staged onsite for later remediation. Subsequently, DNREC contracted with SMC Martin, Inc. (SMC Martin), an environmental consultant, to evaluate remedial alternatives for onsite treatment of the excavated soil.

SMC Martin conducted two initial rounds of soil sampling in May 1985. The sampling scheme was designed to determine the following:

1. Whether any contaminated soil remained in the sidewalls or floor of the excavation;

2. The range of concentration of contaminants in the soil stockpile for the evaluation of feasible remedial alternatives; and

3. Whether any compounds other than VOC's had contaminated the soils.

SMC Martin collected soil samples from the stockpiled soils, and from the floor and sidewalls of the pit, and analyzed them for selected VOCs. Total VOC concentrations ranged from 0 ug/kg (micrograms per kilogram) to 120 ug/kg in the sidewalls, 132 ug/kg to 3640 ug/kg in the floor, and 26 ug/kg to 244 ug/kg in the stockpiled soils. VOC contamination consisted of TCE and TCA.

Based on results from the May 1985 sampling, SMC Martin concluded that soil shredding/aeration was the appropriate alternative for remediation of the soil and issued a report entitled Evaluation of Remedial Alternatives for Soil and Groundwater Cleanup at the Chem-Solv Solvent Recovery Facility, Cheswold, Delaware, dated May 18, 1985.

In August 1985, a second round of soil samples was collected from the in-place soils adjacent to the stockpiled soils and analyzed for VOCs and acid/base neutral organic compounds. No acid/base neutral compounds were detected. VOC concentrations ranged from 1.9 to 31 ug/kg. Samples were also collected from the stockpiled soils and analyzed for VOCs. Total VOC concentrations ranged from 1.1 to 480 ug/kg. These results indicated that the stockpiled soil contained significant levels of VOCs and that the excavation had not extended to an adequate depth, although soil was removed to the water table. Some minor VOC contamination existed in the in-place soil.

The soil shredding process began on September 9, 1985 and continued until November 7, 1985. The stockpiled soils were repeatedly passed through the soil shredder equipment. Samples of the soil were taken before and after shredding and were analyzed for VOC concentration, moisture content, grain size, and pH. When analytical results indicated that additional passes of the soil through the shredder did not result in any additional reduction in VOCs, the soil was placed into the excavated pit and compacted. Otherwise, the soil was returned to the shredder for another pass.

SMC Martin published the findings of the soil shredding operation in a report entitled Removal of Volatile Organic Contaminants from Soils at the Chem-Solv Solvent Recovery Facility, Cheswold, Delaware, dated May 20, 1986.

DNREC also conducted an extensive investigation into ground water contamination associated with the Chem-Solv facility. Between September 1984 and June 1986, DNREC installed 43 monitoring wells and 7 recovery wells on and around the site. Monitoring wells were installed in the shallow and intermediate zones of the Columbia Formation, that is, above and below the low permeability silt layer which is found beneath the former Chem-Solv facility and extends across Route 13. Samples of ground water from these and domestic wells in the vicinity of Chem-Solv were collected and analyzed for organic priority pollutants, primarily VOCs, beginning in October 1984.

Early analytical data collected by DNREC indicated that ground water contamination in the shallow aquifer consisted of VOCs, primarily TCE and associated chlorinated hydrocarbons. Maximum detected concentrations ranged from 2.8 ug/l (micrograms per liter) chlorobenzene to 130,000 ug/l TCE. Other VOCs detected and their maximum concentrations were as follows: benzene (360 ug/l), chloroform (669 ug/l), 1,1-dichloroethane (1,1-DCA) (414 ug/l), 1,1-dichloroethylene (3,200 ug/l), 1,2-dichloroethane (1,2-DCA)(30 ug/l), trans-1,2-dichloroethylene (1,000 ug/l), ethylbenzene (1,100 ug/l), toluene (2,300 ug/l), TCA (1,800 ug/l), m-xylene (250 ug/l), o-xylene (106 ug/l), and p-xylene (111 ug/l). The inorganic element manganese was also found at elevated levels.

Continued monitoring of ground water quality indicated that by October 1985 the contaminant plume had migrated beyond the property boundary to the eastern side of Route 13. Total VOC levels in the median of Route 13 were as high as 418 ug/l and TCE was detected on the east side of Route 13 at a level of approximately 200 ug/l.

Contaminant concentrations in the intermediate zone monitoring wells never reached the high levels found in the shallow zone. The maximum detected VOC levels in the intermediate zone monitoring wells were 1.3 ug/l chloroform, 1.2 ug/l 1,1-DCA, 38 ug/l 1,2-dichloropropane, 2.3 ug/l toluene, 2.1 ug/l TCA, and 3.4 ug/l TCE.

Information gathered during this early investigation allowed DNREC to assess the general hydogeologic conditions underlying the site and to delineate the plume of VOC-contaminated ground water. In April 1985, DNREC retained SMC Martin to evaluate alternatives for ground water remediation at the site. Because of SMC Martin's findings, DNREC decided to implement a ground

water treatment system that included a collection system and treatment of the collected ground water by air stripping.

The ground water collection system became operational in December 1985. Seven recovery wells were installed onsite and were designed to contain the major portion of the plume within a 150-foot radius from the center of the system. Analytical results were obtained for both the untreated and treated ground water. In January 1986, total VOC levels were 37,946 ug/l in the untreated ground water and 3.5 ug/l in the treated water. Total VOC concentrations in the untreated ground water gradually decreased to a low of 1.7 ug/l in April 1988 and then increased to levels ranging from 49.4 ug/l in May 1988 to 173.2 ug/l in July 1988. Total VOC levels in the treated water ranged from not detected to 10.5 ug/l.

In September 1988, the air stripping tower collapsed. Collected ground water was no longer discharged to the air stripper but DNREC continued to discharge to the Kent County sewer system until November 1988 when the ground water collection system was shut down permanently. DNREC continues to conduct quarterly monitoring of several domestic wells in the area. In 1987, DNREC replaced one domestic well, the Gearhart well indicated on Figure 4 on the east side of Route 13, after VOCs were detected in the well. The replacement well was drilled into a deeper uncontaminated aquifer.

2.2 <u>Enforcement Activities</u> - EPA initially proposed the Chem-Solv site for inclusion on the National Priorities List (NPL) on January 22, 1987. Subsequently, procedural issues arose and new technical information became available, resulting in EPA reproposing the site on June 24, 1988. EPA placed the site on the NPL on August 30, 1990.

In December 1987, EPA issued Special Notice Letters to approximately 30 potentially responsible parties (PRPs) inviting them to perform the Remedial Investigation/Feasibility Study (RI/FS) for the Chem-Solv site. In September 1988, DNREC, EPA and 21 of the PRPs entered into an Administrative Order on Consent (AOC). Under the AOC, the PRPs agreed to perform the RI/FS, with DNREC and EPA oversight, in accordance with CERCLA.

## 3.0 <u>HIGHLIGHTS OF COMMUNITY PARTICIPATION</u>

Pursuant to CERCLA § 113(k)(2)(B)(i)-(v), the RI/FS reports and the Proposed Plan for the Chem-Solv site were released to the public for comment on January 15, 1992. These two documents were made available to the public in the Administrative Record file located at the EPA Docket Room in Region III's Philadelphia office, the DNREC office in New Castle, DE, and at the William C. Jason Library at Delaware State College in Dover, DE. The notice of availability of these documents was published in <u>The</u>

Wilmington News Journal and The Delaware State News on January 15, 1992. A public comment period on the documents was held from January 15, 1992 to February 14, 1992. In addition, a public meeting was held on February 6, 1992. At this meeting, representatives from EPA and DNREC answered questions about conditions at the site and the remedial alternatives under consideration. A response to the comments received during the public comment period, including those expressed verbally at the public meeting, is included in the Responsiveness Summary, which is part of this Record of Decision (ROD). This ROD presents the selected remedial action for the Chem-Solv, Inc. site in Cheswold, Delaware, chosen in accordance with CERCLA and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300. The decision for this site is based on the Administrative Record file placed in the above-mentioned locations.

## 4.0 SCOPE AND ROLE OF REMEDIAL ACTION

This ROD addresses ground water contamination in the Columbia aquifer, the only media requiring remedial action at this site. The remedial action objectives are to prevent exposure to the contaminated ground water at the site and to restore the ground water to its beneficial use. In the vicinity of this site, the Columbia aquifer is a potential drinking water source.

## 5.0 SUMMARY OF SITE CHARACTERISTICS

In accordance with the AOC signed in 1988, the PRPs performed a RI/FS to assess the nature and extent of contamination of the local ground water and the soil in and around the former excavated area by site-related contaminants. The PRPs also performed a risk assessment to evaluate the risk to human health and the environment from exposure to site contaminants.

The RI included soil, ground water, and stratigraphic investigations. Ten soil borings were drilled within the boundary and around the edge of the former excavated area and 32 soil samples were collected to evaluate whether contamination remained in these areas. Soil samples were analyzed for all Target Compound List (TCL) and Target Analyte List (TAL) parameters. Five stratigraphic borings were also drilled downgradient to determine the extent of the silt layer which had been identified directly beneath the facility. Seven additional monitoring wells were installed. Ground water samples were collected from these wells and from seven existing wells and analyzed for all TCL/TAL parameters. Analytical data from the ground water sampling were evaluated to determine the horizontal and vertical extent of ground water contamination in both the shallow and intermediate zones of the Columbia aquifer.

5.1 **Soils** - Low concentrations of organic compounds were detected in onsite soils, generally at levels below or close to the method quantitation limit (Figure 7). These compounds included VOCs (TCE, chloroform, methylene chloride, toluene, and xylene), semivolatile organics (benzoic acid, bis [2-ethyhexyl] phthalate, butylbenzylphthalate, and isophorone), and pesticides (DDD, DDE, and DDT). Twenty inorganic elements were detected in onsite soils at background levels. Generally soils from within the former excavated area had lower concentrations of both organic and inorganic compounds than soils located outside the former excavated area.

Results from soil samples collected within the boundary of the former excavated area confirm that the DNREC soil remediation program successfully removed VOCs from the soils. Toluene and xylene were detected below method quantitation limits in only one sample at estimated concentrations of 2 ug/kg and 3 ug/kg, respectively. In addition, analytical results from sampling locations around the former excavated area show maximum levels of chloroform (15 ug/kg), methylene chloride (4 ug/kg), and TCE (5 ug/kg) at levels near the analytical detection limit and indicate that the soil remediation program encompassed the entire source area.

Some semivolatile organics were detected both within and outside the former excavated area at low concentrations. Comparison of data obtained from site background soils indicates that the pesticides detected in onsite soils are anthropogenic. These compounds probably resulted from previous pesticide use at the adjacent open field. In addition, background data indicate that the 20 inorganics detected in onsite soils are generally within background concentrations (Table 1). A slightly elevated lead level in one onsite soil sample is likely attributable to the fact that the site is directly adjacent to Route 13.

5.2 **Ground Water** - Figure 8 summarizes the relevant ground water data collected during the RI. Wells 9A, 22A, 33A, 39A, 41A, MWS-3-17, MWS-5-18, MWS-6-25, and MWS-7-25, drilled to depths of 25 feet or less, are located in the shallow zone of the Columbia aquifer. Wells 9B, 5B, MWI-1-43, MWI-4-40, and MWI-2-40 are drilled in the intermediate zone to depths of approximately 40 feet. Ground water flows to the northeast in both the shallow and intermediate zones. Wells 22A and MWI-1-43 are located upgradient of Chem-Solv and represent background conditions. Wells 9A, 9B, 5B, and 33A are located within the property boundary. The remainder of the wells are located downgradient of the property boundary in the direction of ground water flow.

5.2.1 **Shallow Zone Investigation** - Eleven VOCs (acetone, benzene, 1,1-dichloroethane, cis-1,2-dichloroethene, 1,2-DCA, methylene chloride, tetrachloroethene (PCE), toluene, TCA, TCE, and total xylenes) were found during the ground water

investigation. Total VOC concentrations ranged from 5 ug/l in well MWS-5-18 to 563 ug/l in well 33A to 921 ug/l in well MWS-7-25. Twelve VOC tentatively identified compounds (TICs) were found in well 26A and well MWS-7-25. Phenol was found in one well at 9 ug/l. Eleven semivolatile TICs were detected in three downgradient wells. No pesticides were found in any sample.

Wells 33A and 26A showed the highest concentrations of site-related contamination. TCE concentrations were highest in well 33A at 540 ug/l. Well 26A, located on the adjacent property just north of Chem-Solv, was found to be contaminated with benzene, toluene, and several VOC TICs. It is uncertain whether the contamination in well 26A may be partially attributed to USTs or the operation of a filling station on this property in the past; however, well 26A is situated downgradient from the initial source at Chem-Solv and certain compounds found in this well (benzene, toluene, TCE, and 1,1-DCA) during and previous to the RI have also been determined to be associated with Chem-Solv. The contamination in well 26A will be addressed, therefore, by the selected remedy for the Chem-Solv site.

Sources other than Chem-Solv are believed to be the cause of contamination found just north of the intersection of Routes 13 and 42. VOC contamination found in MWS-7-25 has been interpreted to be representative of compounds found in the subsurface after gasoline or other petroleum hydrocarbons are spilled. DNREC UST files document that USTs were located at several former gasoline stations located at this intersection and just west of Route 13 on Route 42, as discussed in Section 1.0. Some of these tanks were known to have leaked in the past or were reported to be cracked when removed from the ground. The contamination associated with these suspected sources north of Route 42 is not within the boundary of the contaminant plume associated with the Chem-Solv site and therefore will not be addressed as part of the remedy for the site.

Inorganics detected at elevated levels in shallow ground water samples include manganese and zinc. Elevated zinc levels were found only in well 33A and are believed to be caused by the galvanized steel casings of the recovery wells located in the vicinity of well 33A. These recovery wells will be removed during the performance of the selected remedial action at the site as set forth in Section 9.0 of this document.

The highest concentrations of manganese, approximately 23,000 ug/l, were detected in well 26A. Elevated levels were also found in wells further downgradient, but at comparatively lower levels (1800 ug/l at well 41A; 1300 ug/l at well 39A). Manganese concentrations in wells that were sampled and located within the Chem-Solv property boundary were only as high as 148 ug/l. Inorganic compounds, such as manganese, become more soluble in

water under anaerobic conditions. Low pH and dissolved oxygen concentrations for well 26A indicate that these conditions exist in this location. The anaerobic conditions are believed to be influenced by the natural degradation of the hydrocarbon contaminants found in this well. The dissolved manganese consequently moves with ground water to the northeast resulting in elevated levels of manganese in wells 39A and 41A.

5.2.2 Intermediate Zone Investigation - Ground water data collected from wells in the intermediate zone of the aquifer indicate that impact to this zone has been limited by the presence of the low permeability silt layer beneath the site. However, some VOC contamination has occurred as indicated by low levels of VOCs in the intermediate zone monitoring wells and nearby domestic wells (Figure 8).

Low concentrations of volatile and semivolatile organic compounds were found in the two wells located within the property boundary and the upgradient well. TCE was detected in well 5B at an estimated concentration of 5 ug/l and was not detected in well 9B at the quantitation limit. Total semivolatile organic TICs were 10 ug/l in the upgradient well (MWI-1-43), 103 ug/l in well 5B, and 60 ug/l in well 9B. No volatile organic TICs, semivolatile organic compounds, or pesticides were detected in any ground water sample. Elevated levels of mercury were found in well 9B; however, further investigation revealed that the majority of the mercury exists in the less toxic inorganic form and is not of concern at the concentrations detected.

5.2.3 Domestic Wells - DNREC has monitored several domestic wells in the area periodically since 1984. Some of these wells are screened in the water table aquifer, some are much deeper, and many are of unknown depths. As mentioned in Section 2, one well, the Gearhart well located on the east side of Route 13 (see Figure 4) was replaced in 1987 after becoming contaminated with VOCs. Samples collected in March 1991 from the American Roofing, new Gearhart, and Simon wells, the three wells located closest to the Chem-Solv property, indicated little impact from the site (Figure 8). The American Roofing well showed 1,2-DCA at 5 ug/l. No other VOCs were detected in the three wells. Manganese and zinc were not found at elevated levels. Mercury was not detected.

In summary, soil sampling results indicate that the soil shredding operation conducted by DNREC in 1985 was sufficient to remediate the contamination in the source area. Very little contamination of soil remains and is at such low levels that no further action is warranted. No potential or current threat to human health or the environment is presented by the onsite soils.

Ground water, however, remains contaminated with several VOCs, primarily TCE and benzene, and the inorganic contaminant

manganese. The ground water contamination exists beneath the Chem-Solv property and extends laterally some distance to the northeast in the direction of ground water flow to approximately well 41A located on the east side of Route 13. The highest concentrations of contaminants in the ground water have been found in one monitoring well on the Chem-Solv property and in one well on the adjacent property directly to the north. Vertically, the contamination has been detected in the uppermost water table aquifer beneath the site, the Columbia Formation, with the majority present within the upper 20 feet, the shallow zone. Very low concentrations of contaminants have been found at depths of approximately 40-50 feet in monitoring wells and in some domestic wells in the area. Based on the low concentrations of contaminants that were detected relative to their solubilities in water, EPA has determined that it is extremely unlikely that dense nonaqueous phase liquids (DNAPLs) exist beneath the site.

## 6.0 SUMMARY OF SITE RISKS

A Risk Assessment was prepared by the PRPs to assess the potential human health and environmental effects that may result from exposure to contaminants from the site. The Risk Assessment can be found in Section 5 of the Remedial Investigation Report, BCM Engineers, Inc., November 1991. EPA subsequently modified the human health risk assessment. All documentation is included in the Administrative Record file for the site. The revisions are included in the risk discussion presented in this section. Based on the Risk Assessment, as modified by EPA, it has been determined that actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health and welfare.

### 6.1 Human Health Assessment

**6.1.1 Contaminant Identification Information** - No organic or inorganic compounds were determined to be of concern in soil because the concentrations detected were in the range of background concentrations which are not above acceptable health-based levels, represented isolated events unrelated to previous site activities, or were infrequently detected at low concentrations. EPA consequently concluded that onsite soils do not pose a human health or environmental threat. The remainder of the risk assessment was not performed for soils because no contaminants of concern were identified.

Contaminated ground water was the only medium found to pose a threat to human health or the environment at the Chem-Solv site. The contaminants of concern for ground water listed in Table 2 include several VOCs detected during the RI and one inorganic contaminant, manganese, also detected during the RI. The reasonable maximum exposure (RME) values for the contaminants of

concern are also listed in Table 2. The RME represents the 95 percent upperbound confidence interval for the arithmetic mean. It is a statistical estimate of the highest average concentration predicted to occur in 95 out of 100 sets of samples. The RME is used to account for the fact that the actual number of samples is relatively small to accurately predict the average.

6.1.2 **Exposure Assessment** - The exposure assessment determines the pathways that may result in human exposure, the mass of chemicals at the point of exposure, and the concentration of each chemical absorbed by the exposed individual on a daily basis (chronic daily intake, CDI). Exposure pathways include all the various ways in which humans come in contact with the contaminants of concern, either currently or at some time in the future.

The only complete exposure pathway identified at the Chem-Solv site is residential use of the ground water. Currently, one drinking water well is located within the property boundary and several are located downgradient. Potential routes of exposure include ingestion of ground water, inhalation of indoor air containing VOCs, and dermal absorption during showering or bathing.

The potential for contamination of homegrown fruits and vegetables during watering and the release of contaminants to surface water were also considered. Since the contaminants of concern are primarily VOCs which will volatilize during watering, they have little to no potential for accumulation in homegrown food.

The distance to the nearest point of surface water discharge is 0.4 miles, and low concentrations of VOCs indicate that the potential for elevated concentrations in this stream, the Alston Branch of the Leipsic River, is highly unlikely. Nevertheless, an exposure pathway quantified for dermal absorption during showering or bathing can be used to semi-quantitatively evaluate exposure in the stream.

Exposure during recreational use of the stream will be primarily dermal, with occasional wetting of the hands, feet, and lower legs of children. The use of the exposure pathway for dermal absorption during showering and bathing assumes daily contact with ground water over the entire body. If this pathway poses no significant risk, sporadic dermal exposure to water in the stream will pose even less risk. In fact, as explained below, the dermal absorption route alone does not pose an unacceptable risk. Therefore, no adverse health effects would be expected from use of the stream.

The objective of the exposure assessment is to determine how much of the chemical is actually taken into the body (dose or CDI).

