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1999

EPA Superfund
Record of Decision:

Rodale Manufacturing Co. Inc. Site OU 1
Emmaus Borough, PA
9/30/1999

SUPERFUND PROGRAM
RECORD OF DECISION

Rodale Manufacturing Superfund Site
Emmaus, Lehigh County, Pennsylvania

SEPTEMBER 1999

PART I - DECLARATION

SITE NAME AND LOCATION

Rodale Manufacturing Superfund Site
Emmaus, Lehigh County, Pennsylvania

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Rodale Manufacturing Superfund Site (Site). The remedial action was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for the Site.

The Commonwealth of Pennsylvania through the Department of Environmental Protection (PADEP) has verbally concurred on the ROD.

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 ROD, may present an imminent and substantial endangerment to the public health, welfare, or environment.

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DESCRIPTION OF SELECTED REMEDY

The selected remedy described below is the only planned action for the Site. The selected remedy includes 1) hydraulic containment of the highest levels of contaminated ground water at and in the vicinity of a portion of the aquifer at the Site which has been determined to have Dense Non-Aqueous Phase Liquid (DNAPLs) (the area is referred to as the "Probable DNAPL Zone"); 2) a Technical Impracticability waiver for the Applicable and Relevant and Appropriate Requirement (ARAR) for TCE in ground water and TCE and PCE for the subsurface soil in the Probable DNAPL Zone; and 3) passive treatment through Monitored Natural Attenuation (MNA) for the ground water contamination that has migrated beyond the boundaries of the Probable DNAPL Zone.

The selected remedy specifically includes the following major components:

1. Hydraulic containment of the dissolved phase VOC plume at and in the immediate vicinity of the Probable DNAPL Zone by extraction and treatment of ground water. This involves, but is not limited to, using an existing ground water treatment system (GWTS) at the Site. The GWTS includes the following components: an equalization tank, a liquid/solid separation unit and sludge handling equipment, an air stripper, liquid phase granular activated carbon units, and a regenerative vapor phase adsorber unit. Ground water in this part of the plume will be remediated to the cleanup standards listed in Table 1 of Part II of this Record of Decision.

2. Monitored Natural Attenuation to remediate contamination which has migrated beyond the Probable DNAPL Zone. Monitored Natural Attenuation will remediate the ground water dissolved plume in this part of the plume to cleanup standards listed in Table 1 of Part II of this Record of Decision. If it is demonstrated that Monitored Natural Attenuation cannot remediate this portion of the plume in a reasonable timeframe, the GWTS will be expanded to remediate it.

3. A Technical Impracticability waiver of the ARARs for TCE in ground water and TCE and PCE in the subsurface soils in the probable DNAPL zone.

4. Land use restrictions in the Property boundaries to prevent unauthorized access and provide exposure control, and ground water use restrictions throughout the entire plume to provide exposure control and prevent interference with the groundwater remediation process.

STATUTORY DETERMINATIONS

The remedy is protective of human health and the environment and is cost effective. EPA believes that the selected remedy will comply with all Federal and State requirements that are

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legally applicable or relevant and appropriate to the remedial action, unless they are waived. The selected remedy utilizes a permanent solution to the maximum extent practicable and satisfies the statutory preference for a remedy that employs treatment that reduces toxicity, mobility, or volume.

Because this remedy will result in hazardous substances remaining on-Site above health-based levels, a review by EPA will be conducted within five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Abraham Ferdas, Director
Hazardous Site Cleanup Division
Region III

9/30/99
Date

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RODALE MANUFACTURING SITE

PART II - DECISION SUMMARY

I. SITE NAME, LOCATION, AND DESCRIPTION

The "Site" encompasses the approximately 1.2 acre parcel of real property designated as the "Rodale Superfund Site," located at the intersection of Sixth and Minor Streets, in the Borough of Emmaus, Lehigh County, Pennsylvania, (the "Property"), as well as all areas included within the definition of "on-site" at 40 C.F.R. Section 300.5.[1]

Currently the only structure on the Property is a ground-water treatment system (GWTS) building and recovery well protective enclosures. A storm water catch basin near the southwest corner is connected to the storm sewer along Sixth Street. The Property is bounded by a 6-foot high chain-link security fence on the south property line, and an 8-foot high red cedar security fence on the north, east, and west sides. The Property is accessible through locking gates on the east and west sides of the Site.

Prior to 1993, the Property included a three-story building that occupied most of the Property (designated as three inter-connected sections: Buildings A, B, and C) which served as a manufacturing, warehouse, and office facility. An exterior, open-space courtyard area existed on the south side of the facility. This courtyard area was expanded in 1989 as a result of demolition of the southern wing of Building D. Three disposal wells (Wells 1, 2, and 3) were located in the open area, along with several other wells and cisterns (Figure 3).

Following demolition of the buildings in 1993, the Property was graded with quarry fill and #2A modified stone. The basement under Building A, which measured approximately 170 feet in length (north-south direction) by 50 feet in width (east-west direction), was backfilled with clean quarry fill prior to the final grade-level application of #2A modified stone. The walls were left in place, and the floor of the basement broken up to allow for proper drainage.

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[1] 40 CFR Section 300.5 defines "on-site" as "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action." As of the date of the Remedial Investigation, groundwater sampling showed contamination had migrated off the Property approximately 700 feet, to encompass the monitoring wells designated as "MW 3, 4 and 5". For purposes of implementation of the remedial action as detailed in this Record of Decision, the term "Site" includes such areal extent of contamination, as depicted on Figure 2. The area so included may be modified as further information becomes available.

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II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

Prior to the 1930s, the Property was occupied by the D.G. Dery Silk Corporation and later by Amalgamated Silk Corporation. Rodale Press, a publishing and printing business, occupied portions of the building for several years beginning in 1953. From the late 1930s until 1975, the Property was operated by Rodale Manufacturing. Rodale Manufacturing manufactured wiring devices and electrical connectors. In 1975, the Property was sold to Bell Electric, a wholly-owned subsidiary of Square D Company. Bell Electric manufactured similar electrical components.

Pennsylvania Department of Environmental Protection (PADEP) files indicate that under Rodale Manufacturing's operation of the facility, several wells were used for disposal of various wastes. PADEP files indicate that in 1962, approximately 3,000 gallons per day (gpd) of wastewater, including rinse water from copper and zinc plating and acid brass dipping, were discharged to a 452-foot deep borehole (Well 1) located in the former courtyard area. Discharge of wastes into the wells continued probably until 1967 when the electroplating room was connected to the sanitary sewer.

Past disposal practices were first identified by Square D in March 1981, when a capped borehole was discovered during the installation of new equipment. Long-time employees of Rodale Manufacturing indicated that two other wells were also used for disposal purposes, and the locations of these wells were identified. During the course of the investigation at the Site, four additional features were found. They are: a shallow cistern; a tank possibly used for fuel oil storage; a well apparently used for makeup cooling water; and a well which is believed to have been used for septic disposal.

In 1984, in coordination with PADEP, Square D commenced pumping contaminated ground water from one of the disposal wells. The Volatile Organic Compounds (VOCs) contamination in the ground water was treated by an air-stripping tower. This air stripper was operated until 1989. In January 1989, a Site inspection was conducted at the Site on behalf of the USEPA. On July 29, 1991, the Site was proposed for placement on the National Priorities List (NPL) and then listed on October 4, 1991. An Administrative Order on Consent (AOC) to conduct a Remedial Investigation and Feasibility Study (RI/FS) was executed between the USEPA and Square D and became effective on September 21, 1992.

As required by the RI/FS AOC, a Well Survey Investigation was conducted by Square D. This investigation included, among other tasks, sampling on-site wells, off-site monitoring wells, the Borough of Emmaus public supply wells, and several private wells, as well as sampling of local surface water bodies (See Figure 3). The results of this investigation were included in a September 1994 report. Based on the findings of the Well Survey Investigation, a separate AOC for a Removal Response Action for a Site ground-water treatment system (GWTS) was executed between the USEPA and Square D, effective September 30, 1994. The purpose of the GWTS was to recover and treat contaminated ground water to limit further migration of contamination. The construction of the GWTS was completed in August 1996. Remedial investigation activities

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were conducted concurrently with the construction of the GWTS. These activities included ambient air sampling; soil sampling; sampling of ground water both on and off the Rodale Manufacturing property; hydrologic mapping; pumping tests, and installation of eight monitoring cluster wells beyond the boundaries of the Rodale Manufacturing property. Well clusters consist of one shallow and one deep well except for one well cluster which consists of a shallow, intermediate and a deep well (Figure 3). In addition to these activities, the remedial investigation included data collection to evaluate the presence of Dense Non-Aqueous Phase Liquids (DNAPLs) at the Site. A more detailed description of the Well Survey and Remedial Investigation activities is included in Section VI below.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Documents which EPA used to develop, evaluate, and select a remedy for the Site have been maintained at the Emmaus Public Library, 11 East Main Street, Emmaus, PA and at the EPA Region III Office, Philadelphia, PA.

The Proposed Plan was released to the public on June 20, 1999. The notice of availability for the RI/FS and Proposed Plan was published in the *Morning Call* on June 20, 1999. A 30-day public comment period began on June 20, 1999 and concluded on July 20, 1999.

A public meeting was held during the public comment period on June 23, 1999. At the meeting, EPA presented a summary of the alternatives in the Proposed Plan and EPA's preferred remedy. EPA answered questions about the Site and the remedial alternatives. Approximately 8 people attended the meeting, including residents from the impacted area and potentially responsible parties. No written comments were received during the public comment period. A summary of the questions and EPA's responses in the public meeting are contained in Part III of this document.

IV. SCOPE AND ROLE OF RESPONSE ACTIONS

This final selected remedy addresses the threats posed by the release of hazardous substances at the Site. The primary objective of the remedy described in this ROD is to reduce or eliminate the potential for human exposure to contaminated soil and ground water at the Site. The selected remedy outlined in Section X of this ROD will comprehensively address the risks posed by the release or threat of release of hazardous substances from the Site.

V. SUMMARY OF SITE CHARACTERISTICS

A. Topography and Ground Cover

Topography in the Borough of Emmaus varies from between 350 feet and 500 feet above mean sea level (msl) (USGS, 1992). The most prominent topographic feature in the vicinity of the Site is South Mountain to the south and southeast. Gentle sloping hills and stream valleys are found to the west, north, and northwest. The peaks of South Mountain extend as high as

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1,000 feet above msl. Topographic features in the vicinity of the Site include: the Lehigh River; Leibert, Little Lehigh, Swabia, and Cedar Creeks; Chestnut Hill; Lock Ridge; and Bauer Rock. Elevations across the 1.2-acre Site range from 460 to 470 feet msl, with the lowest point located within the central portion of the northern half of the Site.