The dose received daily is expressed as the milligrams of contaminant per kilogram of body weight per day (mg/kg/day). A number of assumptions are used to calculate the dose for each identified exposure pathway since it is seldom possible to measure a specific dose. The assumptions used for this risk assessment are presented in Table 3. Separate calculations were performed for adults and children because children are considered a more sensitive subpopulation.

The data for the ground water monitoring wells were evaluated to determine which wells were most representative of the ground water quality at the site. The data from these wells were then combined to estimate concentrations in a hypothetical drinking water well placed in the contaminated area. Data from the intermediate and shallow zone wells 5B, 26A, 33A, and 39A were combined to simulate ground water use in the area. Area drinking water wells are generally installed at depths greater than 100 feet; however, the high porosity of the soil and the absence of a true confining layer in all areas suggests that water from the shallow zone is likely to be included in the recharge for the intermediate zone wells. In this way, human exposure to water from the shallow aquifer may occur.

6.1.3 <u>Toxicity Assessment</u> - Cancer potency factors (CPFs), also known as slope factors, have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs for contaminants of concern which contribute to the carcinogenic risk are presented in Table 4. CPFs, which are expressed in units of $(mg/kg/day)^{-1}$, are multiplied by the estimated chronic daily intake (CDI) of a potential carcinogen, in mg/kg/day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

The weight of evidence, also presented in Table 4, reflects the degree of confidence in the data used to determine that the chemical is a human carcinogen. EPA toxicologists recognize that the risks associated with a known human carcinogen, based on epidemiological studies, should be evaluated differently from those of a chemical that causes tumor production in a limited number of laboratory animals. Each carcinogen is assigned to a group according to the quality and quantity of evidence for carcinogenicity in humans and animals. The definitions for the groups are presented in Table 5.

The potential for adverse noncarcinogenic health effects is estimated with a toxicity value known as a reference dose (RfD). RfDs are associated with adverse health effects, which are also referred to as toxicity end points. The RfDs and toxicity endpoints for the contaminants of concern are listed in Table 6.

The model to determine RfDs from the dose-response assessment assumes that there is a concentration for noncarcinogens below which there is little potential for adverse health effects over a lifetime of exposure. The RfD is designed to represent this threshold level.

The RfD is calculated from the highest chronic exposure level that did not cause adverse effects (the no-observed-adverse-effect level, or NOAEL) in animals. The NOAEL is divided by a factor to account for any uncertainty such as using data on animals to predict effects on humans and an allowance for sensitive individuals. Uncertainty factors range from 1 to 10,000, based on the confidence level associated with the data. The resulting RfD (mg/kg body weight/day) is used to quantify the risk.

6.1.4 <u>Risk Characterization</u> - The risk characterization combines the dose with the toxicity value to estimate a numerical value for the risk. There are several differences between the approach used to describe risk for carcinogens (cancer risk) and for noncarcinogens (hazard index, HI).

6.1.4.1 <u>Carcinogenic Risks</u> - Excess lifetime carcinogenic risk is calculated by multiplying the dose (CDI) times the slope factor. These risks are probabilities that are generally expressed in scientific notation (e.g., $1 \times 10^{-6}$). An excess lifetime carcinogenic risk of $1 \times 10^{-6}$ indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70 year lifetime under the specific exposure conditions at a site. Carcinogenic risk estimates for the same chemical in different exposure pathways are added together. Also, carcinogenic risks for different chemicals are added together to determine the risk associated with the exposure pathway for all the chemicals.

EPA has not established an intake level below which no adverse carcinogenic effects would be expected to occur. Instead, in the NCP, EPA has identified a range of acceptable carcinogenic risks of $1 \times 10^{-6}$ to $1 \times 10^{-4}$ for Superfund sites. This means that target risk levels are between an upper limit of 1 in 10,000 probability of excess cancer incidence to a lower limit of 1 in 1,000,000.

Table 7 presents carcinogenic risk values for each exposure pathway and for each contaminant in each pathway. The total

carcinogenic risk for the ingestion pathway is $5 \times 10^{-5}$. The majority of risk is attributed to TCE and benzene, $2 \times 10^{-5}$ for each. Total carcinogenic risk for the inhalation pathway is also $5 \times 10^{-5}$ with TCE and benzene contributing the greatest risk at $3 \times 10^{-5}$ and $2 \times 10^{-5}$, respectively. Dermal absorption presents a total carcinogenic risk of $8 \times 10^{-6}$, an order of magnitude lower than ingestion and inhalation. Total carcinogenic risk for all pathways is $1.1 \times 10^{-4}$ which exceeds the upper bound ($1 \times 10^{-4}$) of EPA's target risk range.

6.1.4.2 <u>Noncarcinogenic Risks</u> - Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's reference dose). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. HI values less than 1.0 indicate that lifetime exposure has limited potential for causing an adverse effect in sensitive populations. HI values greater than 1.0 show that acceptable exposure levels have been exceeded.

Table 8 presents the noncarcinogenic risks presented by each exposure pathway and contaminant. Separate calculations are performed for adults and children because children are considered to be a more sensitive subpopulation. The HI values exceeded 1.0 for ingestion of ground water for both adults (4.0) and children (11.0). With an HQ of 4.0, manganese is the contaminant driving the risk for this pathway. The remainder of the contaminants present HQs well below 1.0 and contribute insignificant risk.

For the inhalation and dermal absorption pathways the HQ values do not exceed 1.0 for either adults or children, indicating that the potential for adverse health effects from inhalation or dermal absorption is not expected. The HQ for adults for the inhalation pathway is $2 \times 10^{-2}$ and the HQ for children is $5 \times 10^{-2}$. For the dermal absorption pathway, the HQ for adults is $5 \times 10^{-3}$ and the HQ for children is $7 \times 10^{-3}$. The total HI for all three pathways for adults is 4.0 and for children is 11.0, both of which exceed the acceptable HI of 1.0.

6.2 <u>Environmental Risk Assessment</u> - The environmental risk assessment performed for the Chem-Solv site found no unacceptable risks to the environment. There are no contaminants in the soils at significant concentrations above background. The contaminants of concern in ground water were evaluated for potential impacts on aquatic life at the point of discharge into the nearest surface water, the Alston Branch of the Leipsic River (Figure 1). The evaluation compared the calculated concentrations at the

point of release with water quality guidelines (Table 9). All predicted concentrations based on the RME concentrations for each contaminant are below chronic toxicity guidelines indicating that there is little to no potential for impact on aquatic life at the discharge point.

No critical habitats, endangered species or habitats of endangered species have been identified in the area. The Chem-Solv property is vegetated with perennial plants (e.g., clover, cow vetch, fleabane, plantain, ironweed, and several perennial grasses). In the area where soil excavation and remediation took place, a depression exists where water accumulates after precipitation. This area is vegetated with some of the same plants but many of the predominant plants found on the rest of the property cannot tolerate such wet conditions.

### 6.3 Remedial Action Objectives and Cleanup Levels

The human health risk assessment indicates that the carcinogenic risk ($1.1 \times 10^{-4}$) and the noncarcinogenic risks (Hazard Index of 4.0 for adults, 11.0 for children) associated with the site exceed acceptable levels and therefore warrant remedial action to clean up ground water at the site. Remedial action objectives and ground water cleanup levels must therefore be established.

The remedial action objectives for the site are to restore the ground water to its beneficial use as a potential drinking water source and to prevent exposure to the contaminated ground water until the restoration is complete. Cleanup levels for the contaminants of concern are listed in Table 10. In accordance with § 300.430(e)(2)(i) of the NCP, 40 C.F.R. § 300.430 (e)(2)(i), the non-zero Maximum Contaminant Level Goals (MCLGs) and, where the MCLG is zero, Maximum Contaminant Levels (MCLs) developed under the Safe Drinking Water Act are the appropriate cleanup levels for the majority of the contaminants. For acetone and manganese, risk-based cleanup levels were developed because MCLs do not exist. The cleanup level for manganese is based on the No Observed Adverse Effect Level (NOAEL) and consideration that manganese might be consumed from sources other than water. The cleanup level for acetone is a Drinking Water Equivalent Level calculated using the Reference Dose (RfD).

## 7.0 DESCRIPTION OF ALTERNATIVES

From the results of the Remedial Investigation (RI) and the Risk Assessment, it has been determined that only one medium of concern exists at the site. This has been identified as the ground water in the Columbia aquifer which has been contaminated by VOCs and manganese.

The NCP requires that the alternative chosen to clean up a hazardous waste site meet nine criteria. The alternative must

protect human health and the environment, be cost effective, and meet the requirements of environmental regulations. Permanent solutions to contamination problems should be developed wherever possible. The solutions should reduce the volume, toxicity, or mobility of the contaminants. Emphasis is also placed on treating the wastes at the site, whenever this is possible, and on applying innovative technologies to clean up the contaminants.

The FS evaluated a variety of technologies to see which were appropriate for addressing the contamination at this site. The technologies determined to be most appropriate were developed into remedial alternatives. These alternatives are presented and discussed below. All costs and implementation timeframes provided for the alternatives below are estimates and should be used for comparative purposes only.

**COMMON ELEMENTS:**

The alternatives considered for the site include several common elements. First, all alternatives include a monitoring program for evaluation of ground water quality. The FS assumed that monitoring would include sampling of onsite and offsite monitoring wells and residential wells immediately downgradient of the Chem-Solv property, that the analyses would include VOCs and metals, and that approximately eight wells would be sampled for monitoring purposes. The monitoring costs associated with each alternative are based on these assumptions. Final determination of the specific number and location of wells, the frequency of sampling, and the analytical parameters and methods to be included in the monitoring program during implementation of the selected remedy will be made by EPA during the remedial design for the site.

Second, all alternatives include removal of seven existing recovery wells located on the Chem-Solv property. These wells are constructed of galvanized steel which is believed to be contributing to levels of zinc above background in the immediate vicinity of the ground water collection system installed by DNREC in 1985. Since the collection system is no longer operable, the recovery wells will be removed. Abandonment of these wells will be performed in accordance with the Delaware Regulations Governing the Construction of Water Wells, Title 7, Delaware Code, Chapter 60, § 6010.

Third, Alternatives 2 through 5 include a ground water restriction zone to be instituted and enforced by DNREC. This institutional control would restrict future installation of residential wells in the Columbia aquifer in the contaminated area and an appropriate buffer zone until cleanup levels are achieved. Alternatives 3 through 5 also include provisions for an alternate water supply to existing users should ground water

monitoring indicate that contaminants are present in a well at concentrations exceeding cleanup levels.

Five alternatives were evaluated to deal with the risks posed by current and/or future ground water contamination. Alternative 1 is considered no action because no active remediation would be conducted. Alternatives 2 and 3 are considered limited action since they include institutional controls or, in the case of Alternative 3, an alternate water supply. Alternatives 4 and 5 offer two approaches to active remediation of the contaminated ground water.

Cost figures include capital costs, annual operation and maintenance (O & M) and present worth costs for each alternative. An interest rate of 10 percent before taxes and after inflation was assumed for the present worth analysis. The following is a brief summary of each of the alternatives evaluated for the site:

**Alternative 1: No Action, Ground Water Monitoring**

| | |
|---|---|
| Capital Costs: | $13,500 |
| Annual O & M: | $25,000 - $81,000 |
| Present Worth: | $385,000 |

The NCP requires that the "no action" alternative be evaluated at every site to establish a baseline for comparison. Under this alternative, no further action would be taken to remediate the ground water contamination or to prevent exposure to the ground water either from existing residential wells or from residential wells which might be installed in the future. This would allow the continued migration of contamination in the ground water, resulting in additional exposure of individuals to contaminants exceeding cleanup levels.

The monitoring program discussed above would be included to monitor ground water quality while the contamination is reduced to cleanup levels by natural attenuation. Natural attenuation is a combination of processes, such as biodegradation, dilution, and dispersion that occurs within the aquifer and is estimated to take approximately 14 years. This estimate is based on concentrations of TCE and benzene in ground water being reduced to MCLs. The assumption has been made that if the VOCs are removed, the conditions causing the manganese to become soluble would be eliminated thus reducing the elevated manganese concentrations.

The costs listed above are based on quarterly monitoring for the first 2 years, semiannual monitoring for the next 5 years, and annual monitoring thereafter. Annual monitoring would continue for 3 years after reaching the cleanup levels. The range in O&M costs reflects the range in the frequency of monitoring. In accordance with EPA guidance set forth in "Structure and

Components of Five-Year Reviews," May 23, 1991, OSWER Directive 9355.7-02, a policy review of the remedial action would be conducted not less than every 5 years from the initiation of such remedial action to interpret the ground water data and to monitor the progress of natural attenuation. After review of the monitoring data, the scope of the monitoring program would be adjusted if determined necessary by EPA. This alternative is considered to be easily implementable.

**Alternative 2: Ground Water Monitoring, Ground Water Restriction Zone**

Capital Cost: $18,500
Annual O & M: $25,000 - $81,000
Present Worth: $391,000

As with Alternative 1, this alternative includes no action to remediate the ground water contamination or to prevent exposure to contaminated ground water from existing residential wells. Ground water contamination would continue to exceed cleanup levels and would continue to migrate downgradient. A ground water monitoring program would be implemented as discussed in Alternative 1. Alternative 2 would provide increased protection of human health compared with Alternative 1 because it would use institutional controls to reduce the potential for exposure to contaminated ground water for future users.

This alternative varies from Alternative 1 in that it provides a certain level of protection by restricting ground water use for future users by using institutional controls. In this case, DNREC would institute a ground water restriction zone to restrict future installation of residential wells in the contaminated area until contamination has naturally attenuated to cleanup levels in approximately 14 years. DNREC has administrative programs to support these restrictions, including well permitting, licensing of drillers, and water allocation permitting. All wells must be permitted by DNREC before installation. Notifications would also be placed on the deeds of all properties located in the restriction zone indicating that the property is located within the boundary of a ground water restriction zone. The exact location and extent of the restriction zone would be determined by EPA and DNREC during the remedial design for the site.

As with Alternative 1, policy reviews would be performed in accordance with EPA guidance set forth in "Structure and Components of Five-Year Reviews," May 23, 1991, OSWER Directive 9355.7-02 no less often than every five years from initiation of the remedial action to interpret the ground water data and to monitor the progress of natural attenuation. The implementation of deed restrictions would depend on the cooperation of property owners. This option is considered to be administratively feasible for implementation in a fairly short time frame.

**Alternative 3: Ground Water Monitoring, Ground Water Restriction Zone, Alternate Water Supply**

| | |
|---|---|
| Capital Costs: | $30,500 - $34,500 |
| Annual O & M: | $25,000 - $84,000 |
| Present Worth: | $410,000 - $431,000 |

In addition to ground water monitoring and the ground water restriction zone discussed in Alternatives 1 and 2, Alternative 3 would provide an alternate water supply to residences where ground water monitoring indicates that cleanup levels are exceeded. The alternate water supply would consist of well head treatment at the affected well or replacement of the affected well with a deeper well drilled into an uncontaminated aquifer.

Both existing and future ground water uses would be protected with Alternative 3, though no active remediation of the contaminated ground water would be conducted. Cleanup levels in the aquifer would be reached through natural attenuation. Ground water contamination would continue to migrate and exceedances of cleanup levels in the aquifer would go unaddressed.

The type of well head treatment system to be used would depend on the contaminants found during monitoring. Zeolite filters installed on supply lines would remove inorganic compounds, including manganese, from the household supplies. Carbon adsorption units would then be placed in series after the zeolite filters to remove VOCs. Ultraviolet treatment would be used to control bacterial growth in the carbon units. The objective of the well head treatment systems would be to reduce the concentration of contaminants to cleanup levels (Table 10). EPA would approve the exact configuration of the well head treatment system during the remedial design.

Any residuals from the treatment unit in the form of spent carbon or filtration media would be handled and disposed of offsite in accordance with the requirements of Delaware Regulations Governing Hazardous Waste, Parts 262-264 (40 C.F.R. Parts 262-264) and the land disposal restrictions in 40 C.F.R. Part 268, and transported in accordance with United States Department of Transportation (DOT) regulations, 49 C.F.R. Parts 107 and 171.1-172.604.

Wells now in use, if found to be contaminated, could also be replaced with wells screened in deeper uncontaminated aquifers thus preventing the use of the shallow contaminated aquifer. Two aquifers, the Cheswold and Frederica, could adequately supply the needs of area residents. The Cheswold aquifer is located 60 to 100 feet below ground surface. Although the Columbia, the uppermost aquifer beneath the site, provides recharge to the lower aquifers, the levels of contaminants at 60 to 100 feet would not be expected to exceed cleanup levels. Wells would be

installed in accordance with Delaware Regulations Governing the Construction of Water Wells, Title 7, Delaware Code, Chapter 60, § 6010.

The final decision as to which option would be implemented, well head treatment or well replacement, would be made by DNREC and EPA. Cooperation from property owners would be necessary to accommodate installation and maintenance of well head treatment systems or installation of new wells. Again, the alternate water supply contingency would be in effect until cleanup levels have been achieved through natural attenuation, which is expected to take approximately 14 years.

The cost estimates listed above reflect the range in costs for the alternate water supply options. The FS assumed that an alternate water supply might be provided at two residences immediately downgradient of the Chem-Solv property. The actual number of wells which might be affected may differ from this estimate.

Both well head treatment and well replacement are considered administratively feasible. Well head treatment has been used at other sites and is proven effective. Both options would require the cooperation of the affected property owners. Well installation would also require approval from DNREC. As discussed in Alternatives 1 and 2 above, policy reviews of the remedial action would be conducted no less often than every five years from the initiation of the remedial action in accordance with EPA guidance set forth in "Structure and Components of Five-year Reviews," May 23, 1991, OSWER Directive 9355.7-02.

**Alternative 4: Ground Water Monitoring, Ground Water Restriction Zone, Alternate Water Supply, Ground Water Collection, Discharge to POTW**

| | |
|---|---|
| Capital Costs: | $110,000 - $234,000 |
| Annual O&M: | $57,000 - $148,000 |
| Present Worth: | $660,000 - $686,000 |

Alternative 4 is essentially Alternative 3 with active remediation incorporated to remove contaminants from the affected aquifer. In addition to the ground water monitoring program discussed in Alternative 1, the ground water restriction zone discussed in Alternative 2, and the alternate water supply discussed in Alternative 3, Alternative 4 would include ground water collection from the aquifer. An estimated 8 recovery wells would be installed onsite to capture the contaminated ground water in the Columbia aquifer. The volume of the contaminated ground water has been estimated at approximately 58,500 cubic feet. The collected ground water would then be discharged to the Kent County Publicly Owned Treatment Works (POTW) via a Cheswold

District sanitary sewer located onsite. Treatment of the discharged water would be carried out at the POTW.

The pumping rate could vary depending on discharge limitations. The Kent County Engineering Office has indicated that proposed regulations could limit discharge to 5 gallons per minute (gpm) but that variances from these limits may be available on a case-by-case basis. Estimates for cost and length of time needed for remediation were calculated for pumping rates of 5 gpm and 20 gpm. At 5 gpm, cleanup levels would be reached in an estimated 8 years. At 20 gpm, cleanup levels would be reached in an estimated 2 years. The range in costs listed above reflects the difference in the length of time that pumping would be required at the different pumping rates. Also reflected in the cost range is the difference in the impact fee charged by the POTW at different pumping rates.

The discharge of collected ground water would be carried out in accordance with the General Pretreatment Regulations for discharge to POTWs, 40 C.F.R. Part 403, and any local pretreatment standards established by the Kent County POTW. The Kent County Engineering Office has indicated that collected ground water from the Chem-Solv site could most likely be discharged directly to the POTW without pretreatment because of the low levels of contaminants.

The ground water monitoring program proposed in the FS for 8 years of active remediation would include quarterly monitoring for 2 years, semiannual monitoring for the next 5 years, and annual monitoring for 4 years thereafter. For a two year treatment program, monitoring would be performed quarterly for 2 years and semiannually for the next 3 years. Costs listed above are based on these proposals. Actual monitoring program specifics will be determined by EPA during the remedial design.

Installation of new recovery wells is easily implementable because of information generated during installation of the DNREC collection system. A connection to the sanitary sewer system is readily available. Obtaining final approval from the Kent County POTW to accept the discharge from the site could pose a future problem for implementation of Alternative 4. Kent County has expressed some concern with accepting discharge from the Chem-Solv site because of capacity problems at the treatment facility.