B. Climate

Temperatures in the area of the Site are generally moderate, with mean monthly temperatures ranging between 74° F in July to 27° F in January. Maximum temperatures during most years are not excessively high and temperatures above 100° F are seldom recorded. However, the average humidity in the area can be relatively high. Minimum temperatures during December, January, and February are usually below freezing, but temperatures below 0° F are seldom recorded (Wood, 1996).

Annual precipitation in the Site vicinity averages almost 44 inches per year, with July having the highest monthly average (4.35 inches) and January having the lowest (0.13 inches) (Wood, 1996).

C. Geology and Hydrogeology

The regional geology in the area of the Site is characterized by the crystalline rock units forming South Mountain to the east and south of the Site, and the Cambrian and Ordovician sedimentary units of the Little Lehigh Creek Basin extending north and west of South Mountain. The first bedrock unit encountered at the Site consists of carbonate rocks of the Leithsville Formation. Deep sections of weathered bedrock (saprolite) occur above the competent bedrock of the carbonate units of the Little Lehigh Creek Basin, overlain in some areas in the vicinity of the Site by glacial drift deposits, and generally capped with a soil loam horizon. The saprolite varies in thickness from 50 feet to more than 250 feet in the Site vicinity.

Abundant evidence and literature describes the area as extensively faulted. Detailed hydrogeological characterization of the overburden and bedrock units at the Site indicate that these units are highly heterogeneous and complex at a small scale. The information obtained during the investigations conducted at the Site suggest that the bedrock is highly fractured and faulted in the vicinity of the Site, with the predominant fracture orientations aligned generally in a north-northeast/south-southwest directions, and faults trending northwest-southeast. A linear ground water depression has been consistently observed for both the shallow and deeper bedrock extending from an area immediately west of the Site towards the north-northwest. This feature appears to act as a preferential pathway for the migration of ground water and may be related to the northwest trending dissolution enhanced fault feature.

A bedrock aquifer underlies the Site and is recharged by local precipitation. Ground water beneath the Site flows to the north-northeast, in the direction of the Little Lehigh Creek. Ground water at the Site flows through extensive joints and fractures, and in the case of the

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carbonates, the solution enhancement of these secondary openings. The depth to ground water at the Site and in the immediate Site vicinity has been observed to range from 105 to 115 feet below ground surface (bgs).

Bedrock ground water provides the Borough of Emmaus and the Little Lehigh Creek Basin with approximately 60% of its potable water supply. The Liethsville Formation and the Allentown Dolomite are locally the most important water-bearing units . Four of the six public water supply wells for the Borough of Emmaus are located in the Liethsville Formation. The other two are located in the Allentown Dolomite and the Hardyston Quartzite.

D. Hydrology

Little Lehigh Creek is the primary drainage feature in the area. Little Lehigh Creek is located in northwest Borough of Emmaus (about 1.5 miles northwest of the Site) and flows generally from southwest to northeast towards the City of Allentown where it discharges to the Lehigh River. Leibert Creek is a tributary to Little Lehigh Creek approximately one mile west of the Site. Leibert Creek flows generally from south to north and discharges to Little Lehigh Creek northwest of the Borough of Emmaus.

Based on the topography of the Site and the fact that the entire Property surface is covered with crushed stone, nearly 100% of the precipitation to the Site would be expected to infiltrate into the subsurface during most rain events. No significant runoff would be expected.

E. Land Use

The Site includes approximately 1.2 acre of land at Sixth and Minor Streets in the Borough of Emmaus, Lehigh County, Pennsylvania, approximately five miles south of the City of Allentown. The Property land use is industrial and the land use in the area comprising and surrounding the Site includes residential as well as industrial and commercial facilities.

VI. NATURE AND EXTENT OF CONTAMINATION

This section discusses the nature and extent of contamination in the air, soil (surface and subsurface), ground water, surface water, sediment, and springs at and around the Site. The data included for discussion were generated during the Well Survey Investigation, during the response action for the ground water treatment system (GWTS), and during the Remedial Investigation (RI).

The Well Survey Investigation was conducted at the Site from January to October 1993 to characterize water and sediment quality in and around the Site. This investigation also included, sampling of on-site wells (both monitoring and disposal wells), the Borough of Emmaus public supply wells, and several private wells, as well as sampling of local surface water bodies.

The response action for the GWTS was completed in August 1996. This activity included, rehabilitation of an on-site disposal well (Well 7), installation of a ground water recovery well (RW-3), ground water sampling of Well 7 and RW-3, and collection of subsurface soil samples.

The RI activities were conducted concurrently with the construction of the GWTS. These activities included, ambient air sampling, soil sampling, sampling of ground water both on and off the Rodale Manufacturing property, hydrologic mapping, performance of a pump test, and the installation of eight monitoring well clusters beyond the boundaries of the Rodale Manufacturing property. In addition to these activities, the RI included the collection of data to evaluate the presence of DNAPLs at the Site.

A. Air

Air sampling was conducted during the RI to assess air quality at the Site. Samples were collected during two separate sampling events in the fall of 1995 from two background locations (AS-1 and AS-2), two areas suspected to be source areas based on historical Site information (AS-3 and AS-4), and two downwind locations (AS-5 and AS-6) and analyzed for Volatile Organic Compounds (VOCs) (Figure 5). The sampling results revealed that toluene was the only VOC detected. Toluene was detected in all six air samples during the second sampling event at low concentrations ranging up to 3.7 parts per billion(ppb). The detected concentrations of toluene in samples collected upwind, mid-site, and downwind were consistent, indicating the source of toluene detected was located upwind of the Site and is not Site-related.

B. Surface Soil

Surface soil samples were collected at the Site during the RI to evaluate the extent of shallow soil contamination on the Property (Figure 6). Analytical results for VOCs, metals, and pesticides/PCBs are summarized below.

VOCs

TCE was detected at low levels in seven surface soil samples, ranging from 2 ppb to 63 ppb. Additionally, total 1,2-DCE and PCE were detected in one sample at 8 ppb and 6 ppb, respectively. Figure 7 shows the sampling locations and distribution of VOCs detected.

Pesticides/PCBs

Detectable levels of heptachlor (1.5 ppb), endosulfan I (1.7 ppb), 4,4'-DDE (2.3 ppb), Aroclor-1242 (28 ppb), Aroclor-1248 (30 ppb), and Aroclor-1254 (22 ppb) were observed in soil collected from one sample location. Another sample showed 4,4'-DDE at a concentration of 1.9 ppb.

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Inorganics

All concentrations of detected inorganic constituents were low and no significantly elevated values were present in the soil samples analyzed.

C. Subsurface Soil

Subsurface soil samples were collected during the GWTS investigation and the RI. Although part of the RI investigation, a total of 19 soil borings were completed in late summer and early fall of 1994 during the GWTS investigation. The purpose of conducting this soil sampling at this time was to characterize soil quality in selected portions of the Site identified as potential source areas, and to help in selecting the location of the GWTS building. Seven additional soil borings were completed during the RI in March 1996 to supplement the soil characterization data generated during the GWTS investigation (Figure 7). Summaries of the analytical results for VOCs, Semi-Volatile Organic Compounds (SVOCs) and inorganics are provided respectively, as follows.

VOCs

Detected levels of VOCs were low in most borings, except one located near former disposal Well 2. Samples in this location displayed the highest TCE concentrations (up to 1,400,000 ppb). Elevated TCE concentrations were detected in this location at depths greater than 40 feet, corresponding to the base of the cased portion of Well 2, with concentrations decreasing with depth below 67 feet. Elevated TCE concentrations were also detected at other boring locations at various intervals at concentrations up to 8,300 ppb. PCE was detected at 110,000 ppb in the same sample location near Well 2 in the 65- to 67-foot interval.

The VOC detections are situated in the immediate vicinity of disposal Well 2. The depths at which the elevated concentrations are found correspond with the construction of this well. It is most likely that historical disposal practices account for the VOC detected in soil found in this area at these depths.

Other VOCS detected in one or more soil samples at low concentrations include 1,1,1-TCA (1 ppb), 1,1,2-TCA (2 to 51 ppb), 1,2-DCA (4 ppb), total 1,2-DCE (1 to 630 ppb), 2-butanone (6 to 140 ppb), 2-hexanone (3 ppb), 4-methyl-2-pentanone (12 to 18 ppb), carbon disulfide (2 to 6 ppb), ethylbenzene (11 to 710 ppb), toluene (2 to 880 ppb), and total xylenes (3 to 5,700 ppb).

Semi-Volatile Organic Compounds (SVOCs)

Several SVOCs were detected infrequently in the subsurface soil samples collected at the Site, as indicted on Table 3-6. The following SVOCs were detected in at least one sample: 2-methylnaphthalene (670 to 11,000 ppb); bis(2-ethylhexyl)phthalate (84 to 140 ppb); di-n-octyl-phthalate (78 to 110 ppb); fluorene (83 to 640 ppb); naphthalene (1,200 to 16,000 ppb), and

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phenanthrene (250 to 700 ppb).

Inorganics

Inorganic concentrations were low and no significantly elevated or anomalous values were present in the soil samples analyzed.

D. Ground Water

Ground water samples were collected as part of the Well Survey Investigation, the removal response action, and the RI. The Well Survey Investigation included sampling of on-site wells, six Borough of Emmaus Public supply wells, and several private wells. Two additional on-site wells were sampled during the GWTS response action. The RI included sampling of the existing on-site wells and 16 newly installed off-site wells.

On-Property and Adjacent Wells

Ten on-site wells (Wells 1 through 6 and MW-1 through MW-4) were sampled and analyzed for TCL VOCs, SVOCs, PCBs, and Metals and cyanide (total and dissolved) during the Well Survey Investigation. Two additional wells, RW-3 and Well 7, were sampled during the GWTS response action during the fall of 1994 and analyzed for TCL VOCs, SVOCs (Well 7 only), and metals and cyanide (total and dissolved). During the RI, nine previously installed wells (MW-1 through MW-3, RW-3, Well 1 through Well 4, and Well 6) were sampled and analyzed for TCL VOCs in January 1997 and TCL SVOCs and six Metals (arsenic, beryllium, copper, chromium, lead, and manganese) and cyanide (total and dissolved) in October 1996. On-site well MW-4 was not sampled during the RI due to its well-head configuration and low productivity. Summaries of the analytical results obtained during the investigations for VOCs, SVOCs, and metals/cyanide are presented below respectively. PCBs were not detected in any ground water samples collected from the on-site wells during the Well Survey Investigation.