As discussed in Section 5.2.1, the contamination at well 26A may be influenced by both Chem-Solv releases and sources (e.g., former USTs) on the property on which well 26A is located. Since well 26A is located downgradient to Chem-Solv and the contaminants found there can be partially attributed to Chem-Solv, this area is included in the remedial action for the Chem-Solv site. One concern with pumping and collection of ground water is that if sources remain on the adjacent property, then

benzene and manganese concentrations could increase in the ground water as a result of pumping. EPA anticipates, however, that during the remedial action, both benzene and manganese will be remediated to cleanup levels. Policy reviews would be conducted in accordance with EPA guidance set forth in "Structure and Components of Five-Year Reviews," May 23, 1991, OSWER Directive 9355.7-02 no less often than every 5 years from initiation of the remedial action to evaluate the performance of the remedial action. The possibility of other sources of contamination remaining on the adjacent property and the influence of those sources on the probability of achieving the cleanup levels for the site would be evaluated at that time.

Some uncertainty also exists as to whether ground water collection will significantly reduce the concentrations of contaminants in the ground water. Increased flow velocities caused by pumping may not allow enough time for contaminants in ground water and soil in the saturated zone to reach equilibrium, hence the desorption of contaminants from the aquifer soils may be the rate-limiting step in contaminant removal from the aquifer. In order to overcome this potential problem, pulsed pumping might have to be employed to allow for equilibrium conditions between contaminants in ground water and soil to be reached to more effectively remove the contaminants in the ground water. Aquifer tests would need to be performed during remedial design, and possibly during the remedial action, to optimize recovery of contaminants with a pulsed pumping system. The pumping rates and other operational considerations associated with the ground water collection system would be determined by EPA during the remedial design.

**Alternative 5: Ground Water Monitoring, Ground Water Restriction Zone, Alternate Water Supply, Ground Water Collection, Onsite Treatment, Discharge to Local Surface Water**

| | |
|---|---|
| Capital Cost: | $181,000 - $185,000 |
| Annual O&M: | $148,000 - $189,000 |
| Present Worth: | $687,000 - $688,000 |

Like Alternative 4, Alternative 5 includes the ground water monitoring program, ground water restriction zone, alternate water supply, and active remediation of contaminated ground water by collection via a series of recovery wells. In this case however, rather than discharging to the POTW, collected ground water would be treated onsite to meet cleanup levels. Collected ground water would then be discharged to local surface water by way of a storm sewer located about ten feet south of the Chem-Solv property line. A discharge pipeline would be constructed to connect the onsite treatment system to the storm sewer system. The pumping rate developed in the FS was 20 gpm which was projected to result in reaching cleanup levels in 2 years.

The onsite treatment system would consist of filtration and air stripping of ground water in order to remove both VOCs and manganese. Water from the collection system wells would be piped to a storage/equalization tank for holding before treatment. Manganese would be removed by filtration. A treatability study would be performed before final design of the treatment system to determine whether permanganate pretreatment is required for manganese precipitation in addition to filtration. The exact process design to implement this alternative would be determined by EPA after the treatability study and an aquifer test were conducted during the remedial design phase. The aquifer test would be performed before design of the treatment system to verify that the projected removal rates and discharge standards could be achieved.

Effluent from the manganese removal process would enter an air stripping column for removal of VOCs. Treated ground water would be discharged to a storage tank where it would be collected and sampled before discharge to a nearby storm sewer for transport to the Alston Branch of the Leipsic River.

Discharge of treated water to local surface water would meet the substantive requirements of the National Pollutant Discharge Elimination System (NPDES) program, 40 C.F.R. Part 403, and would comply with federal and state water quality regulations including Clean Water Act Water Quality Criteria for Protection of Human Health and Ambient Water Quality Criteria for Protection of Aquatic Life, 33 U.S.C. § 1314(a)(1), Delaware Water Quality Standards, Stream Quality Standard 10, and Delaware Surface Water Quality Standards of February 1990, § 9.3(a)(i) and § 9.3(b)(i). Discharge would also comply with the Delaware Wetlands Act of 1973, Title 7, Delaware Code, Chapter 66, § 6607 and 40 C.F.R., Part 6, Appendix A.

The collection, treatment, and discharge facilities would be sited in compliance with all location-specific ARARs including the Archaeological and Historic Preservation Act of 1974, 16 U.S.C. § 469 and the National Historic Preservation Act of 1986, 16 U.S.C. §470. The design, construction and operation of the collection, treatment, and discharge systems would comply with RCRA requirements set forth in the Delaware Regulations Governing Hazardous Waste, Parts 262-264 (40 C.F.R. Parts 262-264).

Offsite transport and disposal of treatment residuals would be performed in compliance with RCRA regulations governing the handling of hazardous wastes, Delaware Regulations Governing Hazardous Waste, Parts 262-264 (40 C.F.R. Parts 262-264), Land Disposal Restrictions, 40 C.F.R. Part 268, and DOT regulations for transport of hazardous materials, 49 C.F.R. Parts 107 and 171.1-172.604.

VOC emissions from the air stripper are estimated at 0.05 pounds/day. This estimate is based on maximum concentrations of VOCs found in ground water during the RI and a pumping rate of 20 gpm. Actual emissions from the air stripper would be determined during design and implementation of the remedial action and would comply with all state and federal regulations. The major regulations and guidelines include the following: National Ambient Air Quality Standards (NAAQS), 40 C.F.R. Part 50; National Emissions Standards for Hazardous Air Pollutants (NESHAPS), 40 C.F.R. Part 61; and Delaware Regulations Governing the Control of Air Pollution, 7 Delaware Code, Chapter 60, § 6003, Reg 2, § 2.4. In addition, emissions from the air stripper would comply with EPA policy for control of air emissions from Superfund sites contained in OSWER Directive 9355.0-28 entitled "Control of Air Emissions from Superfund Air Strippers at Superfund Ground Water Sites," June 15, 1989.

Emissions would also be controlled so as not to pose a carcinogenic risk to human health greater than $1 \times 10^{-4}$. A risk assessment for the treatment system would be performed to calculate the risk presented by the emissions of VOCs. Emission controls would be implemented if this value were to be exceeded. Costs for such emissions controls were not included in the cost figures listed above for this alternative.

The treatment technologies for this alternative have proven effective for the contaminants of concern at this site and are commercially available. The treatment system could be easily designed and implemented, as could the collection system. Discharge of treated effluent to surface water would require approval by DNREC. Operation and maintenance of the collection and treatment systems would be conducted until monitoring indicates that cleanup levels have been achieved throughout the contaminated area.

Costs listed above include quarterly monitoring for 2 years, the estimated length of active remediation, and semiannual monitoring for 3 years thereafter. Uncertainties regarding capture of contamination from possible offsite sources by the collection system and the probability of the system significantly reducing contaminant concentrations discussed in Alternative 4 also apply to this alternative. Policy reviews of the remedial action would be conducted no less often than every five years in accordance with EPA guidance set forth in "Structure and Components of Five-Year Reviews," May 23, 1991, OSWER Directive 9355.7-02.

## 8.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The five remedial action alternatives described above were compared against the nine evaluation criteria set forth in the NCP, 40 C.F.R. § 300.430(e)(9). These nine evaluation criteria can be categorized into three groups: threshold criteria,

primary balancing criteria, and modifying criteria. The criteria associated with each category are as follows:

THRESHOLD CRITERIA

- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements (ARARS)

PRIMARY BALANCING CRITERIA

- Long-term effectiveness
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

MODIFYING CRITERIA

- Community acceptance
- Support agency acceptance

These evaluation criteria relate directly to requirements in § 121 of CERCLA, 42 U.S.C. § 9621, which determine the overall feasibility and acceptability of the remedy. Threshold criteria must be satisfied in order for a remedy to be eligible for selection. Primary balancing criteria are used to weigh major trade-offs between remedies. Support agency and community acceptance are modifying criteria formally taken into account after public comment is received on the Proposed Plan.

The following discussion summarizes the evaluation of the five remedial alternatives developed for the Chem-Solv site against the nine evaluation criteria.

## 8.1 Overall Protection of Human Health and the Environment

A primary requirement of CERCLA is that the selected remedial action be protective of human health and the environment. A remedy is protective if it reduces current and potential risks to acceptable levels under the established risk range posed by each exposure pathway at the site. Because no environmental risks were identified at this site, this section will be limited to discussing protection of human health only.

Of the five alternatives evaluated, Alternatives 4 and 5 provide the greatest overall protection of human health. Through the use of institutional controls, a ground water restriction zone and deed restrictions, exposure to contaminated ground water is eliminated by restricting future installation of residential

wells in the contaminated area. The contingency for an alternate water supply also provides protection for current users in the area by providing well head treatment to reduce contaminant concentrations to cleanup levels or by installation of a new well into an uncontaminated aquifer if necessary. In addition, active collection and treatment of contaminated ground water prevents further migration of the contaminant plume, thus reducing the possibility of exposure to additional residents further downgradient. Alternative 5, however, may pose an additional risk to nearby residents by way of air emissions of VOCs from the onsite air stripper. If determined by EPA to be necessary, emission controls would be implemented to minimize the risk.

As with Alternatives 4 and 5, Alternative 3 is protective of current and future users of ground water in the known area of contamination; however, since no active collection is employed in Alternative 3 to prevent further migration of contaminated ground water, future exposure to residents further downgradient is not eliminated. Alternative 3 therefore does not provide the same level of protection as Alternatives 4 and 5.

Neither Alternative 1 nor Alternative 2 is protective of human health. Alternative 1 does nothing to reduce or eliminate exposure for current or future users of ground water and allows continued migration of contamination. Alternative 2 provides protection for future users through the institution of a ground water restriction zone but does not provide a contingency for an alternate water supply for current users whose wells may become contaminated during the time required for natural attenuation to achieve cleanup levels. Since both of these alternatives fail to meet the threshold criterion of overall protection of human health, they will not be discussed further in this section.

## 8.2 Compliance with ARARs

This criterion addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements (ARARs) of other federal and state environmental laws and/or provides grounds for invoking a waiver. Table 11 summarizes the ARARs for the site.

Alternatives 3, 4 and 5 would comply with all ARARs associated with drinking water standards (MCLs and non-zero MCLGs), offsite disposal of treatment wastes from well head treatment, and Delaware Regulations Governing the Construction of Water Wells. Pretreatment requirements for discharge to the POTW would also be met for Alternative 4. Additional ARARs associated with Alternative 5 which would be complied with include federal and state requirements pertaining to point source discharge to surface water including effluent limitations based on state water quality standards and federal ambient water quality criteria. Alternative 5 would also meet ARARs for design construction and

operation of the onsite treatment system, for air emissions from the air stripper and for offsite disposal requirements for any treatment wastes produced by the onsite treatment system.

## 8.3 Long-term Effectiveness and Permanence

Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup levels have been achieved.

Alternatives 4 and 5 provide a high degree of long-term effectiveness by employing ground water collection and treatment to reduce contaminant levels, thereby reducing risk. Any residual contamination remaining in the ground water after cleanup levels have been met would be present at levels which would not exceed an acceptable risk level.

Alternative 3 would provide active treatment of ground water only at the well head and would do nothing to reduce contamination in the aquifer or to prevent contamination from migrating further downgradient. Exceedances of cleanup levels would continue. Therefore, Alternative 3 provides a lesser degree of long-term effectiveness and permanence when compared to Alternatives 4 and 5.

## 8.4 Reduction in Toxicity, Mobility, or Volume Through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that a remedy may employ. There is a statutory preference under CERCLA for selecting remedial actions that employ treatment technologies that permanently and significantly reduce the toxicity, mobility or volume of hazardous substances.

Alternatives 3, 4 and 5 would reduce the toxicity of the ground water at specific residential wells through well head treatment to remove manganese and/or VOCs. This is the only provision for active remediation in Alternative 3. In contrast, Alternatives 4 and 5 would also reduce the toxicity, mobility, and volume of contaminated ground water in the aquifer through ground water collection and treatment. Both alternatives would treat a much larger volume of ground water than Alternative 3.

Treatment at the POTW included in Alternative 4 would reduce the toxicity and volume of both manganese and VOCs in the collected ground water. No treatment residues would be produced at the site.

Onsite treatment by filtration in Alternative 5 would reduce the toxicity and volume of contaminants in the collected ground water by removing manganese, but would result in treatment residues which would require offsite disposal. The toxicity and volume of

contaminants in collected ground water would also be reduced by air stripping onsite but emissions would ultimately be transferred to the ambient air. Controls for reducing levels of air emissions to the atmosphere would be implemented if determined by EPA to be necessary.

## 8.5 Short-term Effectiveness

Short-term effectiveness refers to 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, until cleanup levels are achieved.

Alternatives 3, 4 and 5, which include ground water monitoring, a ground water restriction zone, and a contingency alternate water supply, provide a high degree of short-term effectiveness for local residents during remedial action and effectively prevent exposure to contaminated ground water. Monitoring and institution of the restriction zone could be implemented in a relatively short time frame. An alternate water supply would be provided if contamination from the site is detected above cleanup levels in a residential well.

Implementation of either Alternative 4 or 5 would result in a slight potential for exposure to nearby residents and workers through direct contact with and inhalation of vapors from the contaminated ground water during installation of recovery wells or replacement of residential wells. In addition, workers would be exposed to normal drilling and construction hazards during installation of wells and construction of the collection system. These risks could be mitigated by following proper health and safety practices for well drilling and construction.

Alternative 5 would pose an additional risk to workers due to construction and operation of the onsite treatment system and the offsite disposal of treatment residues. Air emissions from the onsite air stripper may pose an added risk to workers and residents in the area. If determined by EPA to be necessary, proper emission controls would be implemented to minimize risk.

## 8.6 Implementability

Implementability refers to the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement each component.

The institutional controls included in Alternatives 3, 4 and 5 should not pose any major implementation problems. Ground water monitoring and replacement of existing wells would be performed using widely practiced techniques. Well placement would be conducted in accordance with state regulations. Well head treatment systems have been shown to be effective in removing the

contaminants associated with this site. Residuals from well head treatment would need to be disposed of properly and cooperation from property owners would be necessary for well installation and maintenance. A ground water restriction zone would have to be established and enforced by DNREC but is considered administratively feasible.

For Alternatives 4 and 5, installation of new recovery wells is easily implementable because of information generated during the installation of the DNREC collection system. Discharge to the POTW in Alternative 4 would require meeting the pretreatment requirements of the POTW. Kent County has indicated that discharge from the site could be accepted untreated but that the capacity of the treatment plant might be a limiting factor in determining the acceptable pumping rate. Kent County has expressed some reservations with accepting discharge from the site due to capacity limitations at the treatment facility. If the collected ground water is discharged there, they have suggested that certain control mechanisms would have to be placed on the collection system and that the capacity of the POTW might be a limiting factor in determining the acceptable discharge rate. These requirements would need to be considered in the design of the remedial action but do not appear to present a problem with implementation. However, to date, the POTW has not committed to accepting the discharge from the site.

Alternative 5, while considered feasible, would be more complicated to implement. For this alternative, a treatment system for the contaminants of concern would have to be designed, installed, and operated. The technologies being considered have been demonstrated successfully in full scale operations for the contaminants of concern. A treatability study would need to be performed before treatment system design to optimize the process and ensure that discharge requirements would be met. In addition, discharge of treated effluent to surface water would require compliance with the substantive requirements of the National Pollutant Discharge Elimination System (NPDES) program of the Clean Water Act. Solids removed by treatment processes would require disposal as hazardous waste but are expected to be minimal.

## 8.7 Cost

The capital, annual operation and maintenance, and present worth costs for all five alternatives evaluated in the FS are summarized in Table 12. The present worth values for Alternatives 4 ($660,000 - $686,000) and 5 ($687,000 - $688,000) are essentially the same. The present worth value of Alternative 3 is $410,000 - $431,000.

## 8.8 State Acceptance

The State of Delaware concurs with the selected remedy presented in Section 9.0 of this document.

## 8.9 Community Acceptance

Generally, local residents expressed no opposition to the selected remedy. Kent County expressed some concern with the use of the POTW for discharge of collected ground water from the site due to capacity problems. The PRPs submitted comments regarding the use of ground water collection and treatment. All comments received during the public comment period concerning the various alternatives are summarized in the Responsiveness Summary which is a part of this ROD.

# 9.0 SELECTED REMEDY: DESCRIPTION AND PERFORMANCE STANDARDS

Based on the findings in the RI/FS, the nine criteria listed above, and public comments, EPA has selected Alternative 4 as the remedy for this site, with a contingency to implement an onsite treatment system with discharge to surface water identified as part of Alternative 5. The onsite treatment system with discharge to surface water is designated as the contingency remedy. The contingency remedy (i.e., onsite treatment) shall be employed if an agreement with the POTW cannot be reached. The final decision as to whether to treat the collected ground water onsite or to provide treatment at the POTW will be made by EPA during the early stages of the remedial design. The selected remedy consists of the following major components:

- Collection of contaminated ground water
- Discharge of collected ground water to the Kent County POTW, or the contingency remedy, onsite treatment and discharge to local surface water
- Ground water monitoring
- Contingency for an alternate water supply
- Institution of a ground water restriction zone
- Deed restrictions
- Removal of existing recovery wells

Each component of the remedy and appropriate performance standards are described below.

**A. Collection of Contaminated Ground Water**

Ground water shall be collected from the aquifer using multiple recovery wells, the exact location and number of which shall be determined by EPA. Recovery wells shall be installed in accordance with Delaware Regulations Governing the Construction of Water Wells, Title 7, Delaware Code, Chapter 60, § 6010.

**Performance Standards for Ground Water Collection:**

1. The number and location of recovery wells shall be sufficient to prevent further contaminant migration and to capture all ground water containing site-related contaminants of concern which exceed the cleanup levels listed in Table 10.

2. The collection of ground water shall reduce contaminants of concern in the aquifer to the cleanup levels listed in Table 10. The "point of compliance", or the point at which compliance with the cleanup levels will be measured, shall include all wells included in the monitoring program discussed below. Based on statistical analysis, if sampling confirms that cleanup levels have been attained throughout the contaminated area and remain at the cleanup levels for twelve consecutive quarters, operation of the collection system can be suspended. If, subsequent to the collection system shutdown, quarterly monitoring shows the ground water concentrations of the contaminants of concern above cleanup levels, the collection system shall be restarted and continued until the cleanup levels have once more been attained for twelve consecutive quarters.

**B. Discharge of Collected Ground Water to Kent County POTW or Onsite Treatment with Discharge to Local Surface Water.**

Collected ground water shall be discharged to the Kent County POTW via a Cheswold District sanitary sewer line which is present onsite. An operation and maintenance plan approved by EPA shall be required for the ground water collection and discharge systems.

**Performance Standard for Discharge to the POTW:**

> Collected ground water which is discharged to the POTW shall meet the General Pretreatment Regulations for discharge to POTWs, 40 C.F.R. Part 403, and any local pretreatment standards established by the Kent County POTW.

Some reluctance to accept the discharge from the site has been expressed by the Kent County POTW due to potential capacity limitations at the treatment facility. Consequently, a firm

commitment to accept the discharge has not been received from Kent County. Because some uncertainty exists with the implementation of this aspect of the remedy, a contingency has been selected to prevent future complications and delays in the remediation of this site.

In place of offsite discharge of collected ground water to the POTW, the contingency remedy shall include onsite treatment of the collected ground water and discharge to local surface water as discussed in Alternative 5 (Section 7.0). All other components of the selected remedy discussed above shall be identical. The decision as to whether to discharge the collected ground water to the Kent County POTW or to treat it onsite and discharge to surface water, shall be made by EPA at the onset of remedial design. If, at that time, a firm commitment from the Kent County POTW to accept the discharge for the duration of the remedial action has been received and documented, then the remedial design shall proceed with discharge to the POTW. If a firm commitment has not been obtained, however, the remedy shall change to the contingency and remedial design shall proceed with onsite treatment and discharge to local surface water.

If the contingency remedy is implemented, collected ground water shall be treated onsite. Treated water shall be discharged to the Alston Branch of the Leipsic River via a storm sewer connection located just south of the site. A connection to the storm sewer shall be constructed for this purpose.

EPA expects that collected ground water will be treated onsite by filtration and air stripping; however, information submitted during the public comment period indicated that additional unit processes for onsite treatment may be available. Therefore, further evaluation of these unit processes may be performed during a pre-design study and EPA shall determine the most appropriate process to be incorporated into the design of the onsite treatment system should the contingency remedy be implemented. The selection of the actual unit process to be utilized will be based on its demonstrated ability to effectively remove the contaminants of concern in a cost-effective manner in order to achieve compliance with the ARARs and performance standards set forth in this ROD.

**Performance Standards for Onsite Treatment and Discharge to Surface Water:**

1. The onsite treatment system shall reduce contaminants in the collected ground water to the cleanup levels listed in Table 10.