VOCs

Several VOCs were detected in the ground water samples collected from the on-site wells during the Well Survey Investigation and the GWTS response action (Figure 9). Six primary VOCs were identified from the sampling results, including TCE, 1,2-DCE, vinyl chloride, PCE, 1,1-DCE, and 1,1,2-TCA. TCE was detected in all 12 on-site wells at concentrations ranging from 21 to 400,000 ppb. The VOC 1,2-DCE was detected in nine wells with concentrations ranging from 68 to 43,000 ppb. Vinyl chloride was detected in seven wells at concentrations ranging from 71 to 3,200 ppb. PCE was detected in several injection wells at concentrations ranging from 10 to 3,900 ppb. The VOCs 1,1-DCE and 1,1,2-TCA were detected less frequently at concentrations ranging up to 27 ppb and 350 ppb, respectively. Other VOCS detected in one or more wells at elevated levels include 2-butanone (13 ppb), acetone (2 to 37 ppb), benzene (13 ppb), ethylbenzene (9 to 540 ppb), toluene (1 to 530 ppb), and total xylenes (11 to 4,600 ppb).

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VOCs were detected in each of the samples collected from the nine on-site wells sampled during the RI. TCE was detected in all on-site wells at concentrations ranging from 20 to 570,000 ppb. Other VOCs detected in one or more of the well samples include total 1,2-DCE (190 to 23,000 ppb); vinyl chloride (680 to 1,300 ppb); PCE (4 to 5 ppb); chloromethane (2,900 ppb); toluene (15 to 220 ppb); ethylbenzene (21 ppb); and total xylenes (100 ppb).

SVOCs

Several SVOCs were detected in several on-site wells at concentrations up to 6,000 ppb during the Well Survey Investigation and the GWTS response action. Although the greatest number of SVOCs were found in Well 5 (shallow cistern), the concentrations of the SVOCs detected ranged from 1 to 84 ppb. Due to the shallow depth of the cistern (8 feet), the SVOCs are likely attributable to localized soil contamination. SVOCs were not found above quantification limits at wells MW-1 through MW-4.

SVOCs were detected in ground water samples collected from four of the previously installed monitoring wells during the RI. The following SVOCs were detected: naphthalene (17 to 66 ppb); 2-methylnaphthalene (5 ppb and 14 ppb); phenol (9 ppb and 16 ppb); 4-methylphenol (9 ppb and 58 ppb); 2,3,5-trichlorophenol (6 ppb and 8 ppb); pentachlorophenol (2 ppb and 5 ppb); phenanthrene (2 ppb); bis(2-ethylhexyl)phthalate (23 ppb); 2-methyl phenol (3 ppb); and 1,4-dichlorobenzene (1 ppb).

Inorganics

Samples were collected during the Well Survey Investigation and GWTS response action and analyzed for total and dissolved inorganics. Elevated total concentrations of beryllium, cadmium, lead, nickel, and cyanide were detected in some on-site wells. Total beryllium was detected in five well samples at concentrations ranging from 0.72 to 6 ppb. Total cadmium was detected in eight well samples at concentrations ranging from 2.6 to 35.8 ppb. Total lead was detected in several samples at concentrations ranging from 2.3 to 555 ppb. Total nickel was detected in several wells at concentrations ranging from 5.1 ppb to 115 ppb. Total cyanide was detected in several wells at concentrations ranging from 2.8 to 402 ppb.

During the RI, both total and dissolved ground water samples were analyzed for arsenic, beryllium, chromium, copper, iron, lead, manganese, and cyanide. Manganese was detected in samples from all nine previously installed wells for both total manganese (60.7 to 4,120 ppb) and dissolved manganese (14 to 3,100 ppb). Total iron was detected in samples from all nine wells (291 to 49,800 ppb), and dissolved iron was detected in samples from seven wells (120 to 21,300 ppb). Total chromium was detected in samples from eight wells (except Well 4) at concentrations ranging from 3.4 ppb to 129 ppb. Dissolved chromium was not detected in any of the samples collected. Total copper was detected in samples from six wells at concentrations ranging from 10.5 ppb to 238 ppb. Dissolved copper was not detected in any of the samples collected. Total lead was detected in samples from six wells at concentrations ranging from 2.8 ppb to 70.6 ppb. No dissolved lead data is available for any of the samples collected due to the

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rejection of these data during data validation. Total arsenic was detected in two samples (5.4 ppb and 5.7 ppb), and dissolved arsenic was detected in one sample (7.2 ppb). Total cyanide was detected in samples from three wells (10.3 to 62.2 ppb). Dissolved cyanide was detected in one sample (26.5 ppb).

Off-Property Upgradient/Sidegradient Wells

During the RI, seven off-Property upgradient/sidegradient monitoring wells (MW-6, MW-7S, MW-7D, MW-8S, MW-8D, MW-12S, and MW-12D) were installed (Figure 4). Samples were collected from the wells and analyzed for TCL VOCs.

Chloromethane and TCE were detected in one sample at 1 ppb and 0.9 ppb, respectively. Acetone was detected in one sample at a concentration of 6 ppb. No other VOCs were detected in any of the well samples.

Off-Property Downgradient Wells

During the RI, nine off-Property downgradient monitoring wells (MW-5S, MW-5D, MW-9S, MW-9D, MW-10S, MW-10I, MW-10D, MW-11S, and MW-11D) were installed (Figure 4). Samples were collected from the wells and analyzed for TCL VOCs.

Based on laboratory results, detected levels of VOCs were low in most samples, except notably MW-9D. TCE was detected in six wells, with concentrations ranging from 2 to 1,000 ppb (detected in MW-9D). Contaminants detected in MW-9D and not in any other downgradient well included 1,1-DCA (4 ppb), 1,1-DCE (3 ppb), and PCE (51 ppb). Acetone (5 to 100 ppb), carbon tetrachloride (2 to 130 ppb), chloroform (2 to 190 ppb), cis-1,2-DCE (2 to 38 ppb), and toluene (0.6 ppb) were also detected in a few of the wells.

Borough of Emmaus Public Supply Wells

During the Well Survey Investigation, six public supply wells (PSW-1 through PSW-4, PSW-6, and PSW-7) for the Borough of Emmaus were sampled and analyzed for VOCs, SVOCs, PCBs, and Metals. PCBs were not detected in any ground water samples collected from the Borough public supply wells. Results of the sampling are summarized below.

VOCs

Results of the sampling showed TCE in five Borough supply wells, with concentrations ranging from 4.4 ppb to 14 ppb. PCE was detected in two Borough supply wells at 1.4 ppb to 21 ppb. Other VOCs detected at levels less than 4 ppb included 1,1,1-TCA, carbon tetrachloride, cis-1,2-DCE, ethylbenzene, toluene, and total xylenes.

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SVOCs

The only SVOC detected in any of the ground water samples collected from the supply wells was bis(2-ethylhexyl)phthalate, which was detected at 4 ppb in sample PSW-4, however, this compound was also detected in the associated method blank.

Inorganics

The ground water data generated in connection with the Well Survey Investigation appears to have identified an area-wide issue with regard to sodium in ground water. Concentrations of both total and dissolved sodium were observed to range from 4,620 ppb to more than 18,000 ppb. Total barium was also detected in one sample at an elevated concentration of 23,100 ppb. However, a duplicate sample collected at the same time indicated that total barium was detected at a concentration of 27.9 ppb.

Off-Property Private Wells

Thirty-one private wells were sampled and analyzed for VOCs and Metals, and the results are summarized below.

VOCs

Only two VOCs were detected at elevated levels in two private wells. TCE was detected in PW-LM20 at a concentration of 5.2 ppb and PCE was detected in PW-SA08 at a concentration of 5.3 ppb.

Inorganics

The analytical results for total and dissolved metals and cyanide in private wells are summarized below.

Total antimony was detected at in several residential wells at concentrations ranging up to 21.8 ppb. Ground water samples of the residential wells analyzed for dissolved antimony revealed no detectable concentrations.

Thallium was detected in samples collected from some residential wells (both total and dissolved) at elevated levels at concentrations ranging up to 4 ppb of total thallium and 4.8 ppb of dissolved thallium.

Manganese (total and dissolved) was detected in a few samples at concentrations ranging up to 281 ppb and 269 ppb, respectively.

Total lead was detected in several samples at concentrations ranging up to 231 ppb. Dissolved lead was detected in samples at concentrations ranging up to 10.1 ppb.

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Total iron was detected in a few ground water samples at levels ranging up to 775 ppb.

E. Surface Water

Thirteen surface water samples (SW-1 through SW-3, SW-5 through SW-12, SW-15, and SW-16) were collected during the Well Survey Investigation and analyzed for VOCs and Metals. The samples were collected from the primary water courses in the study area at locations both upgradient, downgradient, and near the confluence of streams. A summary of the analytical results for VOCs and metals is provided below.

Results of the sampling showed VOCs, including carbon disulfide, cis-1,2-dichloroethene, benzene, TCE, toluene, and PCE, in three surface water samples at low concentrations (less than or equal to 1 ppb). Acetone was detected in one sample at a concentration of 10 ppb. TAL total and dissolved metals and cyanide in surface water samples indicted that no samples contained elevated metal concentrations.

F. Sediment

Fourteen stream sediment samples were collected during the Well Survey Investigation and analyzed for VOCs and Metals. The sediment samples were collected from the primary water courses in the study area at locations both upgradient, downgradient, and near the confluence of streams. A summary of the analytical results for VOCs and metals is provided below.

Results of the sampling indicated the presence of acetone, methylene chloride and 2-butanone in several samples at low concentrations, however, these compounds were also detected in the associated method blanks. Toluene was detected in a duplicate sample, SD-9, at 8 ppb. Results for metals and cyanide in stream sediment samples indicated low concentrations (0.76 ppm to 10.5 ppm) of arsenic in all samples. Chromium, lead, nickel, and zinc concentrations in one sample were high relative to the other sample results.

G. Springs

Four spring samples were collected during the Well Survey Investigation from four springs located in the vicinity of the Site. All the samples collected were analyzed for metals; only two samples were analyzed for VOCs. A summary of the analytical results for VOCs and metals is provided below.

Results of sample SP-03 found PCE and TCE at 8.7 ppb and 14 ppb, respectively. The VOCs 1,1,1-TCA, benzene, carbon tetrachloride, and cis-1,2-dichloroethene were detected in one spring at levels less than 1 ppb.

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H. DNAPL Investigation

An assessment of the presence of Dense Nonaqueous Phase Liquids (DNAPL) was conducted as part of the RI. DNAPLs, denser than water, are particularly difficult to locate and remove from the subsurface; their ability to sink through the water table and penetrate deeper portions of aquifers is one of the properties that makes them very difficult to remediate. See *Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration*, OSWER Directive 9234.2-25, 1993 (TI Guidance).

The evaluation was performed in accordance with the TI Guidance and EPA's *DNAPL Site Characterization* Fact Sheet (1994)(DNAPL Fact Sheet) and included consideration of historical Site use (i.e., industry type, historical process and waste disposal practices, potential for DNAPL-related chemical usage), and Site characterization data (including ground water and soil quality data, physical observations of DNAPL, geologic structure, hydrogeological information, and structural geology).

As part of the assessment, field screening for DNAPLs was conducted during the RI soil boring activity.