2. Discharge of treated water to local surface water shall meet the substantive requirements of the National Pollutant Discharge Elimination System (NPDES) program, 40 C.F.R. Part

403, and shall comply with federal and state water quality requirements including Clean Water Act Water Quality Criteria for Protection of Human Health and Ambient Water Quality Criteria for Protection of Aquatic Life, 33 U.S.C. § 1314(a)(1), Delaware Water Quality Standards, Stream Quality Standard 10, and Delaware Surface Water Quality Standards of February 1990, § 9.3(a)(i) and § 9.3(b)(i). Discharge shall also comply with the Delaware Wetlands Act of 1973, Title 7, Delaware Code, Chapter 66, § 6607 and 40 C.F.R., Part 6, Appendix A.

3. If an air stripper is included as part of the onsite treatment system, a risk assessment shall be performed for air emissions. Emissions from the air stripper shall not exceed a cumulative carcinogenic risk of $1 \times 10^{-4}$. If this level is exceeded, emission controls shall be installed to reduce emissions below this level. Air stripper emissions shall also be in compliance with National Ambient Air Quality Standards, 40 C.F.R. Part 50, National Emissions Standards for Hazardous Air Pollutants, 40 C.F.R. Part 61, Delaware Regulations Governing the Control of Air Pollution, 7 Delaware Code, Chapter 60, § 6003, Regulation 2, § 2.4, and "Control of Air Emissions from Superfund Air Strippers at Superfund Ground Water Sites," June 15, 1989, OSWER Directive 9355.0-28.

The collection, treatment, and discharge facilities shall be sited in compliance with all location-specific ARARs including the Archeological and Historic Preservation Act of 1974, 16 U.S.C. § 469 and the National Historic Preservation Act of 1986, 16 U.S.C. § 470. The design, construction and operation of the collection and treatment systems shall comply with RCRA requirements set forth in Delaware Regulations Governing Hazardous Waste, Parts 262-264 (40 C.F.R. Parts 262-264).

Offsite transport and disposal of treatment residuals shall be performed in compliance with RCRA regulations governing the handling of hazardous wastes set forth in Delaware Regulations Governing Hazardous Wastes, Parts 262-264 (40 C.F.R. Parts 262-264), Land Disposal Restrictions, 40 C.F.R. Part 268, and DOT regulations for transport of hazardous materials, 49 C.F.R. Parts 107 and 171.1-172.604.

An operation and maintenance plan approved by EPA shall be required for the ground water collection and onsite treatment system.

The performance of the ground water collection and discharge systems in the selected remedy or the collection and onsite treatment systems in the contingency remedy shall be carefully monitored on a regular basis. If determined to be appropriate by

EPA, the system may be modified, as warranted by performance data collected during operation. These modifications may include any or all of the following:

1) at individual wells where cleanup levels have been attained, pumping may be discontinued;

2) alternating pumping at wells to eliminate stagnation points;

3) pulse pumping to allow aquifer equilibration and encourage adsorbed contaminants to partition into ground water; and

4) installation of additional recovery wells to facilitate or accelerate cleanup of the contamination.

**C. Ground Water Monitoring**

A ground water monitoring program shall be implemented to evaluate the effectiveness of the ground water collection and treatment systems in meeting cleanup levels and to ensure protection of nearby residents. EPA shall determine the exact location of monitoring wells and residential wells to be included in the monitoring program. The frequency and duration of sampling and the analytical parameters and methods to be used shall also be determined by EPA during remedial design. In addition, an operation and maintenance plan approved by EPA shall be implemented for the ground water monitoring program. Monitoring shall continue for an estimated 30 years or such other time period as EPA deems necessary based on the policy reviews of the remedial action which shall be conducted not less than every five years from initiation of the remedial action in accordance with EPA guidance set forth in "Structure and Components of Five-Year Reviews," May 23, 1991, OSWER Directive 9355.7-02. Policy reviews will be conducted until EPA determines that the cleanup levels set forth in this ROD have been achieved, or that the hazardous substances remaining on the site do not prevent unlimited use and unrestricted exposure at the site.

**D. Contingency for an Alternate Water Supply**

If through the ground water monitoring program EPA determines that any existing residential well is contaminated with contaminants of concern above cleanup levels, an alternate water supply shall be provided to that residence. The choice of the alternate water supply shall be made by EPA and DNREC and shall be based on the contaminants detected and the hydrogeology of the affected area. The alternate water supply shall consist of either well head treatment at the point of use or installation of a new well in an uncontaminated aquifer. Well head treatment shall consist of filtration to remove inorganic contaminants and/or carbon adsorption units to remove VOCs. An operation and

maintenance plan approved by EPA shall be required for the well head treatment systems.

**Performance Standard for Alternate Water Supply:**

The well head treatment system shall reduce the contaminants of concern in the water to the cleanup levels listed in Table 10. The well head treatment system will result in the production of residual treatment wastes. Any wastes (e.g., spent carbon adsorption units or filtration media) shall be handled and disposed of offsite in accordance with Delaware Regulations Governing Hazardous Waste, Parts 262-264 (40 C.F.R. Parts 262-264), land disposal restrictions, 40 C.F.R. Part 268, and DOT regulations, 49 C.F.R. Parts 107 and 171.1-172.604. Any residential wells which are replaced shall be installed in accordance with Delaware Regulations Governing the Construction of Water Wells, Title 7, Delaware Code, Chapter 60, § 6010. The replacement well shall be installed in an uncontaminated aquifer in order to provide a sufficient quantity of water which meets cleanup levels identified in Table 10.

**E. Institution of a Ground Water Restriction Zone**

As soon as practicable, DNREC shall institute a ground water restriction zone in which no drinking water wells shall be permitted to be installed in the Columbia aquifer until cleanup levels have been achieved throughout the contaminated area.

**Performance Standard for the Restriction Zone:**

EPA and DNREC shall determine the extent of the ground water restriction zone which shall encompass the entire contaminated area including an appropriate buffer zone, and shall prohibit installation of drinking water wells in the uppermost water table aquifer, the Columbia aquifer, until cleanup levels have been achieved.

**F. Deed Restrictions**

As soon as practicable, deed restrictions shall be placed on the deeds of all properties situated in the restriction zone. Deed restrictions shall notify present and potential future property owners that the property is situated within the boundaries of a ground water restriction zone. The deed restrictions shall remain in effect until cleanup levels are achieved throughout the contaminated area.

**G. Removal of Existing Recovery Wells**

All recovery wells installed by DNREC as part of the collection system which operated from 1985 to 1988 and which are presently located on the Chem-Solv property shall be removed. All existing

recovery wells shall be removed in accordance with the Delaware Regulations Governing the Construction of Water Wells, Title 7, Delaware Code, Chapter 60, § 6010.

This remedial action shall restore ground water to its beneficial use, which at this site includes its use as a potential drinking water source. It may become apparent during implementation or operation of the remedy that contaminant levels have ceased to decline and are remaining constant at levels higher than the cleanup levels over some portion of the contaminated area. If EPA determines that implementation of the selected remedy demonstrates, in corroboration with hydrogeologic and chemical evidence, that it will be technically impracticable to achieve and maintain the cleanup levels throughout the entire area of ground water contamination, EPA may require that any or all of the following measures be taken, for an indefinite period of time, as further modifications of the existing system:

1) long-term gradient control may be provided by low level pumping, as a containment measure;

2) cleanup levels may be modified and chemical-specific ARARs may be waived for those portions of the aquifer for which EPA determines that it is technically impracticable to achieve further contaminant reduction;

3) institutional controls may be provided/maintained to restrict access to those portions of the aquifer where contaminants remain above cleanup levels; and

4) remedial technologies for ground water restoration may be reevaluated.

The decision to invoke any or all of these measures may be made by EPA during policy reviews of the remedial action which will occur at least every 5 years from commencement of the remedial action in accordance with EPA guidance set forth in "Structure and Components of Five-Year Reviews," May 23, 1991, OSWER Directive 9355.7-02. If necessary, EPA will issue an Explanation of Significant Differences or a ROD amendment.

## 10.0 STATUTORY DETERMINATIONS

EPA's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, § 121 of CERCLA, 42 U.S.C. § 9621, establishes several other statutory requirements and preferences. These requirements specify that when complete, the selected remedial action for each site must comply with applicable or relevant and appropriate (ARARs) environmental standards established under federal and state environmental laws unless a

statutory waiver is invoked. The selected remedy also must be cost effective and utilize treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that permanently and significantly reduce the volume, toxicity or mobility of hazardous substances. The following sections discuss how the selected remedy for this site meets these statutory requirements.

**10.1 Protection of Human Health and the Environment** - Both the selected remedy and the contingency remedy protect human health and the environment by controlling exposure to contaminated ground water associated with the site. Ground water collection will prevent further migration of contamination from the site which might lead to exposure of additional residents. Ground water monitoring will track the contamination in the ground water and will ensure that any unacceptable levels of contaminants in residential wells will be detected and addressed. If necessary, well head treatment will reduce contaminant levels to acceptable cleanup levels or well replacement will provide water from an uncontaminated aquifer, thereby reducing or eliminating exposure. Ground water collection and treatment will effectively reduce contaminant levels in the aquifer and consequently will reduce the potential for exposure to contaminated ground water. Institutional controls, which provide for the establishment of a ground water restriction zone and deed restrictions, will prevent future exposure to contaminated ground water by prohibiting the future installation of wells in the contaminated aquifer until cleanup levels are achieved.

Air emissions which might be produced by air stripping included in the contingency remedy will be reduced to acceptable risk-based levels by installation of emission controls, if determined by EPA to be necessary. Treated ground water discharged to surface water in the contingency remedy will meet all appropriate water quality standards to prevent any adverse environmental effects. Through monitoring, institutional controls and treatment, this remedy will be protective of human health and the environment during and upon completion of the remedial action.

**10.2 Compliance with Applicable or Relevant and Appropriate Requirements** - The selected remedy and the contingency remedy shall attain all action, location and chemical specific applicable or relevant and appropriate requirements for the site which are listed in Table 11. Also included in the table are criteria, advisories or guidance to be considered (TBCs) for implementation of this remedy.

**10.3 Cost-Effectiveness** - The selected remedy and contingency remedy are cost-effective in mitigating the risks posed by the contaminants associated with the site, meet all other requirements of CERCLA, and afford overall effectiveness

proportionate to costs. The estimated present worth cost range for the selected remedy is $660,000 - $686,000 and for the contingency remedy is $688,000. The costs associated with the three alternatives that did not include ground water collection and treatment are comparatively lower ($385,000 - $431,000) than the costs of the selected remedy but none of those alternatives would achieve remedial action objectives or ground water cleanup levels.

**10.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable** - The selected remedy for the site utilizes permanent solutions and treatment technologies to the maximum extent practicable. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the selected remedy provides the best tradeoff in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, and cost, also considering the statutory preference for treatment as a principal element and considering State and community acceptance.

The selected remedy and contingency remedy both provide long-term effectiveness and permanence, and reduction of toxicity, mobility, and volume through treatment. Costs for both are essentially the same. Provided that the POTW has the capacity and will accept the discharge from the site, the selected remedy is more easily implemented as no onsite treatment system has to be designed, constructed, or operated, no treatability testing would be needed to optimize the treatment system, no treatment residuals would be produced onsite or disposed of offsite, no additional risk would be posed by onsite operation of the treatment system or emissions from an air stripper. The selected remedy has therefore been determined to be the most appropriate solution for the Chem-Solv site. However, the contingency remedy also fulfills the requirement of using permanent solutions and alternative treatment technologies to the maximum extent practicable.

**10.5 Preference for Treatment as a Principal Element** - The selected remedy and the contingency remedy use treatment to address the threats posed by contaminants in the ground water at the site. This preference for treatment as a principal element is satisfied since treatment of VOCs and inorganic contaminants in the ground water are the principal elements of either remedy.

## 11.0 DOCUMENTATION OF SIGNIFICANT CHANGES

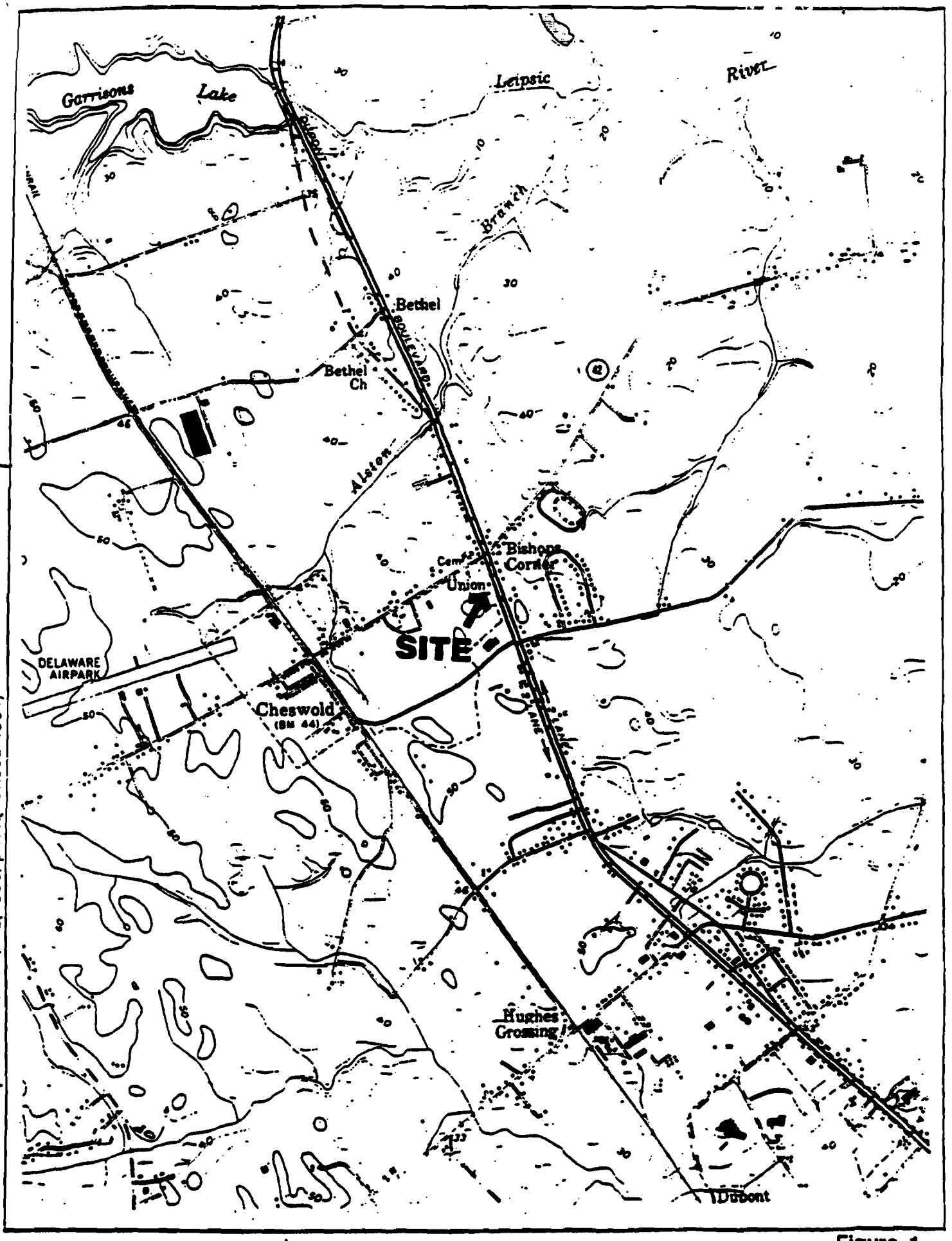
The following changes have been made since the Proposed Plan was issued on January 15, 1992:

1. The Proposed Remedial Action Plan identified Alternative 4, ground water collection and discharge to the POTW, as the preferred alternative. During the public comment period, the POTW expressed some concern with accepting the collected ground water from the site due to capacity problems at the treatment plant. Consequently, EPA has selected Alternative 4 as the remedy for the site but has selected Alternative 5, onsite treatment and discharge to surface water, as a contingency remedy for the site. The contingency remedy will be employed if an agreement with the POTW cannot be reached. The final decision as to whether to treat the collected ground water onsite or to provide treatment at the POTW will be made by EPA during the early stages of the remedial design.

2. The Annual O & M costs, which were presented incorrectly in the Proposed Plan, have been revised. The correct O & M costs are included in Section 7.0 above and in Table 12.

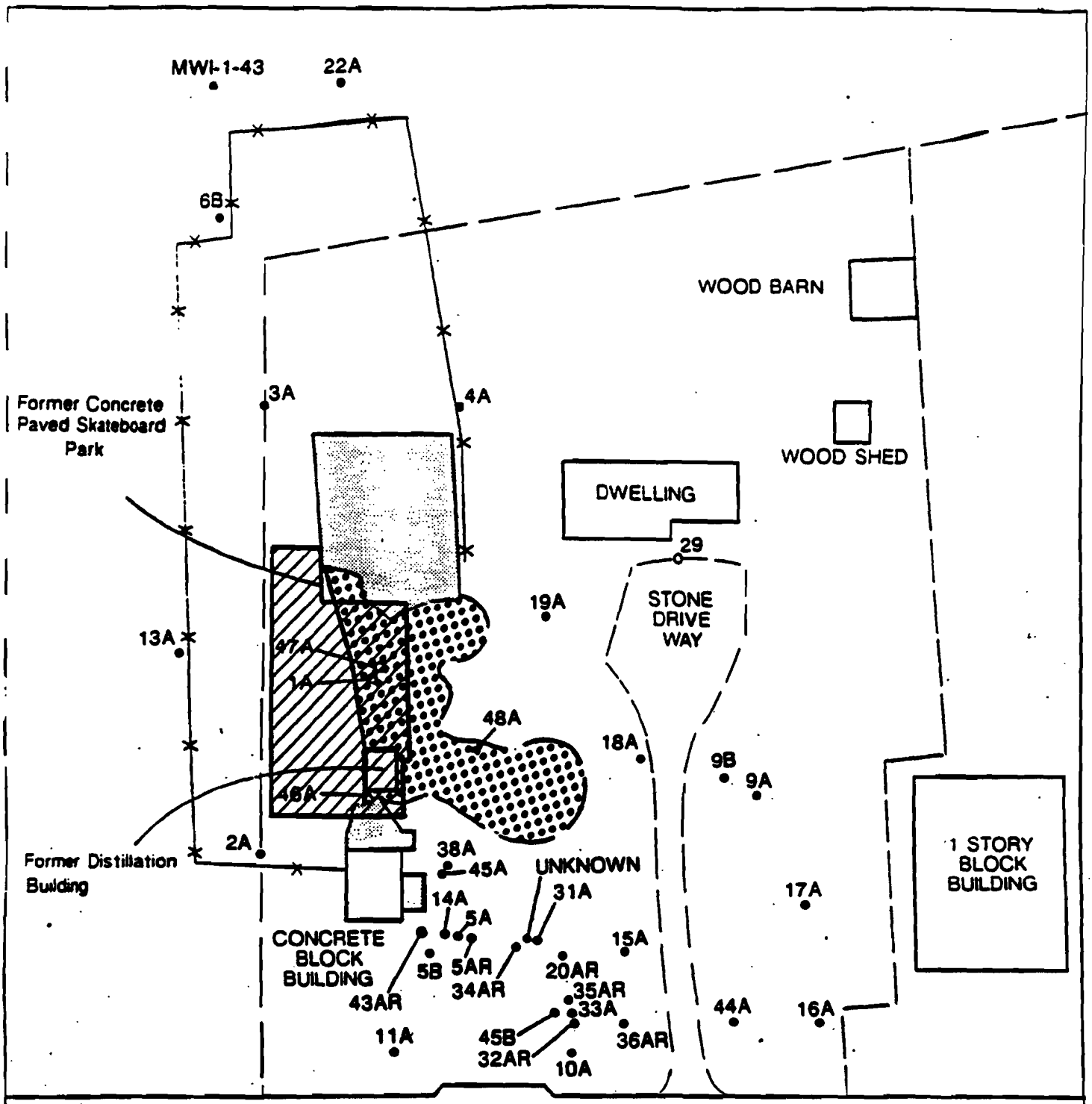
3. EPA expects that if the contingency remedy is implemented, collected ground water will be treated onsite by filtration and air stripping; however, information submitted during the public comment period indicated that additional unit processes for onsite treatment may be available. Therefore, further evaluation of these unit processes may be performed during a pre-design study and EPA shall determine the most appropriate process to be incorporated into the design of the onsite treatment system. The selection of the actual unit process to be utilized will be based on its demonstrated ability to effectively remove the contaminants of concern in a cost-effective manner in order to achieve compliance with the ARARs and performance standards set forth in this ROD.

4. The Proposed Remedial Action Plan stated that the cleanup levels for the site would be risk-based (i.e., a cumulative carcinogenic risk not to exceed $1 \times 10^{-6}$ and a Hazard Index not to exceed 1.0). The Proposed Plan explained that in many cases MCLs would be used as cleanup levels but that the cumulative carcinogenic risk associated with the MCLs for the contaminants of concern at this site was greater than $1 \times 10^{-6}$ and that the MCLs were therefore not appropriate cleanup levels. Upon further evaluation and in accordance with § 300.430(e)(2)(i) of the NCP, 40 C.F.R. § 300.430(e)(2)(i), EPA has determined that the cumulative carcinogenic risk associated with the MCLs ($2 \times 10^{-5}$) is within the acceptable risk range of $10^{-4}$ to $10^{-6}$. Therefore, it is appropriate to use non-zero MCLGs and MCLs as cleanup levels at this site as set forth in Table 10. Risk-based cleanup levels were developed for manganese and acetone because MCLs are not available for those substances.




Source: USGS Topo. Quad: Dover, DE(1956, photo revised 1981)

**Figure 1**
**Site Location Map**




SOURCE. March 11. 1986 Survey (Robert L. Larimore. Wyoming. Delaware);
June 4 and 5. 1990 Survey (J. G. Park Associates. Inc.. Washington Crossing. Pennsylvania).

BCM Project No. 00-6012-02

0 50 Feet

NORTH

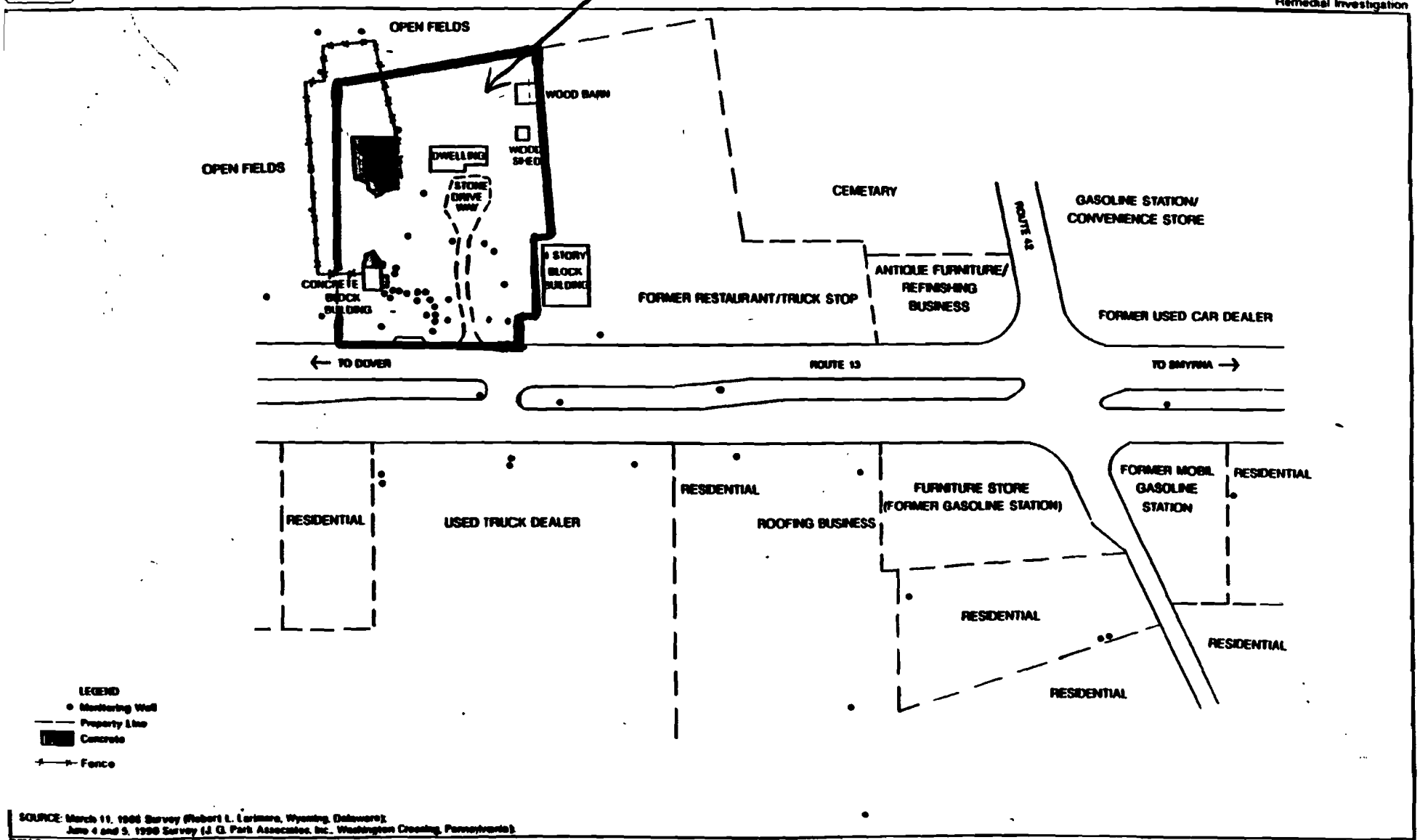
Approximate Location of Former Excavation (SMC Martin, 1986)

LEGEND
- Monitoring Well
- Property Line
- Concrete
- Former Concrete Paved Skateboard Park
- Fence
- Monitoring Well Missing, Approximate Location

Figure 2
**Site Plan Map**

BCM

CHEM-SOLV, INC. SITE
Remedial Investigation




SOURCE: March 11, 1986 Survey (Robert L. Larimore, Wyoming, Delaware);
June 4 and 5, 1990 Survey (J. G. Park Associates, Inc., Washington Crossing, Pennsylvania).

BCM Project No 00-6012-02

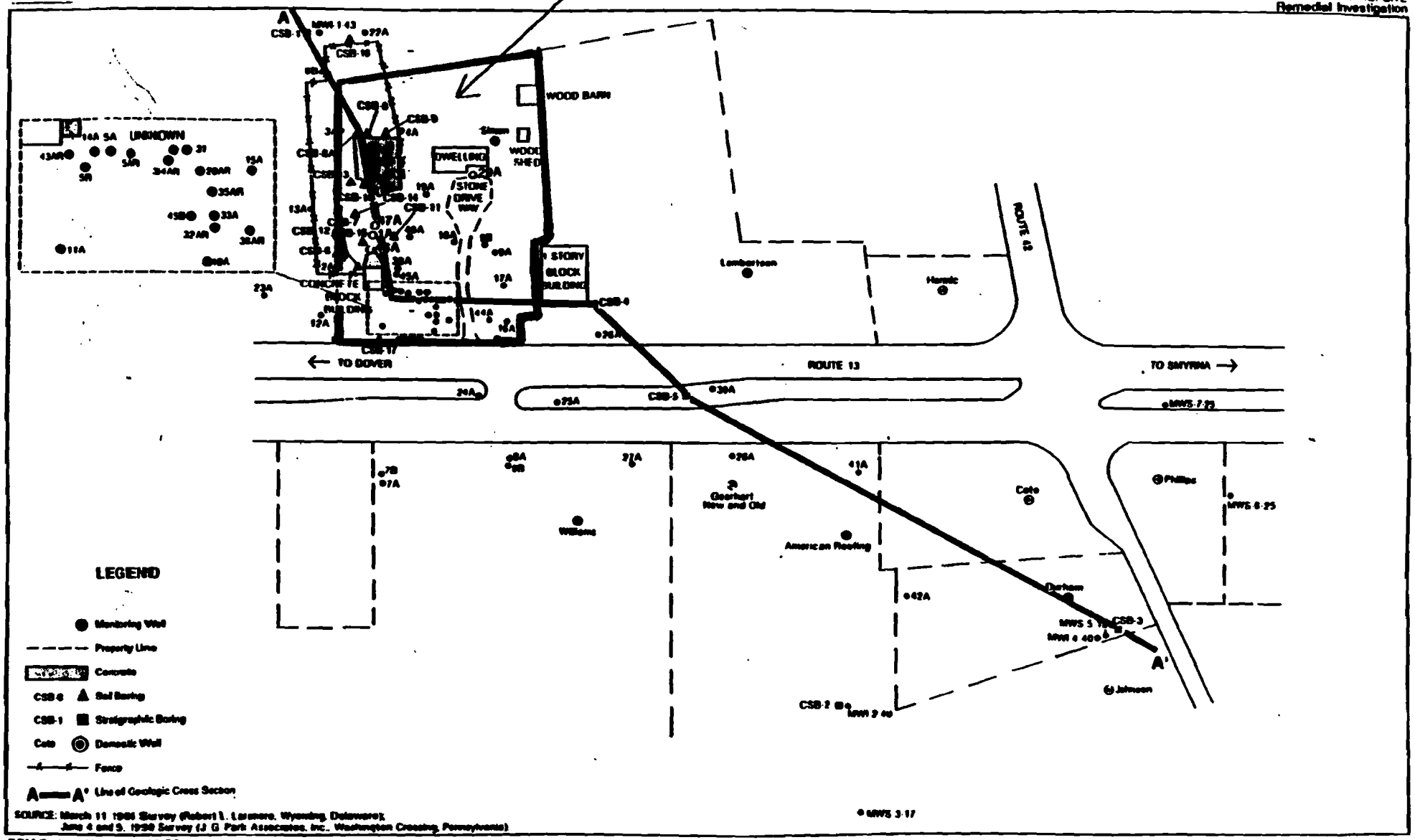
0 100 Feet NORTH

Figure 3
Land Use

Chem-Solv, Inc.

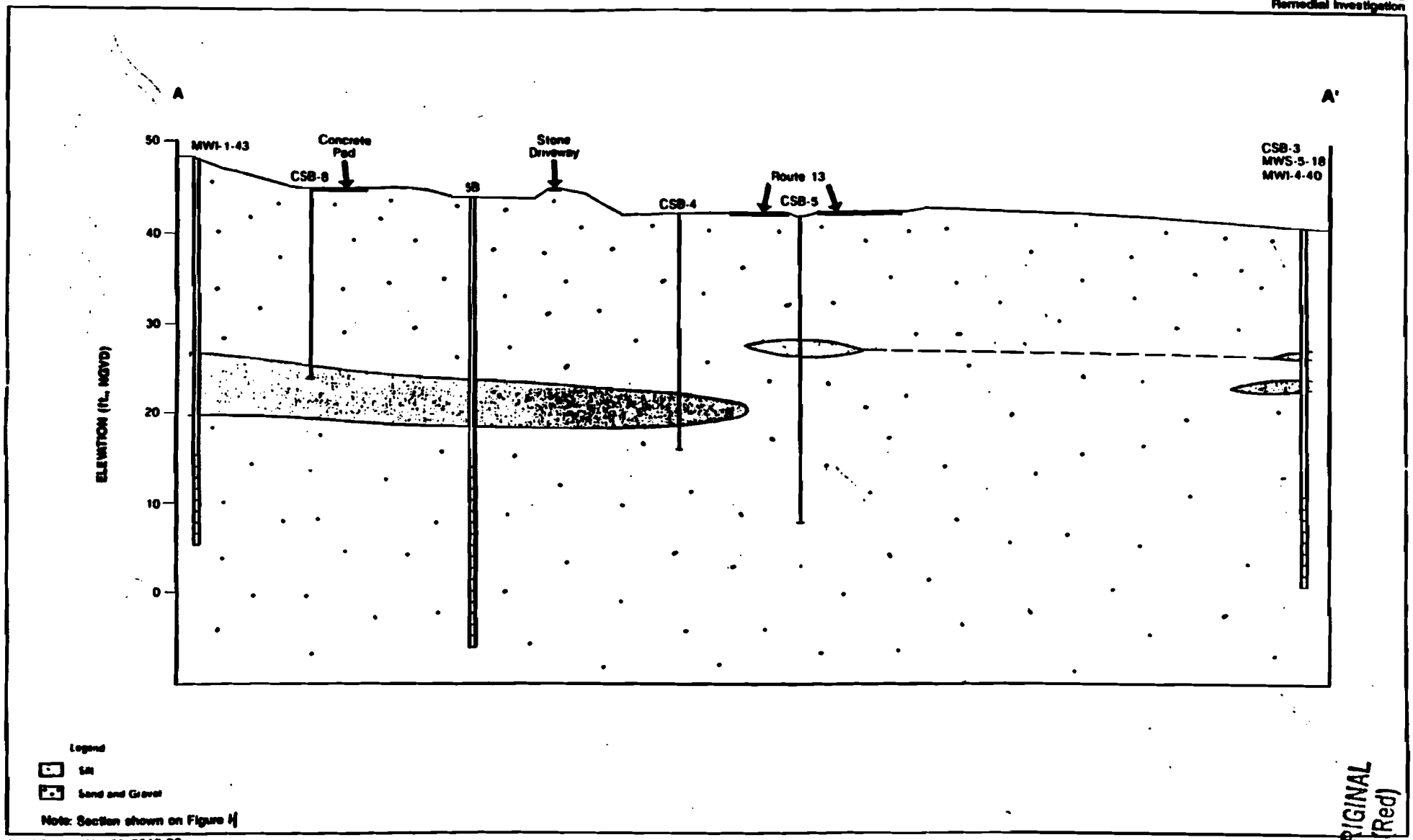
BCM

CHEM-SOLV, INC. SITE
Remedial Investigation




Monitoring Well, Domestic Well, Soil Boring and Stratigraphic Boring Locations

Figure 4



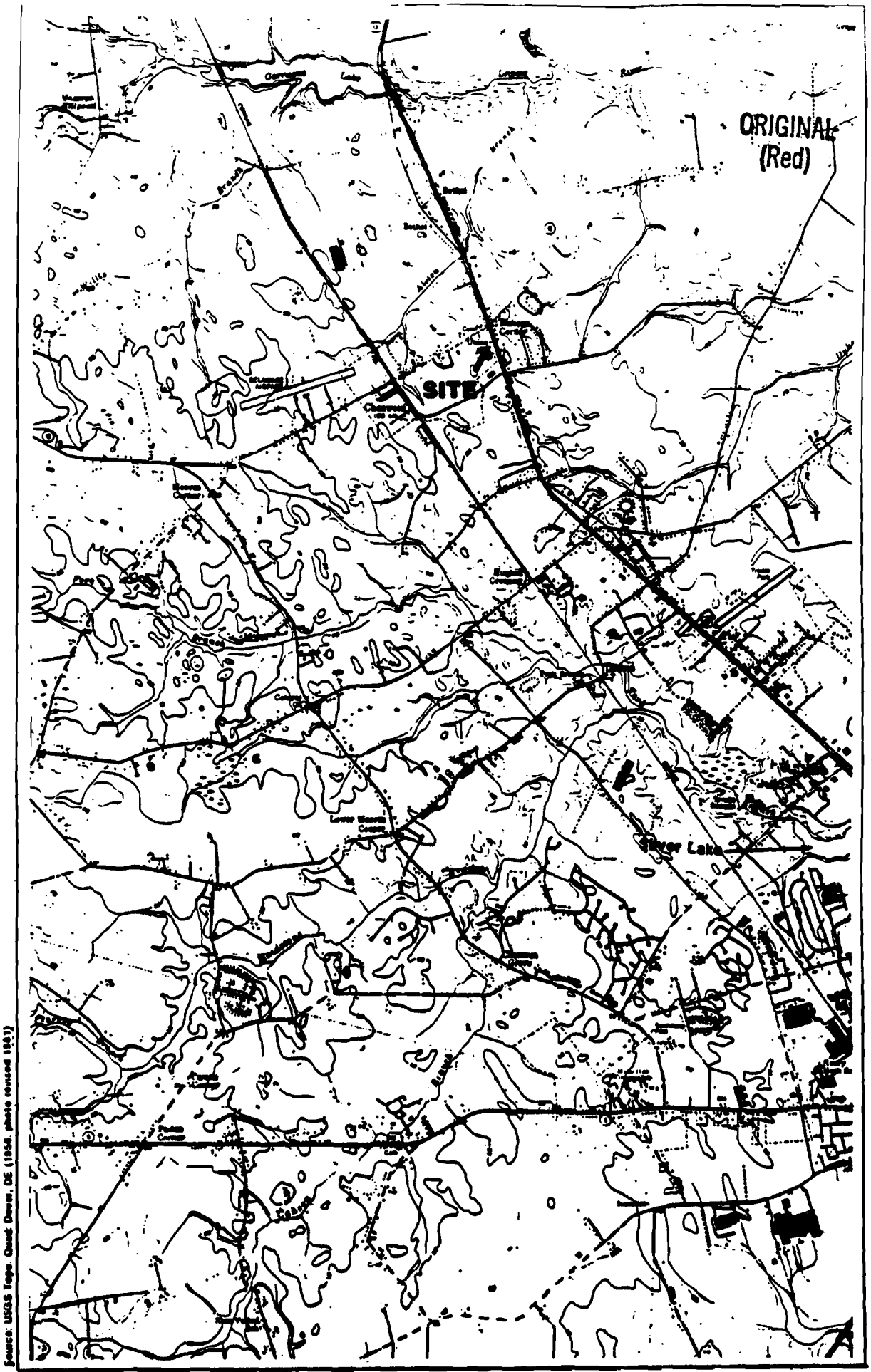

BCM Project No. 00-8012-02

100 FT

Figure 5

Site Geologic Cross Section
A - A'

ORIGINAL
(Red)




Source: USGS Topo. Quad: Dover, DE (1956, photo revised 1981)