Results of the DNAPL evaluation indicate the presence of DNAPLs in the subsurface soil and aquifer at the Site, based on the following:

- Information regarding historical operations and waste disposal practices at the Site suggest the use and disposal of DNAPL-related chemicals (specifically, TCE) into several on-site bedrock wells.

- Observations made during a downhole video of Well 3 indicated an accumulation of dense black material at the bottom of the well.

- Concentration of DNAPL chemicals (e.g., TCE) in groundwater at greater than 1% of the single-component solubility is a strong indicator of the presence of DNAPLs. See DNAPL Fact Sheet. At the Site, dissolved TCE concentrations were observed up to 44.5% of TCE's single-component solubility in six wells including RW-3, Well 2, Well 3, Well 4, MW-4, and MW-1, indicating the presence of DNAPL in the immediate vicinity of these wells.

- Calculations of pore-water concentrations in soil samples obtained at the Site indicates the presence of DNAPL in the overburden soil in the immediate vicinity of on-site soil boring SB-7 (adjacent to Well 2).

- Information regarding the initial cleanup of selected disposal wells following their discovery by Square D included analytical data indicating the presence of materials containing high concentrations of TCE

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Based on the above factors it is likely that DNAPLs exist at the Site.

VII. SUMMARY OF SITE RISKS

Following the RI, analyses were conducted to estimate the human health and environmental hazards that could result if contamination at the Site is not cleaned up. These analyses are commonly referred to as risk assessments and identify existing and future risks that could occur if conditions at the Site do not change. The Baseline Human Health Risk Assessment(BLRA) evaluated human health risks and the Ecological Risk Assessment (ERA) evaluated environmental impacts from the Site.

A. Human Health Risks

The BLRA assesses the toxicity, or degree of hazard, posed by contaminants related to the Site, and involves describing the routes by which humans could come into contact with these substances. Separate calculations are made for those substances that can cause cancer (carcinogenic) and for those that can cause non-carcinogenic, but adverse, health effects.

The primary objective of the risk assessment conducted was to assess the health risks to individuals who may have current and future exposure to contamination present at and migrating from the Site under existing Site conditions. The risk assessment is comprised of the following components:

- Identification of Chemicals of Potential Concern (COPCs) - identify and characterize the distribution of COPCs found at or near the Site.
- Exposure Assessment- identify potential pathways of human exposure, and estimate the magnitude, frequency, and duration of these exposures.
- Toxicity Assessment- assess the potential adverse effects of the COPCs.
- Risk Characterization -characterize the potential health risks associated with exposure to Site-related contamination.

Each of these steps is explained further below:

1. Identification of COPCs

The identification of COPCs includes data collection, data evaluation, and data screening steps. The data collection and evaluation steps involve gathering and reviewing the available Site data and developing a set of data that is of acceptable quality for risk assessment. This data set is then further screened to determine those chemicals and media of potential concern. The data used for the quantitative risk analysis were all validated prior to use in the risk assessment.

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Soil

Soil data collected by Geo Environmental Consultants, Inc. between August and September 1994 and in March 1996 was used for the risk analysis. A total of 26 borings were completed in these two sampling activities. Samples were taken at different intervals from 0 to up to 92 feet below ground surface (bgs). Results from samples taken from 0 to 2 feet bgs were considered surface samples in the risk analysis. Samples from 2 feet bgs and below were considered subsurface samples. However, a risk analysis was conducted only for surface samples, 0 to 2 feet; and for subsurface samples taken up to 15 feet.

Ground water

Ground water sampling was conducted during the Well Survey Investigation and during the RI. The Well Survey Investigation ground water sampling included private wells, on-site disposal and monitoring wells, and six Borough of Emmaus Public Supply wells. The RI sampling included on-site disposal and monitoring wells, and the new monitoring wells installed beyond the Rodale Manufacturing property boundaries. The risk analysis included evaluation of the data collected during these two sampling events.

Springs

The data used in the risk analysis for springs was collected from four springs along the Little Lehigh Creek during the Well Survey Investigation.

Surface and Sediments

The risk analysis included the evaluation of the data collected during the Well Survey

Investigation for surface and sediment samples which were collected from the Little Lehigh Creek, Leibert Run, and the unnamed tributary.

Selection of Chemicals of Potential Concern

The COPC selection process was conservative, to ensure selection of the most constituents. Selection of COPCs was based on the criteria presented in EPA Region III guidelines. The maximum concentration of each detected constituent in each media was compared to the following Health-Based Screening Level (HBSL) criteria developed by EPA to select the COPCs. If the maximum concentration of a constituent exceeded each of the criteria, the constituent was selected as a COPC.

- Soil - April 1998 USEPA Region III Risk-Based Concentrations (RBCs) for residential and industrial exposure;
- Ground Water April 1998 USEPA Region III RBCs for residential tap water;

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- Surface Water - Ten times (10X) the April 1998 Region III residential tap water RBCs; and

- Sediment - 10X the April 1998 USEPA Region III residential soil ingestion RBCs.

The surface water and the sediment criteria are 10X higher because surface water and sediment exposure is expected to be at least ten times less than ground water and soil.

Chemicals of Potential Concern

Tables 2 through 12 identify the chemicals that were selected as COPCs for each media based on the above screening methodology.

In the ground water risk analyses, the wells sampled were divided into three categories: on-site monitoring wells; off-site potentially site-related wells, which include public and private supply wells, monitoring wells, and springs; and off-site non-Site related wells, which include public and private supply wells and monitoring wells. It is important to note that on-site wells, within the context of this categorization of wells, means wells on and adjacent to the Rodale Manufacturing Property. Off-site wells are wells located up, side and down gradient from the Rodale Manufacturing Property. The off-site potentially site-related wells were placed in this category because they were located within an arc downgradient of the Site such that constituents entering the ground water at the Site could potentially be transported to and be intercepted by each of these wells. The off-site potentially non-site related were located in this category because their location was either upgradient or sidegradient of the Site at a distance which is not considered to be within an area potentially impacted by the Site. Although potentially non-Site related, a risk analysis was also conducted for the off-site potentially non-site related wells. This approach was developed for the risk assessment based on current data available for the Site. However, due to the likely presence of DNAPLs at the Site, and since DNAPLs are not governed by flow direction, the breakdown of wells may need to be modified if further information collected in the future shows that contamination from the Site may be impacting any of the wells located in the potentially non-site related category. Table 13 includes the wells for each category.

The risk analysis for ground water samples collected in wells on the Rodale Manufacturing property boundaries includes only those constituents from the RI sampling that were present at concentrations greater than the HBSLs. PCOCs identified in the Well Survey Investigation sampling activity but either not detected or detected at concentrations less than HBSLs in the more recent RI sampling, were not included in the risk analysis but are considered PCOCs and will be included in future ground water sampling to ensure their continued absence or presence at concentrations less than HBSLs.

An evaluation of background concentrations of inorganic constituents in soil, ground water, surface water, and sediment was not included in the risk assessment. Therefore, some of

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the inorganics identified as PCOCs may not be Site-related.

A detailed evaluation of all chemicals exceeding risk screening criteria is presented in the BLRA which can be found in the Site Administrative Record.

2. Exposure Assessment

An exposure assessment involves three basic steps: 1) identifying the potentially exposed populations, both current and future; 2) determining the pathways by which these populations could be exposed; and 3) quantifying the exposure. Under current Site conditions, the BLRA identified potential populations as having the potential for exposure to Site-related contaminants either currently and/or in the future.

The Site land use is industrial and the area surrounding the Site includes residential as well as industrial and commercial facilities. The Site is located within an area which is currently zoned as Residential-High Density & Office with an adjacent area immediately south of Furnance Street zoned as Residential-Low Density. A light industrial facility is located across Sixth Street to the west of the Site and a railroad right-of-way border the Site immediately to the south, but most of the property within the neighborhood surrounding the Site is used for residential housing. Residential populations are present to the north and east of the Site.

The future land use for the Site and surrounding area is expected to be similar to the current land use. However, the Site could possibly be converted to a residential area in the future. Also, construction activities may take place at the Site.

Table 14 summarizes the exposure scenarios considered in the risk assessment.

3. Toxicity Assessment

The purpose of the toxicity assessment is to weigh available evidence regarding the potential for particular contaminants to cause adverse effects in exposed individuals. Where possible, the assessment provides a quantitative estimate of the relationship between the extent of exposure to a contaminant and the increased likelihood and/or severity of adverse effects.

A toxicity assessment for contaminants found at a Superfund site is generally accomplished in two steps: 1) hazard identification; and 2) dose-response assessment. Hazard identification is the process of determining whether exposure to an agent can cause an increase in the incidence of a particular adverse health effect (e.g., cancer or birth defects) and whether the adverse health effect is likely to occur in humans. It involves characterizing the nature and strength of the evidence of causation.

Dose-response evaluation is the process of quantitatively evaluating the toxicity information and characterizing the relationship between the dose of the contaminant administered or received and the incidence of adverse health effects in the administered population. From this

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quantitative dose-response relationship, toxicity values (e.g., reference doses and slope factors) are derived that can be used to estimate the incidence or potential for adverse effects as a function of human exposure to the agent. These toxicity values are used in the risk characterization step to estimate the likelihood of adverse effects occurring in humans at different exposure levels.

For the purpose of the risk assessment, contaminants were classified into two groups: potential carcinogens and noncarcinogens. The risks posed by these two types of compounds are assessed differently because noncarcinogens generally exhibit a threshold dose below which no adverse effects occur, while no such threshold can be proven to exist for carcinogens. As used here, the term carcinogen means any chemical for which there is sufficient evidence that exposure may result in continuing uncontrolled cell division (cancer) in humans and/or animals. Conversely, the term noncarcinogen means any chemical for which the carcinogenic evidence is negative or insufficient.

Slope factors have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic contaminants of concern. Slope factors, which are expressed in units of (mg/kg-day)-1 are multiplied by the estimated intake of a potential carcinogen, in ppm/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 slope factor. Use of this approach make underestimation of the actual cancer risk highly unlikely. Slope 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 to account for the use of animal data to predict effects on humans. Slope factors used in the BLRA are presented in Table 15.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to contaminants of concern exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of acceptable lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g. the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur. Reference doses used in the BLRA are presented in Table 16.

4. Risk Characterization

The risk characterization process integrates the toxicity and exposure assessments into a quantitative expression of risk. For carcinogens, the exposure point concentrations and exposure factors discussed earlier are mathematically combined to generate a chronic daily intake value that is averaged over a lifetime (i.e., 70 years). This intake value is then multiplied by the toxicity value for the contaminant (i.e., the slope factor) to generate the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the contaminant. The

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National Oil and Hazardous Substances Pollution Contingency Plan (NCP) established acceptable levels of carcinogenic risk for Superfund sites ranging from one excess cancer case per 10,000 people exposed to one excess cancer case per one million people exposed. This translates to a risk range of between one in 10,000 and one in one million additional cancer cases. Expressed as scientific notation, this risk range is between 1.0E-04 and 1.0E-06. Remedial action is warranted at a site when the calculated cancer risk level exceeds 1.0E-04. However, since EPA's clean up goal is generally to reduce the risk to 1.0E-06 or less, EPA also may take action where the risk is within the range between 1.0E-04 and 1.0E-06.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (i.e., the chronic daily intake) with the toxicity of the contaminant for a similar time period (i.e., the reference dose). The ratio of exposure to toxicity is called a hazard quotient. A Hazard Index (HI) is generated by adding the appropriate hazard quotients for contaminants to which a given population may reasonably be exposed. The NCP also states that sites should not pose a health threat due to a non-carcinogenic, but otherwise hazardous, chemical. If the HI exceeds one (1.0), there may be concern for the potential non-carcinogenic health effects associated with exposure to the chemicals. The HI identifies the potential for the most sensitive individuals to be adversely affected by the noncarcinogenic effects of chemicals. As a rule, the greater the value of the HI above 1.0, the greater the level of concern.

Table 20 summarizes the total risks for the Site by media. The detailed results of the risks for each well is in the BLRA which can be found in the Site Administrative Record.

B. Ecological Risk Assessment

The ecological risk assessment (ERA) was conducted to evaluate the potential threats to ecological receptors from exposure to Site contaminants. The following activities were conducted:

- Evaluation of potential for off-site migration of site-related PCOCs. This evaluation included surface water runoff from the Site, ground water flow direction, and potential ground water to surface water discharge areas.

- Description of the type and proximity of wetlands or other habitats found in and near the unnamed tributary, Liebert Run, and little Lehigh Creek.

- Analytical results for ground water, and for spring/seeps, surface water and sediments from Little Lehigh Creek used in the ecological risk assessment were from the sampling conducted during the Well Survey Investigation. The wells adjacent next to the Little Lehigh Creek were selected because Site ground water and spring/seep discharge to Little Lehigh Creek is the primary transport mechanism for Site ground water which could affect surface water quality.
- Analytical results for surface soil are from the sampling conducted by GEC during the time-critical investigation and the Remedial Investigation activities.

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- All the analytical results were screened against the EPA Region III ecologically-based screening levels (EBSLs).

The results of the ERA are the following:

- Several wetlands were identified in the areas proximal to the Liebert Run and Little Lehigh Creek, however, they have no potential for Site contamination impacts.

- A Site visit and a review of Pennsylvania Natural Diversity Inventory (PNDI) and U.S. Fish and Wildlife files showed that no documented species of threatened/endangered rare plant or animal species are located within a 2-mile radius of the Site, except for two plants: a lettuce saxifrage (Saxifraga micranthidifolia) and western hairy rockcress (Arabis hirsuta). However, these two plants are located upgradient of the Site and can not be affect by Site contamination. The possible presence of habitat for bog turtles was also investigated. The PNFI files noted an unverified observation of bog turtles near the unnamed tributary. However, the potential bog turtle habitat is also located upgradient of the Site.

- All VOCs detected in surface soil, ground water, springs/seeps, surface water, and sediment samples were below the EBSLs.

- Several inorganic constituents were detected above the EBSLs in surface soil, ground water, surface water, and sediments. Only two inorganic constituents were detected in spring/seeps samples.

- Surface soil samples showed levels of some inorganics above EBSLs, however, the presence of 6 to 24 inches of gravel mitigates direct exposure of any wildlife scavenging on the surface for food.

- Only one detection of aluminum was detected in a spring in the south bank of Little Lehigh Creek. Lead was detected in a spring on the north bank of Little Lehigh Creek, however, the north bank does not receive ground water flow from the Site.

- Although some inorganic constituents were detected in surface water and sediment samples above the EBSLs, some of these inorganics were detected in both upstream and downstream samples.

- Inorganic constituents detected in ground water samples showed certain detections above the EBSLs, however, only about one half of these detections were for dissolved concentrations, which is recognized as the fraction that may be bioavailable and transportable.

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RECOMMENDATIONS

Some inorganics were detected above the EBSLs in some surface water and sediment samples collected in Little Lehigh Creek, and in some ground water samples collected from wells near Little Lehigh Creek, however, these contaminants can not be attributed to the Site based on available data. Although Little Lehigh Creek serves as a discharge for ground water in the area, it is 1.5 miles down gradient from the Site and there are other industries or factors between the Site and the creek which may be contributing to the levels of inorganics detected in those samples. Additional monitoring will be needed to determine whether these inorganics are Site-related.

VIII. DESCRIPTION OF REMEDIAL ALTERNATIVES CONSIDERED FOR THE SITE

In accordance with Section 300.430(e)(9) of the National Oil and Hazardous Substances Contingency Plan (NCP), 40 C.F.R. § 300.430 (e)(9), remedial response actions were identified and screened for effectiveness, implementability and cost during the Feasibility Study to meet remedial action objectives at the Site. The technologies that passed the screening were developed into remedial alternatives. EPA assessed these alternatives against the nine criteria specified in the NCP at 40 C.F.R. Section 300.430(e)(9)(iii). In addition, EPA evaluated the No Action Alternative as required by the NCP. These alternatives are presented and discussed below. All projected costs provided for the alternatives below are estimates.

A. Dense Nonaqueous Phase Liquids (DNAPL) - Effect on Remedy Evaluation and Selection

The following information is relevant to all of the remedial alternatives evaluated:

As indicated in Section VI, data collected during the RI revealed concentrations of TCEdetected in ground water samples from six wells that are indicative of the presence of DNAPLs.[2] The distribution of the wells that meet or exceed the standard indicates the extent of the "Probable DNAPL Zone".

DNAPLs tend to adhere to soil and aquifer material and are very difficult to remove. DNAPL remedial technologies currently are limited, and none are able to recover all trapped DNAPL (TI Guidance). The presence of DNAPLs poses a long-term source of contaminants to soil and groundwater. Most DNAPLs persist for long periods while slowly releasing soluble

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[2] Chemical concentrations that exceed 1 percent of the chemical's single component solubility are an indication of the presence of DNAPLs. Concentrations of TCE in ground water samples collected from six wells at the Site revealed concentrations of up to 45% of TCE's single component solubility. Figure 1 shows the locations of the wells indicating the likelihood of proximal DNAPLs.

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organic constituents to ground water through dissolution. Even with a moderate release, dissolution may continue for hundreds of years or longer under natural conditions before all the DNAPL is dissipated and concentrations of soluble organics in ground water return to background levels. The presence of DNAPLs generally does not allow the restoration of the groundwater to cleanup standards.

Similarly, the presence of DNAPLs in subsurface soils makes remediation of the contaminated soils in the Probable DNAPL Zone impracticable. Where DNAPLs remain in the groundwater, they will continue to act as a source of contamination to the groundwater for the foreseeable future. Therefore, any remedial action that requires removal of the DNAPLs in the subsurface soils in the Probable DNAPL Zone would have a negligible beneficial effect on the groundwater, since the groundwater would remain subject to the source contamination caused by the DNAPLs.

B. Waiver of Specific Arars on Technical Impracticability Grounds ("Ti Waiver")

In this section, EPA, by signature on this ROD, is issuing a waiver of certain ARARs on the basis of technical impracticability.

Generally, a remedy must meet applicable or relevant and appropriate standards, requirements, criteria, and limitations (collectively referred to as "ARARs")[3] or provide grounds for invoking a waiver under the NCP at 40 C.F.R. Section 300.430(f)(1)(ii)(C) and CERCLA, Section 121(d)(4), 42 U.S.C. § 9621(d)(4). Under CERCLA Section 121(d), remedial actions must attain ARARs under federal environmental laws and promulgated State environmental or facility siting laws, unless such ARARs are waived pursuant to Section 121(d)(4) of CERCLA (For a detailed discussion of ARARs applicable to remediation of the Site, please see Section IX.)

ARARs may be waived by EPA for any of the six reasons specified by CERCLA Section 121(d)(4) and the National Contingency Plan. One of the bases for an ARAR waiver is technical impracticability from an engineering perspective.

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[3] Applicable requirements are those substantive environmental standards, requirements, criteria, or limitations promulgated under Federal or State law that are legally applicable to the remedial action to be completed at the Site. A "legally applicable" requirement is one which would legally apply to the response action if that action were not taken pursuant to Sections 104, 106, or 122 of CERCLA. Relevant and appropriate requirements are those substantive environmental protection standards, requirements, criteria, or limitations promulgated under Federal or State law which, while not being legally applicable to the remedial action, do pertain to problems or situations sufficiently similar to those encountered at the Site that their use is well suited to the Site. ARARs may relate to the substances addressed by the remedial action, to the location of the Site, or to the manner in which the remedial action is implemented.

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After the RI indicated the likely presence of DNAPLs at the Site, Square D Company submitted to EPA a Technical Impracticability Evaluation Report (August 1999), which evaluated the practicability of restoring the groundwater in the Probable DNAPL Zone to its beneficial use within a reasonable time frame given the conditions of the Site. This Report is in the Administrative Record for the Site. EPA's TI Guidance requires that the following components be incorporated into a TI Evaluation document:

(1) The specific ARARs for which TI determinations are sought.

(2) Spatial area over which the TI decision will apply.

(3) Conceptual model that describes site geology, hydrology, groundwater contamination sources, transport and fate.

(4) An evaluation of the restoration potential of the site, including data and analyses that support any assertion that attainment of ARARs is technically impracticable from an engineering perspective.

The TI Evaluation Report incorporates all of these components. In addition, the TI Evaluation describes Site geology, hydrology, ground water contamination sources, transport, and fate, and evaluates the restoration potential of the Site. The TI Evaluation Report identifies the DNAPL sources, and demonstrates that no other remedial technologies could attain the cleanup levels at the Site for TCE within a reasonable time frame.

EPA has determined that the TI Evaluation fully and adequately identifies and evaluates existing on-site conditions that support the issuance of a TI waiver, pursuant to the TI Guidance. The TI Evaluation Report demonstrates the need for a waiver of ARARs because it is technically impracticable from an engineering perspective to meet TCE groundwater and subsurface soils ARARs in the Probable DNAPL Zone. Complete restoration of these areas is unlikely, because currently known remedial technologies cannot eliminate the DNAPLs. Hence, it is appropriate to waive the following ARARs by signature of this ROD:

(1) the MCL for TCE in the Probable DNAPL Zone depicted on Figure 1.