SCM Project No. 00-0012-02

0 2500 FEET

NORTH

Regional Surface Water Bodies

Figure 6

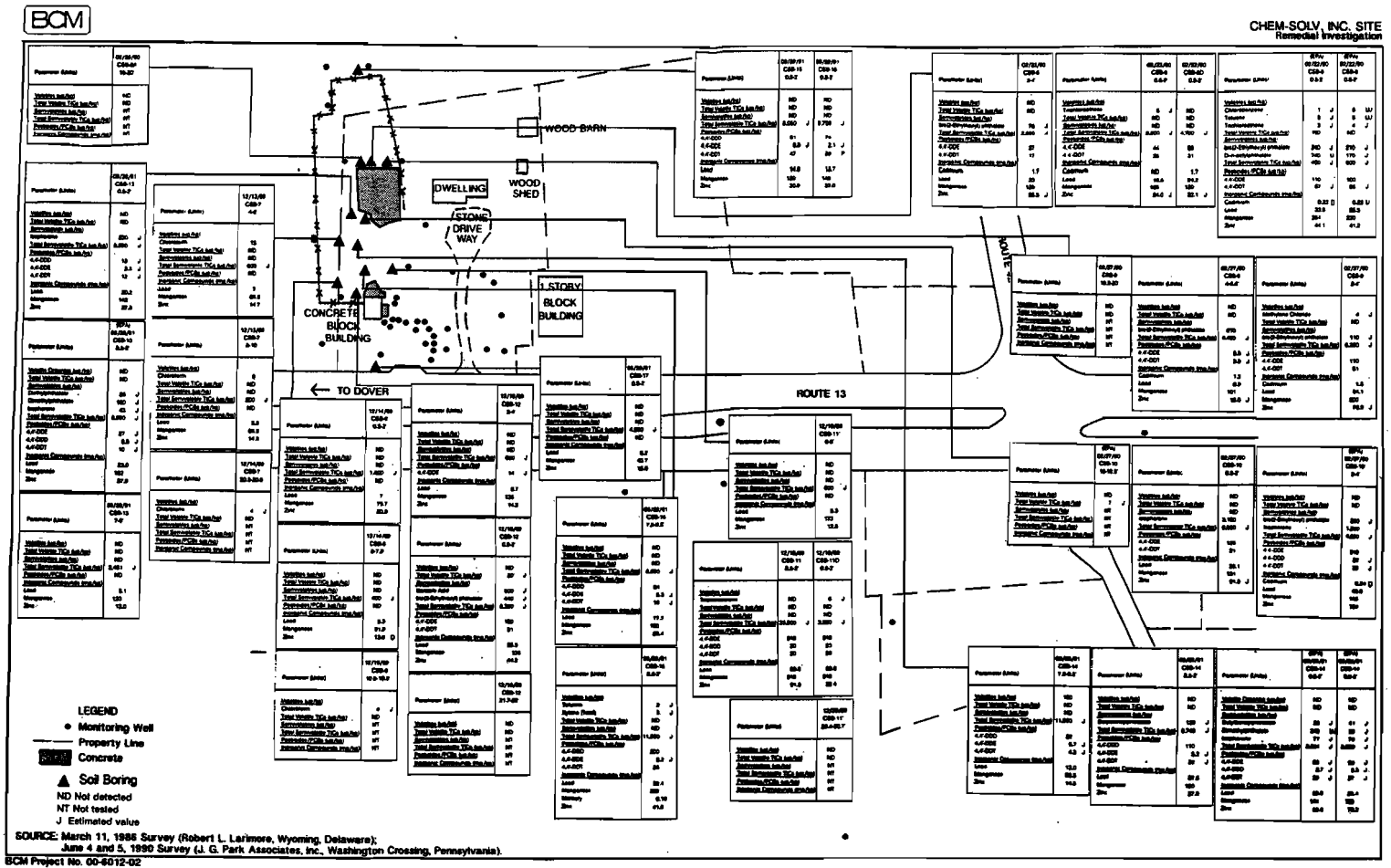



Figure 7

Distribution of Selected Parameters in Soils

BCM

CHEM-SOLV, INC. SITE
Remedial Investigation

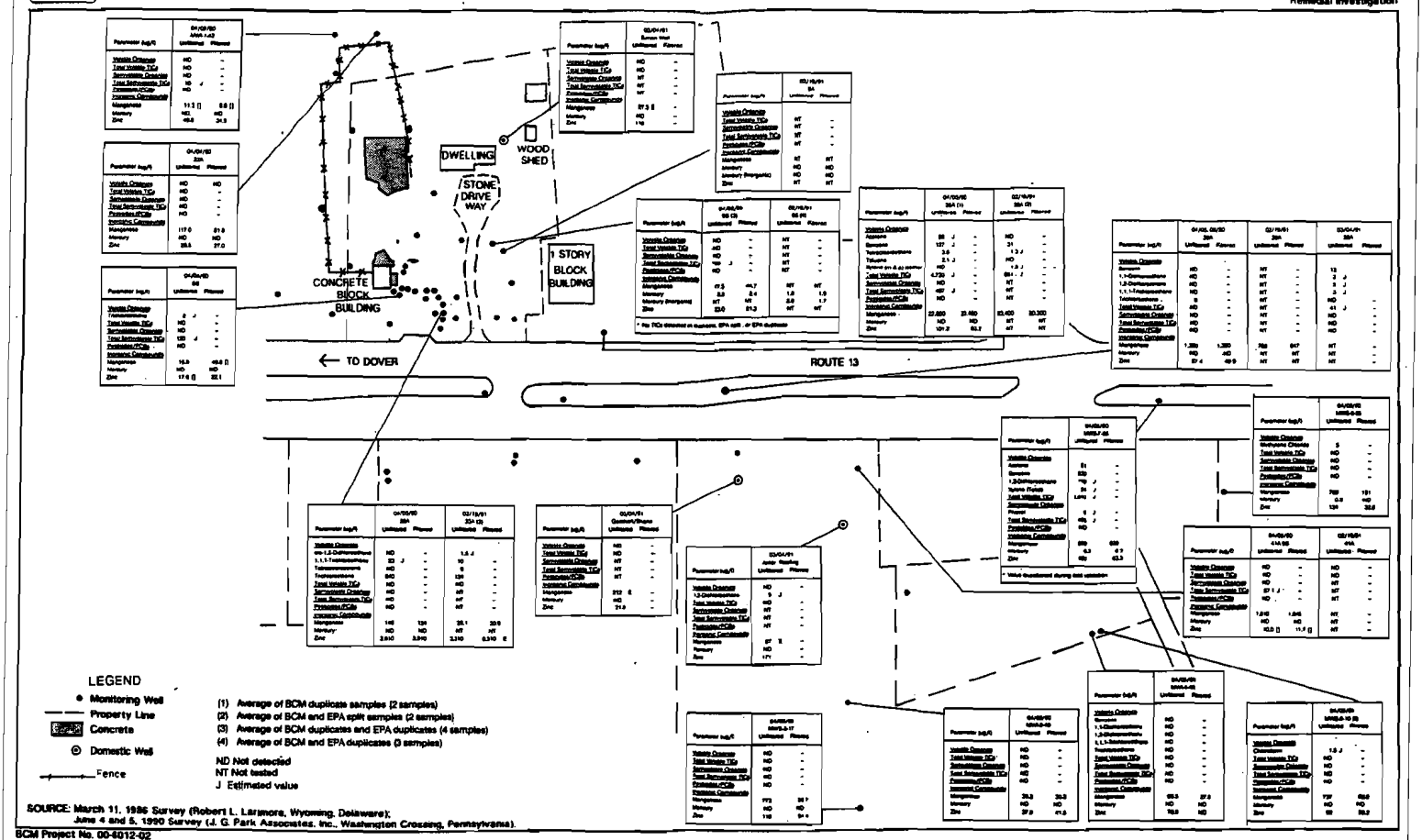
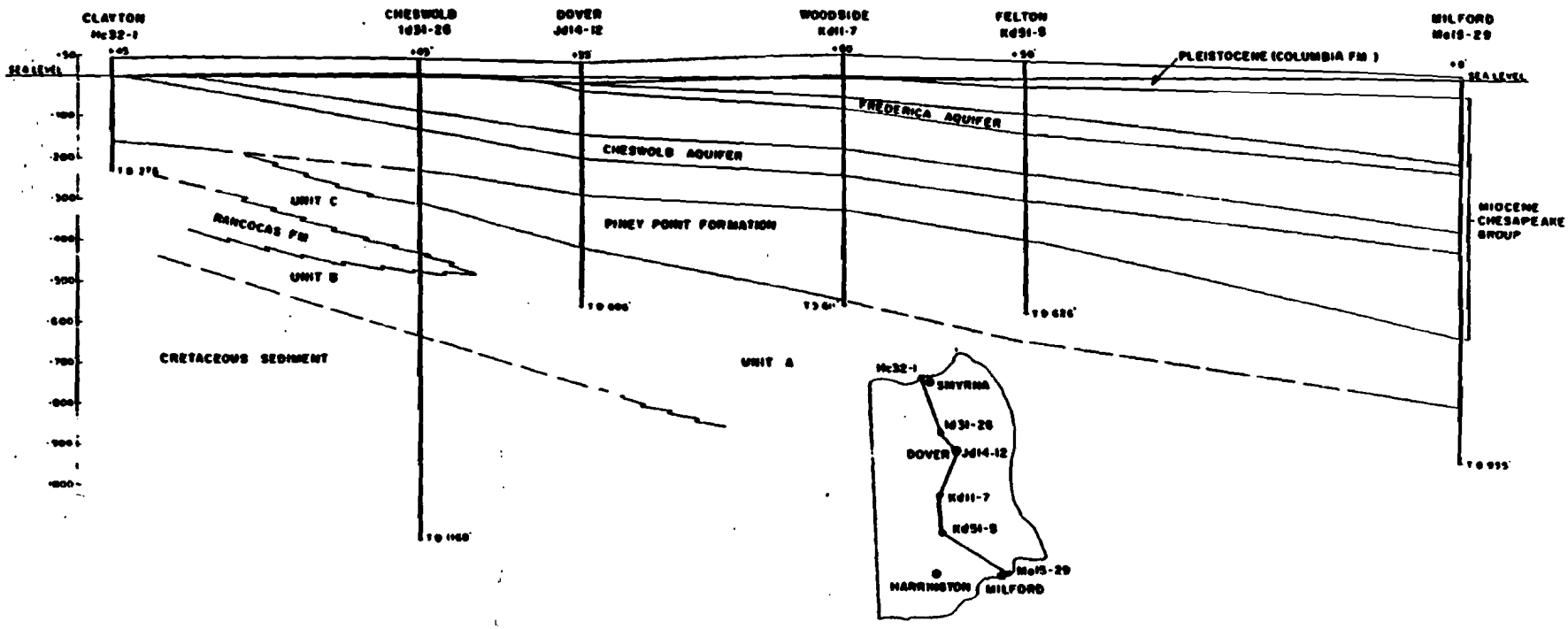



Figure 8

Distribution of Selected Parameters in Groundwater
April 1990, February 1991, and March 1991

BCM

CHEM-SOLV, INC. SITE
Remedial Investigation




1.25" = 1 Mile

Source: Sundstrom, R.W. and Pickett, T.E. 1968. The Availability of Groundwater in Kent County, Delaware. University of Delaware Water Research Center, April 1968.

BCM Project No 00-6012 02

ORIGINAL (Red)

Geologic Cross Section of Kent County

Figure 9

Table 1

SUMMARY OF INORGANIC SOIL DATA AND COMPARISON TO BACKGROUND CONCENTRATIONS

CHEM-SOLV, INC. SITE
CHESWOLD, DELAWARE

| Parameter (Units) | Soils Outside Excavation | | | | Soils Within Excavation (Source) | | | | Site Background Soils | | | | Regional Background Soils | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. Analyses/ No. Sample Locations* | Number Locations Detected* | Maximum Concentration | Average Concentration** | No. Analyses/ No. Sample Locations* | Number Locations Detected* | Maximum Concentration | Average Concentration** | No. Analyses/ No. Sample Locations* | Number Locations Detected* | Maximum Concentration | Average Concentration** | Northern Delaware (a) | Delaware (b) Mean | Delaware (b) SD | Southern NJ/ Maryland/ Delaware (c) | Eastern U.S. Geometric Mean (d) |
| Inorganic Compounds (mg/kg) | | | | | | | | | | | | | | | | | |
| Aluminum | 28 / 14 | 14 | 17,000 | 12,005 | 0 / 0 | 0 | 15,000 | 11,421 | 3 / 2 | 2 | 9,380 | 6,183 | 30,000 | — | — | 700 - 30,000 | — |
| Antimony | 28 / 14 | 0 | — | — | 0 / 0 | 1 | — | — | 3 / 2 | 0 | — | — | | | | | |
| Arsenic | 28 / 14 | 14 | 10.7 | 3.9 | 0 / 0 | 0(2) | 5.1 | 3.2 | 3 / 2 | 2 | 3.9 | 2.4 | <0.1 - 2.6 | — | — | 10 - 41 e | — |
| Barium | 28 / 14 | 14 | 109.6 | 54.7 | 0 / 0 | 0 | 69.6 | 53.1 | 3 / 2 | 2 | 57.7 | 44.1 | 600 | — | — | 10 - 300 | 300 |
| Beryllium | 28 / 14 | 0(2) | 0.69 | 0.3 | 0 / 0 | 5 | 0.43 | 0.28 | 3 / 2 | 2 | 0.46 | 0.35 | <1 | — | — | <1 | — |
| Cadmium | 28 / 14 | 5 | 1.7 | 0.6 | 0 / 0 | 0 | — | — | 3 / 2 | 0 | — | — | — | 0.17 | 0.06 | — | 1.6 |
| Calcium | 28 / 14 | 14 | 1,000 | 600 | 0 / 0 | 0 | 1,100 | 600 | 3 / 2 | 2 | 340 | 294 | 130 - 2,300 | — | — | 130 - 5,200 | — |
| Chromium | 28 / 14 | 14 | 17.6 | 16.6 | 0 / 0 | 0 | 12.3 | 9.6 | 3 / 2 | 2 | 10.3 | 6.5 | 60 | — | — | 1 - 20 | 36 |
| Cobalt | 28 / 14 | 13 | 9.6 | 4.6 | 0 / 0 | 0 | 6.2 | 5.5 | 3 / 2 | 2 | 3.7 | 3.6 | 3 - 5 | — | — | <3 | 7 |
| Copper | 28 / 14 | 14 | 14.6 | 6.3 | 0 / 0 | 0 | 8.1 | 6.5 | 3 / 2 | 2 | 4.6 | 4.2 | <1 - 10 | 5 | 2.2 | <1 - 20 | 14 |
| Iron | 28 / 14 | 14 | 15,000 | 9,677 | 0 / 0 | 0 | 10,000 | 8,630 | 3 / 2 | 2 | 6,600 | 9,075 | <7,000 | — | — | 100 - 10,000 | 18,000 |
| Lead | 28 / 14 | 14 | 60.0 | 22.6 | 0 / 0 | 0 | 32.4 | 19.5 | 3 / 2 | 2 | 18.7 | 11.7 | 20 | 10 | 2 | <10 - 20 | 14 e |
| Magnesium | 28 / 14 | 14 | 1,030 | 654 | 0 / 0 | 0 | 700 | 500 | 3 / 2 | 2 | 405 | 476 | 6 - 1,000 | — | — | 50 - 3,000 | — |
| Manganese | 28 / 14 | 14 | 250 | 140 | 0 / 0 | 0 | 232 | 143.4 | 3 / 2 | 2 | 140 | 96.5 | 100 | — | — | <2 - 300 | 285 |
| Mercury | 28 / 14 | 0 | — | — | 0 / 0 | 1 | 0.10 | 0.09 | 3 / 2 | 0 | — | — | | | | | |
| Nickel | 28 / 14 | 12(2) | 9.6 | 6.0 | 0 / 0 | 0 | 6.6 | 5.3 | 3 / 2 | 2 | 4.7 | 4.0 | 7 - 10 | 0.5 | 4.4 | <5 - 10 | 13 |
| Potassium | 28 / 14 | 14(2) | 631 | 502 | 0 / 0 | 0 | 557 | 300 | 3 / 2 | 2 | 304 | 246 | 10,000 | — | — | 2,200 - 11,000 | — |
| Selenium | 28 / 14 | 2 | 1.4 | 0.3 | 0 / 0 | 3(2) | 0.28 | 0.16 | 3 / 2 | 2(2) | 0.21 | 0.10 | 0.5 | — | — | <0.1 - 0.3 | — |
| Sodium | 28 / 14 | 13(2) | 141 | 89.5 | 0 / 0 | 0(2) | 162 | 100 | 3 / 2 | 2(2) | 101 | 93.5 | 0 - 5,000 | — | — | <500 - 5,000 | — |
| Vanadium | 28 / 14 | 14 | 25.1 | 16.5 | 0 / 0 | 0 | 19.1 | 16.3 | 3 / 2 | 2 | 16.4 | 16.5 | 30 - 80 | — | — | <7 - 80 | 46 |
| Zinc | 28 / 14 | 14 | 164.0 | 41.9 | 0 / 0 | 0 | 73.3 | 39.6 | 3 / 2 | 2 | 32.0 | 22.7 | 62 e | 25 | 8 | <5 - 160 e | 38 |

* Duplicate and split samples not counted in total number of locations. Values ( ) indicate the number of locations where detected concentrations not questioned during data validation.

** Duplicate and split samples used to calculate an average concentration for a given location prior to calculating an average for each soil type. One half the quantitation limit used to calculate average if parameter undetected at a location.

a Shacklette & Boerngen, 1984. Element Concentrations in Soils and other Surficial Materials of the Conterminous United States.

b Logan, T.G. and Ryan, J.A., 1987. Land Application of Sludge. Lewis Publishers, Chelsea, MI.

c Pennsylvania State University, 1985. Criteria and Recommendations for Land Applications of Sludges in the Northeast. Bulletin 851, March 1985.

d USEPA, 1985. Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants in Surface and Ground Water - Part 1. EPA/600/6-85/008a. September 1985 Revised.

e USEPA, 1984. Health Assessment Document for Inorganic Arsenic. EPA/600/8-83/021F. March 1984.

BCM Engineers Inc. (Project No. 89-6012-02)

ORIGINAL (Red)

TABLE 2

ORIGINAL (Red)

CONTAMINANTS OF CONCERN

| CONTAMINANT | RME (ug/l) |
|---|---|
| Acetone | 25.1 |
| Benzene | 58.6 |
| 1,2-dichloroethane (1,2-DCA) | 2.7 |
| Tetrachloroethene (PCE) | 2.8 |
| Toluene | 1.8 |
| 1,1,1-trichloroethane | 11.9 |
| Trichloroethene (TCE) | 245.0 |
| Xylene | 1.8 |
| Manganese | 14,987.2 |

ORIGINAL
(Red)

Table 3

ASSUMPTIONS USED IN CALCULATING EXPOSURE

| | Children | Adults | Reference |
|---|---|---|---|
| Ingestion of Groundwater | | | |
| Ingestion Rate (liters/day) | 1.3 | 2 | EPA (1989a and 1989b) |
| Exposure Frequency (events/year) | 365 | 365 | Site Specific |
| Exposure Duration (years) | 5 | 30 | EPA (1989a and 1989b) |
| Body Weight (kg) | 17 | 70 | EPA (1989a and 1989b) |
| Dermal Absorption from Groundwater Use | | | |
| Skin surface area (sq. cm) | 7,128 | 19,400 | EPA (1989a and 1989b) |
| Exposure time (hours/event) | 0.25 | 0.25 | EPA, 1989c |
| Exposure frequency (events/year) | 365 | 365 | Site Specific |
| Exposure duration (years) | 5 | 30 | Site Specific |
| Body weight (kg) | 17 | 70 | EPA (1989a and 1989b) |
| Inhalation from Groundwater Use | | | |
| Drinking Water Equivalent Factor* | | 0.95 | EPA, 1988 |

* See Section 5.3.2.2 and Appendix Q of the Remedial Investigation Report

Compiled by: BCM Engineers Inc. (BCM Project No. 00-6012-02)

Table 4

TOXICITY VALUES: POTENTIAL CARCINOGENIC EFFECTS

| Chemical | | Slope Factor (mg/kg/day)-1 | Weight-of-Evidence Classification | Tumor Site | Source of Slope Factor | Model |
|---|---|---|---|---|---|---|
| Benzene | Oral | 0.029 | A | [1] | IRIS | One hit (pooled data) |
| | Inhalation | 0.029 | A | [1] | IRIS | One hit (pooled data) |
| 1,2-Dichloroethane | Oral | 0.091 | B2 | Circulatory System | IRIS | Linearized multistage (extra risk) |
| | Inhalation | 0.091 | B2 | Circulatory System | IRIS | Linearized multistage (extra risk) |
| Tetrachloroethene | Oral | 0.051 | B2 | Liver | HEAST | NA |
| | Inhalation | 0.0018 | B2 | Leukemia, Liver | HEAST | NA |
| Trichloroethene | Oral | 0.011 | B2 | Liver | HEAST | NA |
| | Inhalation | 0.017 | B2 | Lung | HEAST | NA |

NA Not available
IRIS Integrated Risk Information System
HEAST Health Effects Assessment Summary Tables
[1] Acute myelogenous leukemia and aplastic anemia

Table 5

EPA CATEGORIES FOR POTENTIAL CARCINOGENS

| EPA Category | Group Description | Evidence |
|---|---|---|
| Group A | Human Carcinogen | Sufficient evidence from epidemiologic studies to support a causal association between exposure and cancer in humans |
| Group B1 | Probable Human Carcinogen | Limited evidence in humans from epidemiologic studies |
| Group B2 | Possible Human Carcinogen | Sufficient evidence in animals, inadequate evidence in humans |
| Group C | Possible Human Carcinogen | Limited evidence in animals and/or carinogenic properties in short-term studies |
| Group D | Not Classified | Inadequate evidence in animals |
| Group E | No Evidence | No evidence in at least two adequate animal tests or in both epidemiologic and animal studies |

Source: EPA, 1986

Table 6

TOXICITY VALUES: POTENTIAL NONCARCINOGENIC EFFECTS

| Chemical | Chronic RfD * (mg/kg/day) | | Confidence Level | Critical Effect | RfD Source | Uncertainty and Modifying Factors UF | MF |
|---|---|---|---|---|---|---|---|
| Acetone | Oral | 0.1 | Low | Kidney, Liver | IRIS | 1000 | 1 |
| Tetrachloroethene | Oral | 0.01 | Medium | Liver | IRIS | 1000 | 1 |
| Toluene | Oral | 0.2 | Medium | Blood | IRIS | 100 | 1 |
| | Inhalation | 0.6 a | Medium | CNS, Liver, Kidney | IRIS | NA | NA |
| 1,1,1-Trichloroethane | Oral | 0.09 | Medium | Liver | IRIS | 1000 | 1 |
| Xylene | Oral | 2 | Medium | Mortality | IRIS | 100 | 1 |
| | Inhalation | 0.2 | Medium | CNS, Mortality | HEAST | NA | NA |
| Manganese | Oral | 0.1 | Medium | CNS | IRIS | 1 | NA |

NA Not available
IRIS Integrated Risk Information System
HEAST Health Effects Assessment Summary Table
* Inhalation reference dose (RfD) values have not been determined; oral RfD values were used in the exposure calculations, except for 1,1,1-trichloroethane. HEAST lists an inhalation RfD of 0.3 mg/kg/day for 1,1,1-trichloroethane. Critical effect is the central nervous system with an uncertainty factor of 100.
a EPA comments for the draft RI report dated September 17, 1990, p.23, recommended an inhalation RfD of 1.5 mg/kg/day. A more conservative value of 0.6 mg/kg/day was obtained from 4th Quarter 1990 HEAST.