(2) the soil standards established pursuant to Pennsylvania Act 2, Section 303 (25 PA Code § 250.305(b) and Appendix A, Table 3b) for TCE and perchloroethene for subsurface soil below 15 feet. Soil contamination exceeding cleanup standards is present in a small area directly above or close to the aquifer within the Probable DNAPL Zone. Since the concentration of contaminants in ground water below these soils is very high (due to the presence of DNAPLs), contamination contribution from soils into the ground water is not significant. Further, since DNAPLs will remain in the groundwater in the Probable DNAPL Zone for the foreseeable future, any remedial actions addressing subsurface soil would have a negligible benefit of protecting the DNAPL-contaminated ground water.

These waivers are collectively referred to as the "TI Waiver".

C. Descriptions of the Alternatives

Below are the description of the remedial alternatives evaluated

Alternative 1: **No Action.**

Capital Cost:	$	0
Operation and Maintenance	$	0
Total Cost:	$	0

The no action alternative is required by the National Contingency Plan, 40 C.F.R. Part 300, as a baseline alternative against which other alternatives can be compared. Under this alternative, no control or remediation would occur. A review of Site conditions would be required every five years, since under this alternative, waste would be left in place.

Alternative 2: **Natural Attenuation with a Technical Impracticability Waiver in the Probable DNAPL Zone**

Capital Cost:		$ 30,000
Operation and Maintenance - estimated annual cost:		$ 90,000
Present Worth of O&M (30 years, 5%) -	$1,383,525	
Total Cost:	$1,410,000	

This alternative includes natural attenuation for the dissolved phase ground water contamination and the issuance of a TI Waiver for the groundwater and subsurface soils ARARs in the Probable DNAPL Zone. Natural attenuation relies on natural processes to decontaminate contaminated ground water. These processes include dilution, biodegradation, volatilization, adsorption, and chemical reactions with subsurface materials. During natural attenuation, monitoring of the contaminants of concern in the monitoring wells is conducted to determine if natural attenuation is decreasing the concentrations of the contaminants at an acceptable rate, while providing sufficient protection to human health and the environment. Specifically, ground water samples are collected and analyzed for biological and chemical indicators to confirm that contaminant biodegradation is reducing contaminant mass, mobility, and risk at an acceptable rate.

Data collected during the RI showed that natural attenuation activities are occurring at the Site, however, a natural attenuation demonstration needs to be conducted to evaluate current available data and to determine any additional data that needs to be collected. Based on this, EPA will determine if natural attenuation will reduce the levels of contamination at the Site at an acceptable rate.

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Alternative 3: **Ground Water Extraction with Conventional Treatment with a Technical Impracticability Waiver in the Probable DNAPL Zone.**

Capital Cost:		$	90,000
Operation and Maintenance - annual estimated cost		$	225,000
Present Worth of O&M (30 years, 5%)	$ 4,150,575		
Total Cost:	$ 4,240,000		

This alternative includes extraction and treatment of the dissolved phase ground water contamination and the issuance of the TI Waiver for the groundwater and subsurface soils ARARs in the Probable DNAPL Zone. This alternative would involve extracting ground water from a series of extraction wells, treating the extracted ground water using conventional treatment processes and discharging the treated ground water to surface water. The GWTS is currently operating on-site since it was constructed as part of the removal response action. This alternative assumes that the existing ground-water extraction and treatment system would continue to be operated.

The GWTS uses conventional treatment processes including: flow equalization; liquid/solid separation; sludge handling; air stripping; liquid phase granular activated carbon adsorption; and a vapor phase regenerative off-gas treatment unit. The ground-water treatment system has been in operation since August 1996 and, based on operational data, effectively treats ground water to meet current PADEP discharge limitations.

The GWTS was designed and installed to extract ground water from four monitoring wells. One of the wells proved marginally effective (flow rate of less than 1 gallon per minute) and ground water extraction from that well was eliminated. Because of the discontinued use of one of the wells and the highly fractured and heterogenous nature of the bedrock, the current ground water extraction system may not be providing complete hydraulic containment of the highest levels of the dissolved phase VOC plume. Therefore, further investigation needs to be conducted to determine the number of additional wells that may need to be installed to contain contamination from the Probable DNAPL Zone.

Preferred Alternative:

EPA's preferred alternative for remediating the dissolved ground water contamination is a combination of Alternatives 2 and 3:

- Containment by extraction of ground water with conventional treatment in the Probable DNAPL Zone.
- Monitored natural attenuation of contaminants which have migrated beyond the Probable DNAPL Zone.

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- . TI Waiver for ground water and subsurface soils in the Probable DNAPL Zone.

The GWTS will provide hydraulic containment of the dissolved phase VOC plume in the immediate vicinity of the Probable DNAPL Zone. Natural attenuation will remediate the ground water dissolved plume beyond the Probable DNAPL Zone. Together, these two aspects of the remedy will be used to achieve the cleanup levels listed in Table 1.

IX. COMPARATIVE EVALUATION OF ALTERNATIVES

The alternatives discussed above were compared on the basis of the nine criteria set forth in the NCP at 40 C.F.R. Section 300.430(e)(9)(iii) in order to select a remedy for the Site. These nine criteria are categorized according to three groups: threshold criteria; primary balancing criteria: and modifying criteria. These evaluation criteria relate directly to the requirements in Section 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 among remedies. State and community acceptance are modifying criteria formally taken into account after public comment is received on the Proposed Plan. A summary of each of the criteria is presented below, followed by a summary of the relative performance of the alternatives with respect to each of the nine criteria. These summaries provide the basis for determining which alternative provides the "best balance" of trade-offs with respect to the nine criteria.

Overall Protection of Human Health and the Environment

CERCLA requires 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 within the established risk range posed by each exposure pathway to the contamination.

Compliance With ARARs

This criterion addresses whether a remedy will meet applicable or relevant and appropriate standards, requirements, criteria and limitations (collectively referred to as "ARARs") or provide grounds for invoking a waiver under CERCLA Section 121(d)(4), 42 U.S.C. § 9621(d)(4), and the NCP at 40 C.F.R. § 300.430(f)(1)(ii)(C). Applicable requirements are those substantive environmental standards, requirements, criteria, or limitations promulgated under Federal or State law that are legally applicable to the remedial action to be completed at the Site. A "legally applicable" requirement is one which would legally apply to the response action if that action were not taken pursuant to Sections 104, 106, or 122 of CERCLA. Relevant and appropriate requirements are those substantive environmental protection standards, requirements, criteria, or limitations promulgated under Federal or State law which, while not being legally applicable to the remedial action, do pertain to problems or situations sufficiently similar to those encountered at a specific site that their use is well suited to the site. ARARs may relate to the

substances addressed by the remedial action, to the location of the site, or to the manner in which the remedial action is implemented.

In addition, Section 121(d)(2)(A) of CERCLA requires a level of cleanup "which at least attains Maximum Contaminant Level Goals (MCLG) established under the Safe Drinking Water Act (42 U.S.C. § 300f et seq.) and Water Quality Criteria (WQC) established under section 304 or 303 of the Clean Water Act (33 U.S.C. § 1314 or 1313), where such goals or criteria are relevant and appropriate under the circumstances of the release...." 42 U.S.C. § 121(d)(2)(A). The NCP expands upon this provision of CERCLA, specifying that at Superfund sites whose ground or surface waters are current or potential sources of drinking waters, all non-zero MCLGs must be met to the extent they are relevant and appropriate; and that to the extent a non-zero MCLG is not relevant and appropriate for a given contaminant, the MCL for that contaminant must be met in the surface and ground water to the extent relevant and appropriate. The NCP also provides that where an MCLG for a contaminant has been set at a level of zero, the MCL promulgated for the contaminant under the SDWA must be attained by remedial actions for ground or surface waters that are current or potential sources of drinking water, where the MCL is relevant and appropriate under the circumstances of the release.

As indicated above, EPA has reviewed a Technical Impracticability Evaluation Report for the Site which documents the likely presence of DNAPLs at the Site, and has determined that it is impracticable to remediate the ground water to its beneficial use for TCE within the designated Probable DNAPL Zone depicted on Figure 1.

By signature on this Record of Decision, EPA therefore approves the TI Waiver detailed in Section VIII.B. for the Probable DNAPL Zone. Aside from the TI Waiver, all other components of the remedy selected for the remediation of the Site must meet ARARs.

A. Identification of ARARs

Based on the requirements of CERCLA, the NCP, the Pennsylvania's remediation standards, the potential chemical-specific "relevant and appropriate" requirements are:

(1) the MCLs promulgated under the Safe Drinking Water Act ("SDWA"), 42 U.S.C. §§ 300f-300j-26, at 40 CFR §§ 141.11-.12 and 141.61-.62;

(2) non-zero MCLGs, promulgated under the SDWA, § 300g-l, at 40 CFR §§ 141.5-.51 and any more stringent requirements of the Pennsylvania Safe Drinking Water Act, 35 P.S. §§ 721 et seq., and set forth at 25 Pa. Code §§ 109.202-.203; and/or

(3) Pennsylvania's statewide standards promulgated under Section 303 (a) and (b) of Act 2, P.S. § 6026.303(a), and set forth at 25 Pa. Code § 250.301(a) and Appendix A, Table 1 Medium-Specific Concentrations for Organic Regulated Substances in Groundwater, Used Aquifers, TDS$\leq$ 2500) and Table 2 (Medium-

Specific concentrations for Inorganic Regulated Substance in Groundwater, Used Aquifers, TDS≤ 2500 and Secondary Contaminants).

(4) All other requirements cited on Table 18 .

The selected ground water cleanup standards were derived in accordance with the above discussed requirements, including the requirement that remedial actions "at least" attain ARARs (including MCLs and non-zero MCLGs) and be protective of human health and the environment. As reflected in the selected ground water cleanup standards (Table 1), the cleanup standard for a number of the COCs was based on a risk-based concentration which has been determined specifically for this Site. Consistent with CERCLA and the NCP, RBCs were used when ARARs were not sufficiently protective because of the presence of multiple contaminants and exposure pathways.

Long Term Effectiveness/Permanence

This evaluation criterion addresses the long-term protection of human health and the environment after remedial action cleanup goals have been achieved, and focuses on residual risks that will remain after completion of the remedial action.

Reduction of Contaminant Toxicity, Mobility, and Volume Through Treatment

This evaluation criterion addresses the degree to which a technology or remedial alternative reduces the toxicity, mobility, or volume of a hazardous substance. Section 121(b) of CERCLA, 42 U.S.C. § 9621(b), establishes a preference for remedial actions that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances. A combination of treatment and engineering controls may be used, as appropriate, to achieve protection of human health and the environment, as set forth in the NCP at 40 C.F.R. Section 300.430(a)(iii). Treatment should be utilized to address the principal threats (such as liquids, high concentrations of toxic compounds, and highly mobile materials) presented by a Site, and engineering controls such as containment will be considered for wastes that pose a relatively low, long term threat or where treatment is impracticable. *See* 40 C.F.R. § 300.430(a)(iii).

Short-term Effectiveness

This evaluation criterion addresses the period of time needed to achieve protection of human health and the environment, and any adverse impacts that may be posed by construction and implementation of a remedy.

Implementability

This evaluation criterion addresses the technical and administrative feasibility of each remedy, including the availability of materials and services needed to implement the chosen remedy.

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Cost

The cost of each of the alternatives is evaluated, and compared to the no action alternative.

State Acceptance

The EPA, as lead agency for this Site, selects the remedy in consultation with the State. EPA has provided the information on which this Record of Decision is based to the Pennsylvania Department of Environmental Protection (PADEP), and has had discussions on this matter with PADEP representatives.

Community Acceptance

The comments and concerns expressed by the public during the public meeting and during the comment period are considered. This criterion includes a determination of which components of the alternatives interested persons in the community support, have reservations about, or oppose based on public comments.

A summary of the relative performance of the Alternatives with respect to each of the nine criteria follows:

Overall Protection of Human Health and the Environment

Alternative 1 does not provide exposure control for the human exposure to contaminated subsurface soils and ground water. Under Alternative 2, natural processes would continue to mineralize constituents but the time frame to restore the area outside the Probable DNAPL Zone can not be predicted due to the continued discharge of contaminants from the Site due to the presence of DNAPLs. Site land and ground water use restrictions would be required to provide exposure control for Alternatives 2 and 3. Alternative 3 ranks higher in terms of overall protection of human health and the environment because it includes treatment of the areas with the highest levels of contamination. It would result in restoring the area outside the Probable DNAPL Zone to beneficial use more quickly than would Alternative 2. However, the GWTS alone will not address the portion outside the hydraulic containment area.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

As indicated above, EPA approved a Technical Impracticability(TI) Evaluation Report for the Site which documents the likely presence of DNAPLs at the Site, and based on information in the TI report, EPA has determined that it is impracticable to remediate the ground water to its beneficial use for TCE within the designated Probable DNAPL Zone as depicted on Figure 1.

By signature on this ROD, EPA is therefore approving the TI Waiver for the Probable DNAPL Zone. Aside from the TI Waiver, all other components of the remedy selected for the remediation of the Site must meet ARARs.

Alternatives 1 and 2 would not achieve the ARARs throughout the plume because of the continued discharge of contaminants from the DNAPL zone. Under Alternative 3, the GWTS will contain the levels of contamination emanating from the Probable DNAPL Zone and prevent this contamination from continuing to spread to the dissolved phase ground water area. However, the current GWTS does not capture the contaminated ground water in the entire plume. Therefore, alternative 3 will not meet the ARARs beyond the GWTS hydraulic containment area. Alternative 3 would also require that the surface water discharge of the treated ground water meet ARARs for such a discharge.

Long-Term Effectiveness and Permanence

Alternative 1 will not be effective and permanent since it does not include any action. Alternative 2 would be effective and permanent once the natural processes reduce the levels of contamination in the ground water, which will take many years, and provided the institutional controls are enforced. Data collected during the remedial investigation indicated that some natural attenuation processes are occurring. However, since DNAPLs exist at the Site, natural attenuation alone will not be effective in restoring the ground water in the entire plume to its beneficial use in a reasonable time frame. Alternative 3 controls the continued down gradient migration of contaminants in the aquifer, and is therefore considered a more effective remedy. However, Alternative 3 alone would not address contamination outside the hydraulic containment area. Alternative 3 like alternative 2, rely on enforcement of the institutional controls to be effective.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 1 and 2 will not reduce the toxicity, mobility and volume through treatment. Therefore, alternatives 1 and 2 will not meet the statutory preference for treatment. Natural attenuation will reduce the toxicity, mobility and volume, but it will take many years. Alternative 3 does use treatment to reduce toxicity, mobility and volume of contaminants. Although a component of these alternatives is a technical impracticability waiver for TCE in the Probable DNAPL Zone, there is a reduction of contaminant mobility and volume through pumping and treating the highest levels of contamination and, therefore, this alternative rank highest in terms of this factor.

Short-Term Effectiveness

For Alternatives 1 and 2, the exposure levels will gradually decrease over time, which could take many years. For alternative 3, the exposure to contaminated ground water will be reduced more quickly since most of the contaminated ground water at and near the Probable DNAPL Zone will be contained with the existing GWTS.

Implementability

Alternative 1 requires no action to implement. Alternative 2 would be easy to implement,

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since it involves only installation of additional monitoring wells, conducting standard sampling procedures, and implementing land and ground water use restrictions. Alternative 3 is also easy to implement because the GWTS is already in place. Only minor modifications will be needed such as the installation of additional extraction and monitoring wells will need to be installed. Land use restrictions to restrict the future usage of the Site and use of Site ground water will need to be implemented as part of alternative 3 as well.

Cost

The alternatives range from $0 for the no action Alternative 1 to $4,240,000 for Alternative 3. This cost assumes that at least one additional extraction well and one additional monitoring well will be installed as part of alternative 3. The cost for alternative 3 would be slightly higher if it is determined during the remedial design that more monitoring and extraction wells need to be installed. However, the cost is not expected to be significantly higher.

State Acceptance

The Commonwealth of Pennsylvania has had the opportunity to review and comment on all the documents in the Administrative Record and has participated in selecting the remedy for this Site. The Commonwealth has had the opportunity to comment on the draft ROD and, has verbally concurred on the ROD.

Community Acceptance

A public meeting on the Proposed Plan was held on June 23, 1999 at the Emmaus Public Library. Oral comments were received during the meeting. No written comments were received. No comments were made in opposition to the preferred alternative at the public meeting. See Part III of the ROD document (Responsiveness Summary) for a summary of the oral comments received during the public meeting.

X. SELECTED REMEDY AND PERFORMANCE STANDARDS

Based upon considerations of the requirements of CERCLA and the detailed analysis of the alternatives using the nine criteria, EPA has determined the most appropriate remedy for the Site is a combination of Alternatives 2 and 3. The remedy will specifically include the following components:

1. Hydraulic containment of the dissolved phase VOC plume in the Probable DNAPL Zone. This involves extraction of ground water with conventional treatment using the existing ground water treatment system (GWTS) at the Site. The GWTS includes the following components: an equalization tank, a liquid/solid separation unit and sludge handling equipment, an air stripper, liquid phase granular activated carbon units, and a regenerative vapor phase adsorber unit. The GWTS system will provide hydraulic containment of the dissolved phase VOC plume in the Probable DNAPL Zone. The extraction and treatment

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of the dissolved phase plume will continue until the cleanup standards listed on Table 1 are met. Full implementation of the hydraulic containment may require installation and operation of additional wells and/or equipment, to supplement the GWTS.

2. Decontamination of ground water through Monitored Natural Attenuation (MNA) outside the ground water extraction system capture zone until the cleanup standards in Table 1 are met. Natural attenuation relies on natural processes to decontaminate contaminated ground water. These processes include dilution, biodegradation, volatilization, adsorption, and chemical reactions with subsurface materials. During natural attenuation, monitoring of the contaminants of concern in the monitoring wells is conducted to determine if natural attenuation is decreasing the concentrations of the contaminants at an acceptable rate, while providing sufficient protection to human health and the environment. Specifically, ground water samples are collected and analyzed for biological and chemical indicators to confirm that contaminant biodegradation is reducing contaminant mass, mobility, and risk at an acceptable rate. Natural attenuation will remediate the ground water dissolved plume beyond the GWTS capture zone to cleanup standards in Table 1. Results of the monitoring will be used to determine if natural attenuation is decreasing the concentrations of the contaminants at an acceptable rate, while providing sufficient protection to human health and the environment. The evaluation of the monitoring will be conducted during the 5-year review of the remedy conducted by EPA. If it is demonstrated that natural attenuation can not remediate this portion of the plume, the GWTS will be expanded to remediate it.

3. The TI Waiver in the Probable DNAPL Zone, as set forth in Section VIII of this ROD.

4. Institutional controls, in the form of land use restrictions in the Property boundaries to prevent or reduce exposure to contaminated soils, and ground water use restrictions throughout the entire Site to prevent or reduce exposure to contaminated ground water.

Detailed requirements and further performance standards associated with the selected remedy are presented below.

A. General

1. A background analysis shall be conducted during the remedial design phase to determine if any of the inorganic contaminants of concern are background or site-related.

2. Five year statutory reviews under Section 121(c) of CERCLA will be required, as long as hazardous substances remain on the Site and prevent unlimited use and unrestricted access to the Site. Five year reviews shall be conducted at the initiation of the remedial action in accordance with applicable EPA guidance.

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B. Ground Water Extraction System

1. The ground water contamination associated with and in the vicinity of the Probable DNAPL Zone as outlined in Figure 1 shall be contained through extraction and treatment. The GWTS shall be used for this purpose, but since the GWTS may not be capturing all of the contamination migrating from the Probable DNAPL Zone, additional extraction wells will be required to be designed and installed to prevent the continued migration of the contamination from this zone. The exact number and location of extraction wells shall be subject to approval by EPA during the remedial design phase.

2. The treated ground water effluent shall be discharged to the unnamed tributary to Liebert Creek and shall meet the discharge requirement limits. These discharge requirements limits are listed on Table 17. This list shall also include other inorganic contaminants of concern if EPA later concludes that they should be added to the list.

3. Management of waste from operation of the GWTS shall comply with the requirements of: 25 Pa. Code Chapter 262 Subparts A (relating to hazardous waste determination and identification numbers); B (relating to manifesting requirements for off-site shipments of hazardous wastes); and C (relating to pretransport requirements); 25 Pa. Code Chapter 263 (relating to transporters of hazardous wastes); and with respect to the operations at the Site generally, with the substantive requirements of 25 Pa. Code Chapter 264, Subparts B-D, I (in the event that hazardous waste generated as part of the remedy is managed in containers); 25 Pa. Code Chapter 264, Subpart J (in the event that hazardous waste is managed, treated or stored in tanks); and 40 C.F.R. 268 Subpart C, Section 268.30, and Subpart E (regarding prohibitions on land disposal and prohibitions on storage of hazardous waste).

4. The existing Operations and Maintenance Manual(O&M) dated October 31, 1996 for the GWTS shall be used. However, any modifications made during the remedial design phase, such as the addition of extraction wells, shall be incorporated in the O&M plan. Any modifications shall be subject to approval by EPA.

5. A long-term ground water monitoring program, as well as analyses of flow and contaminant levels, shall be implemented to evaluate the effectiveness of the GWTS. The installation of additional monitoring wells will be required. Numbers and locations of these monitoring wells may be subject to change, with EPA approval, during the remedial design. The installation of the monitoring wells to evaluate the effectiveness of the GWTS shall be coordinated with the installation of monitoring wells to be installed as part of the MNA demonstration and implementation. Installation of additional wells may be necessary and must be in accordance with 25 Pa. Code Chapter 107. These regulations are established pursuant to the Water Well Drillers License Act, 32 P.S. § 645.1 et seq.