Compiled by: BCM Engineers Inc. (BCM Project No. 00-6012-02)

Table 7

CANCER RISK ESTIMATES

INGESTION OF CONTAMINATED GROUNDWATER

| CHEMICAL | SLOPE FACTOR | CDI (mg/kg/day) | CHEMICAL SPECIFIC RISK | TOTAL PATHWAY EXPOSURE |
|---|---|---|---|---|
| BENZENE | 2.9E-02 | 6.0E-04 | 2.0E-05 | |
| 1,2-DICHLOROETHANE | 9.1E-02 | 3.0E-05 | 3.0E-06 | |
| PCE | 5.1E-02 | 3.0E-05 | 2.0E-06 | |
| TCE | 1.1E-02 | 2.0E-03 | 2.0E-05 | |
| | | | | 5.0E-05 |

INHALATION OF CONTAMINANTS IN GROUNDWATER DURING USE

| | | | | |
|---|---|---|---|---|
| BENZENE | 2.9E-02 | 6.0E-04 | 2.0E-05 | |
| 1,2-DICHLOROETHANE | 9.1E-02 | 3.0E-05 | 3.0E-06 | |
| PCE | 1.8E-03 | 3.0E-05 | 5.0E-08 | |
| TCE | 1.7E-02 | 2.0E-03 | 3.0E-05 | |
| | | | | 5.0E-05 |

DERMAL ABSORPTION OF CONTAMINANTS IN GROUNDWATER DURING USE

| | | | | |
|---|---|---|---|---|
| BENZENE | 2.9E-02 | 2.0E-04 | 6.0E-06 | |
| 1,2-DICHLOROETHANE | 9.1E-02 | 7.0E-06 | 6.0E-07 | |
| PCE | 5.1E-02 | 2.0E-05 | 1.0E-06 | |
| TCE | 1.1E-02 | 4.0E-05 | 4.0E-07 | |
| | | | | 8.0E-06 |

| | |
|---|---|
| TOTAL EXPOSURE | 1.1E-04 |

ORIGINAL (Red)

# Table 8

## CHRONIC HAZARD INDEX ESTIMATES

### INGESTION OF CONTAMINANTED GROUNDWATER

| CHEMICAL | CDI (mg/kg/day) | RfD (mg/kg/day) | HAZARD QUOTIENT | PATHWAY HAZARD INDEX |
|---|---|---|---|---|
| ADULTS | | | | |
| ACETONE | 7.0E-04 | 1.0E-01 | 7.0E-03 | |
| PCE | 8.0E-05 | 1.0E-02 | 8.0E-03 | |
| TOLUENE | 5.0E-05 | 2.0E-01 | 3.0E-04 | |
| 1,1,1-TRICHLOROETHANE | 4.0E-04 | 9.0E-02 | 4.0E-03 | |
| XYLENE | 5.0E-05 | 2.0E+00 | 3.0E-05 | |
| MANGANESE | 4.0E-01 | 1.0E-01 | 4.0E+00 | |
| | | | | 4.0E+00 |
| CHILDREN | | | | |
| ACETONE | 2.0E-03 | 1.0E-01 | 2.0E-02 | |
| PCE | 2.0E-04 | 1.0E-02 | 2.0E-02 | |
| TOLUENE | 1.0E-04 | 2.0E-01 | 5.0E-04 | |
| 1,1,1-TRICHLOROETHANE | 8.0E-04 | 9.0E-02 | 9.0E-03 | |
| XYLENE | 9.0E-05 | 2.0E+00 | 5.0E-05 | |
| MANGANESE | 1.1E+00 | 1.0E-01 | 1.1E+01 | |
| | | | | 1.1E+01 |

### INHALATION OF CONTAMINANTS IN GROUNDWATER DURING USE

| | | | | |
|---|---|---|---|---|
| ADULTS | | | | |
| ACETONE | 7.0E-04 | 1.0E-01 | 7.0E-03 | |
| PCE | 8.0E-05 | 1.0E-02 | 8.0E-03 | |
| TOLUENE | 5.0E-05 | 6.0E-01 | 8.0E-05 | |
| 1,1,1-TRICHLOROETHANE | 2.0E-04 | 9.0E-02 | 2.0E-03 | |
| XYLENE | 5.0E-05 | 2.0E-01 | 3.0E-04 | |
| | | | | 2.0E-02 |
| CHILDREN | | | | |
| ACETONE | 2.0E-03 | 1.0E-01 | 2.0E-02 | |
| PCE | 2.0E-04 | 1.0E-02 | 2.0E-02 | |
| TOLUENE | 1.0E-04 | 6.0E-01 | 2.0E-04 | |
| 1,1,1-TRICHLOROETHANE | 7.0E-04 | 9.0E-02 | 8.0E-03 | |
| XYLENE | 1.0E-04 | 2.0E-01 | 5.0E-04 | |
| | | | | 5.0E-02 |

TABLE 8 (con't)

DERMAL ABSORPTION OF CONTAMINANTS IN GROUNDWATER DURING USE

ADULTS

| | | | | |
|---|---|---|---|---|
| ACETONE | 8.0E-06 | 1.0E-01 | 8.0E-05 | |
| PCE | 4.0E-05 | 1.0E-02 | 4.0E-03 | |
| TOLUENE | 6.0E-06 | 2.0E-01 | 3.0E-05 | |
| 1,1,1-TRICHLOROETHANE | 7.0E-05 | 9.0E-02 | 8.0E-04 | |
| XYLENE | 9.0E-06 | 2.0E+00 | 5.0E-06 | |
| | | | | 5.0E-03 |

CHILDREN

| | | | | |
|---|---|---|---|---|
| ACETONE | 9.0E-06 | 1.0E-01 | 9.0E-05 | |
| PCE | 6.0E-05 | 1.0E-02 | 6.0E-03 | |
| TOLUENE | 9.0E-06 | 2.0E-01 | 5.0E-05 | |
| 1,1,1-TRICHLOROETHANE | 1.0E-04 | 9.0E-02 | 1.0E-03 | |
| XYLENE | 9.0E-06 | 2.0E+00 | 5.0E-06 | |
| | | | | 7.0E-03 |

| | |
|---|---|
| TOTAL EXPOSURE ADULTS | 4.0E+00 |
| TOTAL EXPOSURE CHILDREN | 1.1E+01 |

TABLE 9

COMPARISON OF WATER QUALITY GUIDELINES TO PREDICTED ENVIRONMENTAL CONCENTRATIONS

| Chemical | Water Quality Guidelines (ug/l)* | | Predicted Concentrations at the Point of Release (ug/l)** | | |
|---|---|---|---|---|---|
| | Acute | Chronic | Average | RME | Maximum |
| Acetone | (a) | (a) | 0.4 | 0.8 | 7.5 |
| Benzene | 5,300 | 53 b | 0.3 | 0.8 | 13.6 |
| Chloroform | 28,900 | 1,240 | 0.1 | 0.1 | 0.2 |
| 1,1-Dichloroethane | NA | NA | 0.1 | 0.1 | 0.2 |
| 1,2-Dichloroethane | 110,000 | 20,000 | 0.1 | 0.2 | 0.3 |
| 1,2-Dichloroethene | 11,400 | 114 b | 0.1 | 0.1 | 0.2 |
| Tetrachloroethene | 5,280 | 840 | 0.1 | 0.2 | 0.4 |
| Toluene | 17,500 | 175 b | 0.1 | 0.1 | 0.2 |
| 1,1,1-Trichloroethane | 9,320 | 93 b | 0.6 | 1.3 | 3.7 |
| Trichloroethene | 45,000 | 21,900 | 1.1 | 2.9 | 36.7 |
| Manganese | NA | NA | 193.0 | 478.2 | 1,657.4 |

* EPA, 1986. Gold Book: Quality Criteria for Water. EPA 440/S-86-1

** Average and RME groundwater concentrations (far wells) diluted to estimate concentrations at the point of release (Alston Branch of the Leipsic River)

$$\text{Dilution Factor} = \frac{\text{Site water shed area}}{\text{Area of far well plume}} = \frac{5.3E+06}{3.6E+05} = 15$$

a Recommended solvent carrier for aquatic bioassays: non-toxic

b Value for acute guideline multiplied by 0.01 (EPA 1984)

RME Reasonable maximum exposure

NA Not available

Compiled by: BCM Engineers Inc. (BCM Project No. 00-6012-02)

ORIGINAL (Red)

TABLE 10

GROUNDWATER CLEANUP LEVELS

| Contaminant | MCL (ug/l) | MCLG (ug/l) | CLEANUP Level (ug/l) |
|---|---|---|---|
| Acetone | -- | -- | 3,500 (DWEL) |
| Benzene | 5 | 0 | 5 |
| 1,2-Dichloroethane | 5 | 0 | 5 |
| Manganese | 50 (SMCL) | -- | 3,000 (NOAEL) |
| Tetrachloroethene | 5 | 0 | 5 |
| Toluene | 1,000 | 1,000 | 1,000 |
| 1,1,1-Trichloroethane | 200 | 200 | 200 |
| Trichloroethene | 5 | 0 | 5 |
| Xylene | 10,000 | 10,000 | 10,000 |

MCLG - Maximum Contaminant Level Goal
MCL - Maximum Contaminant Level
SMCL - Secondary MCL
DWEL - Drinking Water Equivalent Level calculated using the RfD following the procedure in EPA/540/G088-003
NOAEL - No Observed Adverse Effect Level calculated based on a 70 kg adult consuming 2 liters of water per day

TABLE 11

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)
AND TO BE CONSIDERED MATERIAL (TBCs)
CHEM-SOLV, INC. SITE

| ARAR or TBC | Legal Citation | Classification | Requirement Synopsis | Applicability to Selected Remedy |
|---|---|---|---|---|
| I. CHEMICAL SPECIFIC | | | | |
| A. Water | | | | |
| 1. Safe Drinking Water Act | 42 U.S.C. § 300f et seq. | | | |
| a. Maximum Contaminant Levels (MCLs) | 40 C.F.R § 141.11-12 | Relevant and Appropriate | Enforceable standards for public drinking water supply systems (with at least fifteen service connections of used by at least 25 persons). MCLs apply to public water systems that provide piped water for human consumption. These requirements are not directly applicable since groundwater at the site is used as a private drinking water supply. MCLs are, under the circumstances of this site, relevant and appropriate requirements. | Remedial action must meet MCLs for contaminants of concern for which they exist and for which the MCLG is set at a level of zero. The NCP requires that where the MCLG for a contaminant has been set at a level of zero, the MCL promulgated for that contaminant shall be attained by remedial actions for ground water that is a current or potential source of drinking water, where the MCL is relevant and appropriate under the circumstances of the release. |
| b. Maximum Contaminant Level Goals (MCLGs) | 40 C.F.R § 141.50-51 | Relevant and Appropriate | Non-enforceable health goals for public water supplies. The NCP requires that MCLGs shall be attained by remedial actions for ground water that is a current or potential source of drinking water, where the MCLGs are relevant and appropriate under the circumstances of the release. Analogous to the discussion for MCLs, MCLGs are relevant and appropriate requirements. | Remedial action must meet non-zero MCLGs for contaminants of concern for which they exist. |
| 2. EPA Health Advisories | EPA Office of Drinking Water | To be Considered | Non-enforceable guidelines for public water supply systems | To be considered for remedial actions involving groundwater monitoring, recovery and treatment. |



ORIGINAL (Red)

| ARAR or TBC | Legal Citation | Classification | Requirement Synopsis | Applicability to Selected Remedy |
|---|---|---|---|---|
| 3. Health Effects Assessment | | To be Considered | Non-enforceable toxicity data for specific chemicals for use in public health assessments. Also to be considered are Carcinogenic Potency Factors and Reference Doses provided in the Superfund Public Health Evaluation Manual. | To be considered where remedial alternatives address risk-based criteria or standard setting for cleanup. |
| 4. State of Delaware Regulations Governing Public Drinking Water, Revised May 19, 1989 | Title 16, § 122 | Relevant and Appropriate | Sets criteria for public drinking water supply. These requirements are not directly applicable since groundwater at the site is used as a private drinking water supply. However, under the circumstances of this site, these requirements are relevant and appropriate. | Remedial action must meet levels which are more stringent then Federal MCLs and non-zero MCLGs |
| 5. Delaware Surface Water Quality Standard of Feb. 1990 | §§ 9.3 (a)(i) and 9.3 (b)(i) | Applicable | Criteria are provided to maintain surface water of satisfactory quality consistent with public health and recreational purposes, the propagation and protection of fish and aquatic life, and other beneficial uses of water. | Any surface water discharge must meet these levels if more stringent than federal regulations. |
| B. Air | | | | |
| Clean Air Act | 42 U.S.C § 7401 | | | |
| 1. National Ambient Air Quality Standards | 40 C.F.R. Part 50 | Relevant and Appropriate | National limitations on ambient concentrations of pollutants intended to protect public health and welfare. Applies to for potential releases resulting from groundwater treatment. | Relevant and appropriate should remedial action include onsite air stripper. |
| 2. National Emissions Standards for Hazardous Air Pollutants | 40 C.F.R Part 61 | Relevant and Appropriate | Standards promulgated for air emissions from specific source categories. Not applicable but may be relevant and appropriate for emissions from air strippers at Superfund sites. | Air emissions from the air stripper must meet the standard for benzene |



ORIGINAL (Red)

| ARAR or TBC | Legal Citation | Classification | Requirement Synopsis | Applicability to Selected Remedy |
|---|---|---|---|---|
| **II LOCATION SPECIFIC** | | | | |
| A. The Endangered Species Act of 1978 | 16 U.S.C § 1531<br>50 C.F.R Part 402 | Applicable | Requires federal agencies to ensure that any action authorized by an agency is not likely to jeopardize the continued existence of any endangered or threatened species or adversely affect its critical habitat. | Potentially affected endangered species have not been identified. The remedial action will be implemented so as not to adversely affect such resources should any be identified in the future. |
| B. The Archaeological and Historical Preservation Act of 1974 | 16 U.S.C § 469 | Applicable | Requirements relating to potential loss or destruction of significant scientific, historical, or archaeological data | Archaeological and historical resources will be identified and actions taken to mitigate any adverse effects on those resources that would result from implementation of the remedial action (e.g., construction of an onsite treatment system). |
| C. Delaware Wetlands Act of 1973 | Title 7, Delaware Code, Ch 66, § 6607 | Applicable | Revised June 29, 1984- Requires activities that may adversely affect wetlands in Delaware to be permitted. Permits must be approved by the county or municipality having jurisdiction. | Applies should discharge to surface water affect wetlands. |
| D. Procedures for Implementing the Requirements of the Council on Environmental Quality on the National Environmental Policy Act | 40 C.F.R Part 6 Appendix A | Applicable | EPA's policy for carrying out the provisions of Executive Order 11990 (Protection of Wetlands). No activity that adversely affects a wetland shall be permitted if a practicable alternative that has less effect is available. If there is no other practical alternative, impacts must be mitigated. | Applicable should remediation involve discharge to surface water. |
| E. Ground Water Protection Strategy of 1984 | EPA 440/6-84-002 | To be Considered | Identifies ground water quality to be achieved during remedial actions based on aquifer characteristics and use. | The EPA aquifer classification will be taken into consideration during design and implementation of the treatment remedy. |
| F. National Historic Preservation Act of 1986 | 16 U.S.C. §§470 et seq.<br>36 C.F.R. Part 800 | Applicable | Requires remedial action to take into account effects on properties included in or eligible for the National Register of Historic Places and to minimize harm to National Historic Landmarks. | If the property is eligible for or included on the National Register of Historic Places, actions will be taken to mitigate any adverse effects that would result from implementation of the remedial action (e.g., construction of an onsite treatment system). |

| ARAR or TBC | Legal Citation | Classification | Requirement Synopsis | Applicability to Selected Remedy |
|---|---|---|---|---|
| **III. ACTION SPECIFIC** | | | | |
| A. Occupational Health and Safety Act | 29 C.F.R Parts 1904, 1910, and 1926 | Applicable | Provides occupational safety and health requirements for workers engaged in onsite field activities | Applicable to onsite work performed during implementation of remedial activities |
| B. Water | | | | |
| 1. Clean Water Act (CWA); National Pollutant Discharge Elimination System Requirements | 33 U.S.C § 1251; 40 C.F.R. Part 122 | Applicable | Enforceable standards for all discharges to waters of the United States. | Applicable should remedial action involve discharge to surface water. |
| 2. General Pretreatment Regulations | 40 C.F.R Part 403 | Applicable | Standards for discharge to POTW. | Applicable for discharge of extracted groundwater to POTW. |
| 3. Delaware Environmental Protection | Title 7, Delaware Code, Chapter 60 Section 6010 | Applicable | Regulations Governing the Construction of Water Wells | All wells will be installed and maintained according to state procedures for permitting, construction, and abandonment. |
| 4. Delaware Water Quality Standards | Stream Quality Standard Section 10 | | Standards are established in order to regulate the discharge into state waters in order to maintain the integrity of the water. | Applicable since remediation involves discharge to surface water. |
| 5. EPA Policy for Ground Water Remediation at Superfund Sites | OSWER Directive 9355.4-03 | To be Considered | This policy recommends approaches to ground water remediation using a pump and treat system. | This policy will be considered during the ongoing implementation of the remedial action. |
| 6. Delaware River Basin Commission Water Quality | Memorandum of Agreement between the Delaware River Basin Commission and the U.S. Environmental Protection Agency Region III (§ III.5 and V.8) | Applicable | Regulate restoration, enhancement and preservation of state waters. | Applicable if remedial action involves discharge of >50,000 gallons/day average over any month or a withdrawal of ground water of 100,000 gallons/day or more average over any month. |

| ARAR or TBC | Legal Citation | Classification | Requirement Synopsis | Applicability to Selected Remedy |
|---|---|---|---|---|
| C. Air | | | | |
| 1. Delaware Regulations Governing the Control of Air Pollution | 7 Delaware Code, Chapter 60, Section 6003, Regulation 2, Section 2.4 | Applicable | Sets forth the requirement that a permit is necessary to operate an air stripper if emissions will exceed 2.5 lbs./day. | If emissions exceed 2.5 lbs./day then the substantive requirements of the regulation must be met. In addition, the emissions from the air stripper must meet the Ambient Air Quality Standards set forth in Regulation 3 of 7 Delaware Code, Chapter 60, Section 6003. |
| 2. Control of Air Emissions from Air Strippers at Superfund Ground Water Sites, June 15, 1989 | OSWER Directive 9355.0-28 | To be Considered | Policy to guide the selection of controls for air strippers at groundwater sites according to the air quality status of the site's location (i.e., attainment or non-attainment area). | To be considered in determining if air emissions controls are necessary for an air stripper. Sources most in need of controls are those with emissions rates in excess of 3 lbs./hour or 15 lbs./day or a potential rate of 10 tons/year of total VOCs. |
| D. Hazardous Waste | | | | |
| 1. United States Department of Transportation Rules for Transportation of Hazardous Materials | 49 C.F.R Parts 107, and 171.1-172.604 | Applicable | Regulations for transport of hazardous materials | Applicable to offsite shipment of process wastes. |
| 2. Delaware Regulations Governing Hazardous Waste<br><br>(The Solid Waste Disposal Act (RCRA)) | Delaware Regulations Governing Hazardous Waste<br><br>(42 U.S.C. § 6901 et seq.) | Applicable | Delaware Regulations Governing Hazardous Waste Part 261 (40 C.F.R. Part 261) define "hazardous waste". The regulations listed below apply to the handling of such hazardous waste. | The collected ground water, treatment systems, and hazardous wastes generated by the treatment systems shall be handled in accordance with regulations listed below |
| a. Standards Applicable to Generators of Hazardous Waste | Delaware Regulations Governing Hazardous Waste, Part 262.10-58 (40 C.F.R Part 262.10-58) | Applicable | Establishes standards for generators of hazardous wastes including waste determination manifests and pre-transport requirements. | Applies to wastes generated by the groundwater treatment systems. |
| b. Standards Applicable to Transporters of Hazardous Waste | Delaware Regulations Governing Hazardous Waste, Part 263 (40 C.F.R Part 263) | Applicable | Sets forth regulations for off-site transporters of hazardous waste in the handling, transportation, and management of the waste. | Apply to any company contracted to transport hazardous material from the site. |

| ARAR or TBC | Legal Citation | Classification | Requirement Synopsis | Applicability to Selected Remedy |
|---|---|---|---|---|
| c. Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF) | Delaware Regulations Governing Hazardous Waste, Part 264 (40 C.F.R Part 264) | Applicable | Regulations for owners and operators of TSDFs which define acceptable management of hazardous wastes. | Applies to onsite recovery and treatment systems and any facilities to which wastes generated at the site may be taken. |
| d. RCRA Requirements for Use and Management of Containers | Delaware Regulations Governing Hazardous Waste, Part 264.170-178 (40 C.F.R Part 264.170-178) | Applicable | Requirements for storage of hazardous waste in storage containers. | Applicable for onsite treatment systems and temporary storage containers. |
| e. RCRA Requirements for Tanks Systems | Delaware Regulations Governing Hazardous Waste, Part 264.190-199 (40 C.F.R Part 264.190-199) | Applicable | Requirements for storage or treatment of hazardous waste in tank systems. | Applicable for onsite treatment systems and temporary storage tanks. |
| f. RCRA Manifest System, Record-keeping, and Reporting | Delaware Regulations Governing Hazardous Waste, Part 264.70, 264.73-75, and 264.77 (40 C.F.R Part 264.70, 264.73-75, and 264.77) | Applicable | Requirements for manifesting for offsite disposal of hazardous wastes. | Applicable for offsite disposal of hazardous waste generated by treatment systems. |
| g. RCRA Land Disposal Restrictions | 40 C.F.R Part 268 | Applicable | Restrictions on land disposal of hazardous wastes. | Applicable for land disposal of treatment process wastes. |

Table 12

Cost Summary

| | Capital Costs | Annual O&M | Present Worth |
|---|---|---|---|
| Alternative 1 | | | |
| No Action<br>Ground Water Monitoring | $13,500 | $25,000-<br>$81,000 | $385,000 |
| Alternative 2 | | | |
| Ground Water Monitoring<br>Ground Water Restriction Zone | $18,500 | $25,000-<br>$81,000 | $391,000 |
| Alternative 3 | | | |
| Ground Water Monitoring<br>Ground Water Restriction Zone<br>Alternate Water Supply | $30,500-<br>$34,500 | $25,000-<br>$84,000 | $410,000-<br>$431,000 |
| Alternative 4 | | | |
| Ground Water Monitoring<br>Ground Water Restriction Zone<br>Alternate Water Supply<br>Ground Water Collection<br>Direct Discharge to POTW | $110,000-<br>$234,000 | $57,000-<br>$148,000 | $660,000-<br>$686,000 |
| Alternative 5 | | | |
| Ground Water Monitoring<br>Ground Water Restriction Zone<br>Alternate Water Supply<br>Ground Water Collection<br>Onsite Treatment<br>Discharge to Surface Water | $181,000-<br>$185,000 | $148,000-<br>$189,000 | $687,000-<br>$688,000 |

**RESPONSIVENESS SUMMARY**

**CHEM-SOLV, INC. SITE**
**CHESWOLD, DELAWARE**

A public comment period was held from January 15, 1992 through February 14, 1992 to receive comments from the public on the Remedial Investigation and Feasibility Study (RI/FS) Reports, the Proposed Remedial Action Plan, and EPA's and DNREC's preferred alternative for the Chem-Solv, Inc. site. A public meeting was held on February 6, 1992 at 7:00 PM at the Richardson and Robbins Building in Dover, Delaware. The public meeting was attended by EPA and DNREC staff, local residents, members of the press, and representatives and consultants of the potentially responsible parties (PRPs). The public meeting was preceded by a briefing of public officials held at 3:00 PM at the same location. The briefing was attended by EPA and DNREC staff and state and local public officials.

The purpose of the meetings was to present and discuss the findings of the RI/FS and to apprise meeting participants of EPA's and DNREC's preferred remedial alternative. Comments received during the meetings and written comments received throughout the public comment period are presented below along with a response to each.

A. COMMENTS FROM THE PUBLIC MEETING

A.1 Comment: A local resident asked what actions had been taken at the site to date.

Response: DNREC responded by saying that after the explosion and solvent spill in 1984, DNREC excavated approximately 1300 cubic yards of contaminated soils. Then, to recover the contaminated ground water, DNREC installed a recovery well system and an air stripper which operated from December 1985 to September 1988. The recovery system, along with the air stripper, was effective in containing further migration of contaminated ground water offsite and considerably reducing the concentrations of volatile organic compounds from 130,000 micrograms per liter (ug/l) to about 150 ug/l.

A.2 Comment: A resident was concerned about some of the area residents having wells approximately 20 feet deep and asked how safe the residents are relative to the contaminants associated with the site.

Response: DNREC responded by saying that DNREC has a

quarterly monitoring program in place under which samples are taken from domestic wells located in the direction of ground water flow, which is to the northeast. This is the area most likely to be impacted by the contaminated ground water from the Chem-Solv site. To date, sampling results have not shown any adverse impact from the site on the domestic wells except for one well on the east side of Route 13 (Gearhart) which DNREC replaced with a well drilled into a deeper uncontaminated aquifer. The continued quarterly monitoring ensures that migration of the contamination is tracked over time and that area residents are protected. The majority of the site-related contamination extends to approximately the median of Route 13 which is approximately 1500 feet downgradient from the Chem-Solv, Inc. property boundary. The recovery system which operated from December 1985 to November 1988 was effective in restricting the movement of contamination to this short distance from the spill location.

A.3 Comment: A resident asked if he had reason to be concerned about installing a new well on his property which is located across Route 13 from the Chem-Solv site.

Response: Based on the location of the property and following consultation with an expert hydrogeologist at DNREC, DNREC would approve the installation of new wells in the area to which the commentor was referring because it is not situated in an area that would be expected to be impacted by the Chem-Solv site.

A.4 Comment: A resident asked how long it would be before the actual implementation of the selected remedy.

Response: EPA explained that it would be approximately 18 months from the date the Record of Decision (ROD) is issued before construction of the remedy would actually begin. EPA would first attempt to negotiate a Consent Decree with the PRPs to perform the work at the site. The Consent Decree would provide the mechanism under which the PRPs would be required to complete this work on an enforceable schedule.

A.5 Comment: A resident asked what effect the remedial action will have on the local water table.

Response: Based on the past pumping activities from the

wells that worked in unison with the air stripper at the site from 1985 to 1988, DNREC found that the maximum rate at which water could be withdrawn from the aquifer (yield) was in the range of five to ten gallons per minute. This pumping rate would not have any significant impact on the local water table.

A.6 Comment: A resident asked why only a few residential wells are being sampled and not every well in the area.

Response: DNREC explained that the contamination related to the site has been determined to be migrating to the northeast of the site. Those wells located in the direction of ground water flow have been periodically sampled and have not been impacted by the site; therefore, there is no technical reason to sample every residential and commercial well in the area.

A.7 Comment: Several residents who live to the west of the site asked about the direction of ground water flow and if they could be affected by the contaminated ground water.

Response: The ground water flow direction has been determined to be to the northeast, not to the west. Residents living to the west of the site should not be affected by contaminants from the Chem-Solv site in the ground water.

A.8 Comment: A resident asked why workers wore protective clothing during the soil aeration process in 1985 and why residents in the area were not informed that they might be in danger. She believes that vapors from the soil aeration could have been responsible for medical problems she was having at that time.

Response: All personnel working in situations similar to this one are required to wear protective clothing as a precaution. Air monitoring conducted during the aeration process indicated that no danger to local residents existed from any vapors which were released to the air.

A.9 Comment: An elected official from the area requested that Alternative 4 be explained in more detail.

Response: DNREC explained that Alternative 4 would include a ground water monitoring program. A restriction zone would be instituted in which no new domestic

wells would be permitted to be installed without prior consultation with DNREC. In addition, if any existing domestic wells were found to be contaminated in the future, they would be replaced with new wells. Ground water would be extracted from the aquifer via a recovery system and discharged to the Kent County Publicly Owned Treatment Works (POTW) via an existing sewer system.

A complete description of Alternative 4 and all other alternatives including the contingency remedy is presented in Section 7.0 of the Decision Summary of this ROD.

A.10 Comment: An elected official stated that at previous meetings regarding the Chem-Solv site, the public had been informed that ground water flows to the south in the area, not to the north/northeast as presented at this public meeting.

Response: DNREC explained that over 40 wells have been installed at the site and have been used to determine ground water flow direction at the site. Based on the information gathered from these wells before and during the Remedial Investigation, it has been established that the ground water flow direction is to the northeast from the Chem-Solv site. There was some concern at one time that flow in the deeper aquifer, which is not affected by the Chem-Solv site and is used as a source of water supply in Dover, was to the south. But because the contamination from the Chem-Solv site never reached that depth, that did not become relevant. In fact, the flow in the deeper aquifer probably is not southward either.

A.11 Comment: A resident asked for an estimate of the area that the ground water restriction zone might include.

Response: DNREC estimated that the restriction zone might extend in a thousand foot radius to the northeast of the site. The exact location of the restriction zone will be determined by DNREC and EPA during the remedial design.

A.12 Comment: The mayor of Cheswold asked if DNREC was aware that a local resident who lives near the intersection of Routes 13 and 42 had complained to him that she had just had a new well installed and was told that the water was not suitable to drink. The mayor questioned how the resident was able to

get the permit to install the well and was concerned that there was a "slip" in the system.

Response: In fact, earlier in the day, DNREC had personally discussed the results of the water sampling from the new well with the resident. The results of the analysis showed that the well was contaminated with bacteria due to improper disinfection of the well by the driller at the time of installation. This was not related to the Chem-Solv site. The driller subsequently rectified the problem by disinfecting the well by chlorination.

In the proposed restriction zone, DNREC's Division of Air and Waste Management and Division of Water Resources shall routinely consult with each other before issuing a permit for the installation of a new drinking water well in the area. By following this protocol, DNREC should avoid any kind of "slip" in the system. DNREC followed this protocol in issuing the permit which was requested by the resident to drill a deeper well in the uncontaminated aquifer.

A.13 Comment A private vendor made a brief presentation on a treatment system produced by his company which could potentially be used for onsite treatment at the Chem-Solv site. This was later followed by a written proposal of a ground water remediation system from such vendor.

Response: See the response to comment D.2 below.

## B. COMMENTS ON EPA'S REVISED RISK ASSESSMENT

Following submittal of the RI Report (BCM Engineers Inc., November 1991) which contained the risk assessment for the site, EPA revised the risk calculations. EPA's revised risk calculations are attached to the RI report in the Administrative Record file. BCM Engineers Inc. (BCM) submitted several comments on the revised risk calculations performed by EPA.

B.1 Comment: BCM stated that EPA's averaging of data from two rounds (April 1990 and February 1991) of monitoring well sampling is inappropriate for risk assessment purposes. BCM believes that historical data from several years of ground water sampling previous to the RI and data collected during the RI indicate a decreasing trend in concentrations in the aquifer over time and that only the most recent round of data should be used for risk

assessment calculations because it more accurately represents current conditions.

Response: Generally it is desirable to utilize data from several rounds of sampling to characterize the ground water due to variations in ground water quality that may occur because of seasonal effects and various other factors that may cause fluctuations in contaminant concentrations over time. The impact of anomalies in data sets tends to be off-set and the distribution of data tends to be normalized by evaluation of a greater number of relevant samples. Thus it would be most desirable to take an infinite number of samples in order to gain the most accurate picture of the ground water conditions and to capture the most representative data set for the medium in question. Since such a sampling protocol is not possible, it is then desirable and advantageous to utilize as many appropriately representative samples as possible in such characterizations. The greater the number of relevant measurements utilized in the statistical evaluation of a given parameter, the more reasonable and accurate that evaluation will be.

It is important to consider the nature of the study and the critical questions that must be answered. The nature of the study involves the characterization of the ground water at the Chem-Solv site at the time of the RI and the associated risk presented to exposed receptors of that ground water. At the Chem-Solv site, EPA believes that the two most recent rounds of ground water data collected are representative of the conditions at the Chem-Solv site which existed at the time of the RI and are seen as presenting a reasonable set of data for the evaluation of the ground water.

The critical question that must be answered is whether the ground water sampling performed is representative of the true ground water conditions at the site. BCM suggests that there has been a decrease in contaminant concentrations over time at the Chem-Solv site, and therefore feels that the February 1991 round of ground water sampling is most representative of conditions at the site. However, since only data from the April 1990 and February 1991 rounds of sampling are being utilized for risk evaluation, it is important to determine if there is a statistically significant downward trend in the data that provides evidence

indicating that the April 1990 sampling data is not representative of the ground water conditions at the site. It is not merely enough to show that contaminant concentrations have decreased over an extended time period. It must also be documented that a statistically significant difference exists between the two sets of data collected in a ten month period which would make the use of both sets of data invalid. Statistical proof must be provided to show that these two sets of data represent different populations of data. BCM has never provided such documentation.

It should also be noted that the use of the two rounds of data collected during the RI gives a more accurate picture of the ground water in a reasonable time period, and provides a data set which gives a clearer picture of ground water quality and risk throughout that period. Thus, it remains EPA's position that using data from both the April 1990 and the February 1991 rounds of ground water sampling was both reasonable and appropriate.

B.2 Comment: In calculating average and reasonable maximum exposure (RME) concentrations, EPA did not incorporate data from multiple sampling dates into one average concentration for each location. BCM believes that the statistical methods used by EPA are biased to the concentrations detected in the well locations with the greatest number of samples and that EPA's RME concentrations are biased high.

Response: The data sets EPA used in calculating RME concentrations included both the April 1990 and February 1991 rounds of ground water data. An average concentration for each contaminant was determined for each well sampled in each of the rounds of sampling. Calculation of RME concentrations was carried out according to standard procedures. EPA's rationale for using this approach is that by representing the sample values obtained in each round of sampling a more normalized distribution of the data is obtained. This produces a more representative and less skewed data set. The resulting decrease in the variance produces more reasonable RME concentrations.

The actual calculations of the RME concentrations indicate that the EPA values are not biased high. Of the 11 contaminants for which RME

concentrations were calculated, only 3 of the values computed by EPA were slightly higher than those calculated by BCM and none of the three values resulted in a change in the calculated risk. Complete data tables comparing RME concentrations calculated by both EPA and BCM methods can be found as an attachment to the RI Report in the Administrative Record file for the site.

B.3. Comment: EPA used n-1 instead of n in the formula used to calculate the RME concentration.

Response: EPA did not use n-1 in the formula used to calculate the RME concentration but used n as is appropriate and correct.

B.4. Comment: EPA incorrectly used n instead of n-1 to calculate the standard deviation.

Response: The software package EPA used to calculate the standard deviation was an older version of Lotus which used n instead of n-1. This situation has been corrected. EPA recalculated the standard deviation using n-1. Tables which present both the original computations using n and the revised computations using n-1 are provided as an attachment to the RI Report which can be found in the Administrative Record file for the site. It should be noted that this change caused an increase in the RME concentrations of only one to two percent in most cases and did not result in any change in the risk numbers calculated using the revised RME concentrations.

C. TECHNICAL CONCERNS/COMMENTS REGARDING ALTERNATIVES

C.1 Comment: The PRPs commented that the Proposed Remedial Action Plan did not mention that benzene and manganese contamination may be partially related to sources other than Chem-Solv and that ground water extraction has the potential to capture non site-related plumes.

Response: Section 5.0 of the Decision Summary of this ROD discusses possible other sources of contamination in the vicinity of the Chem-Solv site, namely USTs presently or previously located on several properties in the area. EPA states that contamination in the vicinity of the intersection of Routes 13 and 42 is believed to be due to USTs

in that area and is not addressed by the remedial action for the Chem-Solv site. EPA does not believe that contamination in that area will be captured by the ground water collection system at the Chem-Solv site. At the same time, EPA acknowledges that USTs or the former operation of a fueling establishment on the adjacent property to the north may be partially responsible for manganese and benzene found in well 26A; however, these contaminants have also been determined to be related to the Chem-Solv site. The remedy selected in this ROD will deal with contamination resulting from releases from the Chem-Solv site. It is impossible to design or operate a ground water extraction system which will selectively remove contaminants from only the Chem-Solv site. Therefore, the remedial action may in fact provide some degree of treatment for benzene and manganese from other sources in the area. EPA addresses the possibility that sources remain on the adjacent property and states in the discussion for Alternative 4 that this will be taken into consideration during periodic reviews of the remedial action.

C.2 Comment: The PRPs commented that EPA's use of risk-based cleanup levels for ground water is not appropriate. They believe that MCLs should be used instead. They also commented that the FS was developed using MCLs as cleanup levels; therefore, the length of time for and cost of remediation were underestimated in the Proposed Plan.

Response: The Proposed Remedial Action Plan stated that the cleanup levels for the site would be risk-based (i.e., a cumulative carcinogenic risk not to exceed $1 \times 10^{-6}$ and a Hazard Index not to exceed 1.0). The Proposed Plan explained that in many cases MCLs would be used as cleanup levels but that the cumulative carcinogenic risk associated with the MCLs for the contaminants of concern at this site was greater than $1 \times 10^{-6}$ and that the MCLs were therefore not appropriate cleanup levels. Upon further evaluation, and in accordance with § 300.430(e)(2)(i) of the NCP, 40 C.F.R. § 300.430(e)(2)(i), EPA has determined that the cumulative carcinogenic risk associated with the MCLs ($2 \times 10^{-5}$) is within the acceptable risk range of $10^{-4}$ to $10^{-6}$. Therefore, it is appropriate to use non-zero MCLGs and MCLs as cleanup levels at this site as set forth in Table 10 of the Decision Summary of this ROD. Risk-

based cleanup levels were developed for manganese and acetone because MCLs are not available.

C.3 Comment: The PRPs commented that the Proposed Remedial Action Plan states that emissions levels from an air stripper are unknown at this time, but the FS quantifies air emissions, indicating that at the maximum concentrations of contaminants observed in RI sampling, emissions are anticipated to be below state and federal regulated concentrations which would require emission controls.

Response: Not only must air emissions from an air stripper meet all ARARs, but they must not exceed levels which would pose an unacceptable risk to human health and the environment. No risk calculation was included in the FS. Therefore, risk calculations must also be performed with respect to the air emissions to determine whether emission controls are required.

C.4 Comment: The PRPs commented that the Proposed Remedial Action Plan discusses the implementability of Alternatives 4 and 5 without discussing any potential problems with recovery of contaminants. Pulse pumping may be required to achieve the remediation goals because of the low concentrations of contaminants and the difficulty in desorption of TCE from soil particles.

Response: In the discussion for Alternative 4 in Section 7.0 of the Decision Summary, EPA acknowledges that pulse pumping may become necessary to remove low concentrations of contaminants in the ground water.

## D. REMEDY SELECTION

D.1 Comment: Kent County Levy Court has expressed opposition to discharge of extracted ground water from the Chem-Solv site to the Kent County POTW because of problems that the POTW is experiencing with the capacity of the conveyance system and the treatment plant. They believe that onsite treatment with discharge to surface water is therefore the most appropriate action for the site. Kent County has stated that if the selected remedy includes discharge to the POTW, then it would require certain conditions other than pretreatment requirements to be met for the discharge from the Chem-Solv site.

Response: Kent County has not submitted a definitive answer as to whether they would accept discharge from the Chem-Solv site; however, EPA has taken their concerns into consideration during the remedy selection process. As discussed in Section 9.0 of the Decision Summary, EPA has selected discharge to the POTW as the remedial action for the site with the contingency for onsite treatment with discharge to surface water. The contingency remedy will be employed if an agreement with the POTW cannot be reached. The decision as to whether to discharge the extracted ground water to the Kent County POTW or treat it onsite with discharge to surface water shall be made by EPA at the onset of remedial design.

D.2 Comment: At the public meeting, a private vendor made a brief presentation on a treatment system produced by his company which could potentially be used for onsite treatment at the Chem-Solv site. This was later followed by a written proposal of a ground water remediation system from such vendor.

Response: The selected remedy presented in Section 9.0 of the Decision Summary calls for ground water extraction with discharge to a POTW with a contingency for onsite treatment and discharge to surface water. Should the contingency remedy ultimately be implemented at the site, the vendor's proposal could potentially be considered during the design, provided that it is able to achieve the performance standards and ARARs presented in this ROD as described in Section 9.0.