7. If the MNA demonstration shows that natural attenuation will not reduce the levels of contaminants in the portion of the plume beyond the Probable DNAPL Zone to the

cleanup standards in Table 1, the GWTS shall be expanded to cleanup the ground water in this area.

C. Monitored Natural Attenuation

1. A MNA demonstration shall be provided to EPA to determine whether MNA is effective in remediating the plume which has migrated beyond the Probable DNAPL Zone to cleanup standards in Table 1 in a reasonable time frame.

2. Monitoring shall be conducted until the cleanup standards for all the contaminants of concern in Table 1 are achieved. The necessary monitoring shall be determined during remedial design phase and shall be provided in a Natural Attenuation Monitoring Plan approved by EPA. A sufficient number of wells shall be installed as part of the MNA. The number, location of wells, and monitoring parameters necessary to verify the performance of the remedial action will be subject to approval by EPA. Installation of additional wells will be necessary and must be in accordance with 25 Pa. Code Chapter 107. These regulations are established pursuant to the Water Well Drillers License Act, 32 P.S. § 645.1 et seq.

3. Monitoring shall continue until such time as EPA determines that the performance standard for each contaminant of concern has been achieved.

D. Institutional Controls

1. Throughout the course of the cleanup, all persons conducting the cleanup shall refrain from using the Property in any manner that would interfere with or adversely affect the integrity or protectiveness of the remedial measures.

2. The Site shall not be used:

   (a) in any manner that would interfere with or adversely affect the integrity or protectiveness of the remedial measures;

   (b) in any way as to implement newly commenced or expanded groundwater pumping in the aquifer, not identified in this ROD, which will adversely affect the plume migration;

3. Human consumption of contaminated groundwater shall be prevented (drinking water supply wells shall not be installed in the area of the contaminated plume at and/or emanating from the Site).

4. Any new development at or near the Site that will adversely affect the hydraulic containment and plume migration shall be prohibited.

5. The Site shall be identified as property underlain by contaminated ground water.

6. Easements, restrictive covenants, and/or local governmental controls, along with other appropriate means as determined by EPA, shall be used to implement the requirements above.

XI. STATUTORY DETERMINATIONS

The following sections discuss how the selected remedy for the Rodale Manufacturing Site meets these statutory requirements.

A. Overall Protection of Human Health and the Environment

Based on the Baseline Human Health Risk Assessment for the Site, measures should be considered to reduce potential risk from contaminants in ground water. This media and contaminants were selected because potential health hazards for some exposure scenarios exceeded the EPA target range of 1.0E-04 (or 1 in 10, 000) and 1.0E-06 91 in 1,000,000) for lifetime cancer risk or a non-cancer hazard of one (1). The results of the Ecological Risk Assessment does not show the potential for risk to ecological receptors.

The selected remedy protects human health and the environment by containing ground water contamination associated with the Probable DNAPL Zone through extraction and treatment using the existing GWTS. In addition to the GWTS, Monitored Natural Attenuation will remediate the plume which has migrated beyond the Probable DNAPL Zone to cleanup standards in Table 1. Also, institutional controls to prevent the future usage of the Site and the use of ground water, will be employed to provide exposure control.

Implementation of the selected remedy will not pose any unacceptable short term risks or cross media impacts to the Site, or the community.

B. Compliance with and Attainment of Applicable or Relevant and appropriate Requirements ("ARARs")

The selected remedy will comply with all applicable or relevant and appropriate chemical specific, location-specific and action-specific ARARs to the extent discussed in Section IX of this ROD, and summarized in Table 18.

C. Cost Effectiveness

The selected remedy is cost-effective in providing overall protection in proportion to cost and meets all other requirements of CERCLA. Section 300.430(f)(ii)(D) of the NCP requires EPA to evaluate cost-effectiveness by comparing all the alternatives which meet the threshold criteria - protection of human health and the environment and compliance with ARARs - against three additional balancing criteria: long-term effectiveness and permanence; reduction of toxicity,

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mobility or volume through treatment; and short-term effectiveness. The selected remedy meets these criteria and provides for overall effectiveness in proportion to its cost.

The cost estimated present worth cost for the selected remedy presented in this ROD is $4,240,000.

D. Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized while providing the best balance among the other evaluation criteria. Of those alternatives evaluated that are protective of human health and the environment and meet ARARs, the selected remedy provides the best balance of tradeoffs in terms of long-term and short-term effectiveness and permanence, cost effectiveness, implementability, reduction in toxicity, mobility, or volume through treatment, State and community acceptance, and preference for treatment as a principal element.

Under the selected remedy, extraction and treatment of ground water, as well as Monitored Natural Attenuation, reduces the risk associated with exposure to the ground water to the extent practicable.

E. Preference for Treatment as a Principal Element

The selected remedy satisfies, in part, the statutory preference for treatment as a principal element. The GWTS will provide treatment for the highest levels of contamination and will prevent the migration of contamination due to continue dissolution of DNAPLs in ground water. The selected remedy, which includes a natural attenuation component, provides the best overall protection of human health and the environment. In addition, Site land and ground water use will be restricted to prevent exposure to contaminated soil and ground water.

XII. DOCUMENTATION OF CHANGES FROM PROPOSED PLAN

The Proposed Plan identifying EPA's preferred alternative was released for comment on June 20, 1999. No written comments were received during the public comment period. EPA's preferred alternative outlined in the Proposed Plan included a TI waiver for <u>all</u> of the contaminants of concern in the ground water in the Probable DNAPL Zone. Based on further review of the TI Guidance, EPA has approved a waiver for ground water in the Probable DNAPL Zone for TCE standard only. The cleanup standards for the rest of the COCs in the groundwater will be met in the entire contamination plume.

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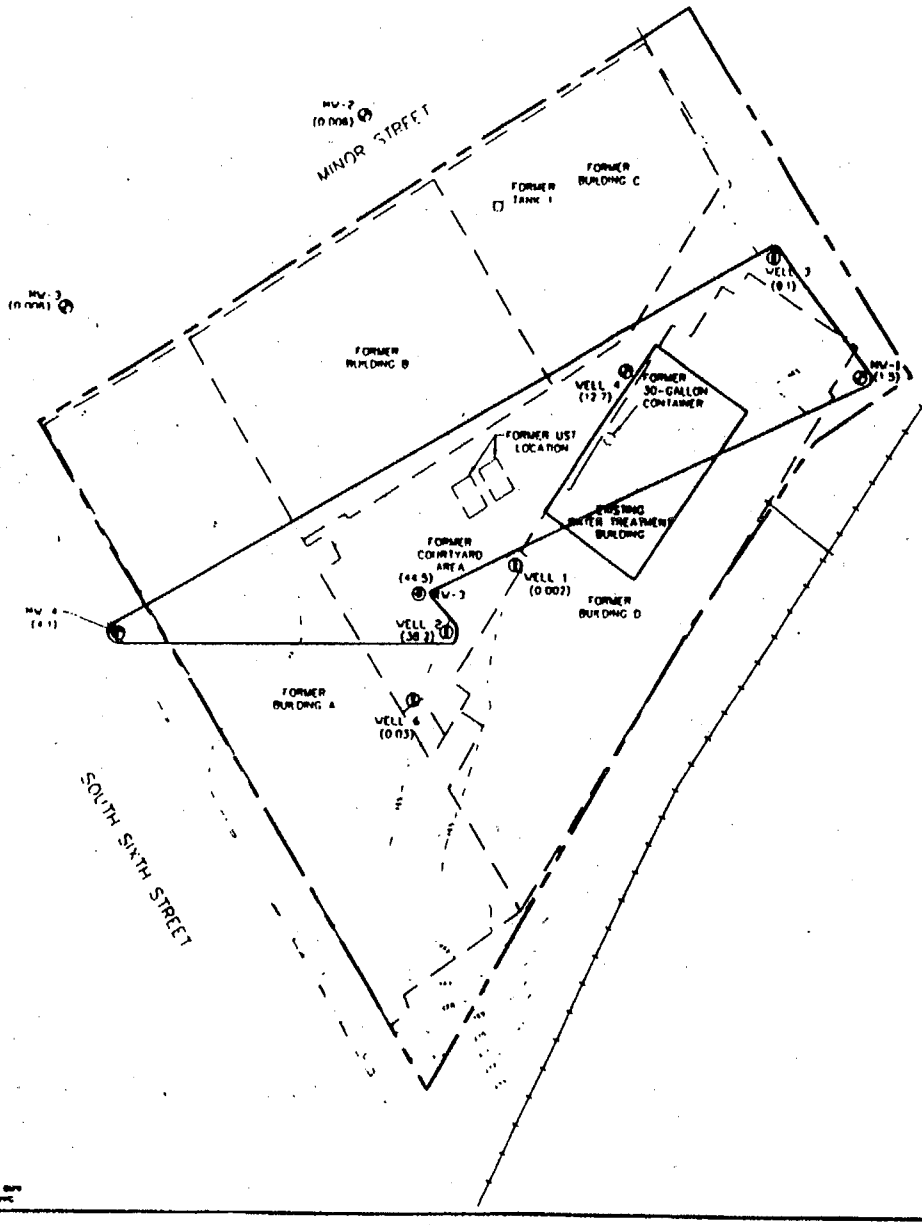
APPENDIX A



LEGEND

WELL 1	FORMER DISPOSAL WELL
MW-2	GROUND-WATER MONITORING WELL
RW-3	RECOVERY WELL
— — —	PROPERTY BOUNDARY
...	GROUND-SURFACE ELEVATION CONTOUR IN FEET ABOVE MEAN SEA LEVEL
— — —	FOOTPRINT OF FORMER BUILDING
(4.1)	PERCENT OF ICE SOLUBILITY
———	LIMITS OF PROBABLE DNAPL ZONE

NOTES

1. BASE MAP DIGITIZED FROM SITE PLAN, PROVIDED IN RI/FS WORK PLAN (DEC. 1995)
2. MONITORING WELL, SOIL BORING, AND SURFACE SOIL SAMPLE LOCATIONS COMPLETED IN CONNECTION WITH THIS REMEDIAL INVESTIGATION HAVE BEEN SURVEYED ALL OTHER LOCATIONS ARE APPROXIMATE
3. PERCENT OF ICE SOLUBILITY VALUES CALCULATED USING JANUARY 9-14, 1997 GROUND-WATER ANALYTICAL DATA EXCEPT MW-4 FOR WHICH PERCENT SOLUBILITY WAS CALCULATED FROM AUGUST 20 1996 GROUND-WATER DATA
4. DEFINITION OF PROBABLE DNAPL ZONE DISCUSSED IN REPORT

0 40' 80'
GRAPHIC SCALE

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA
TECHNICAL IMPRACTICABILITY EVALUATION

PROBABLE DNAPL ZONE

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

1

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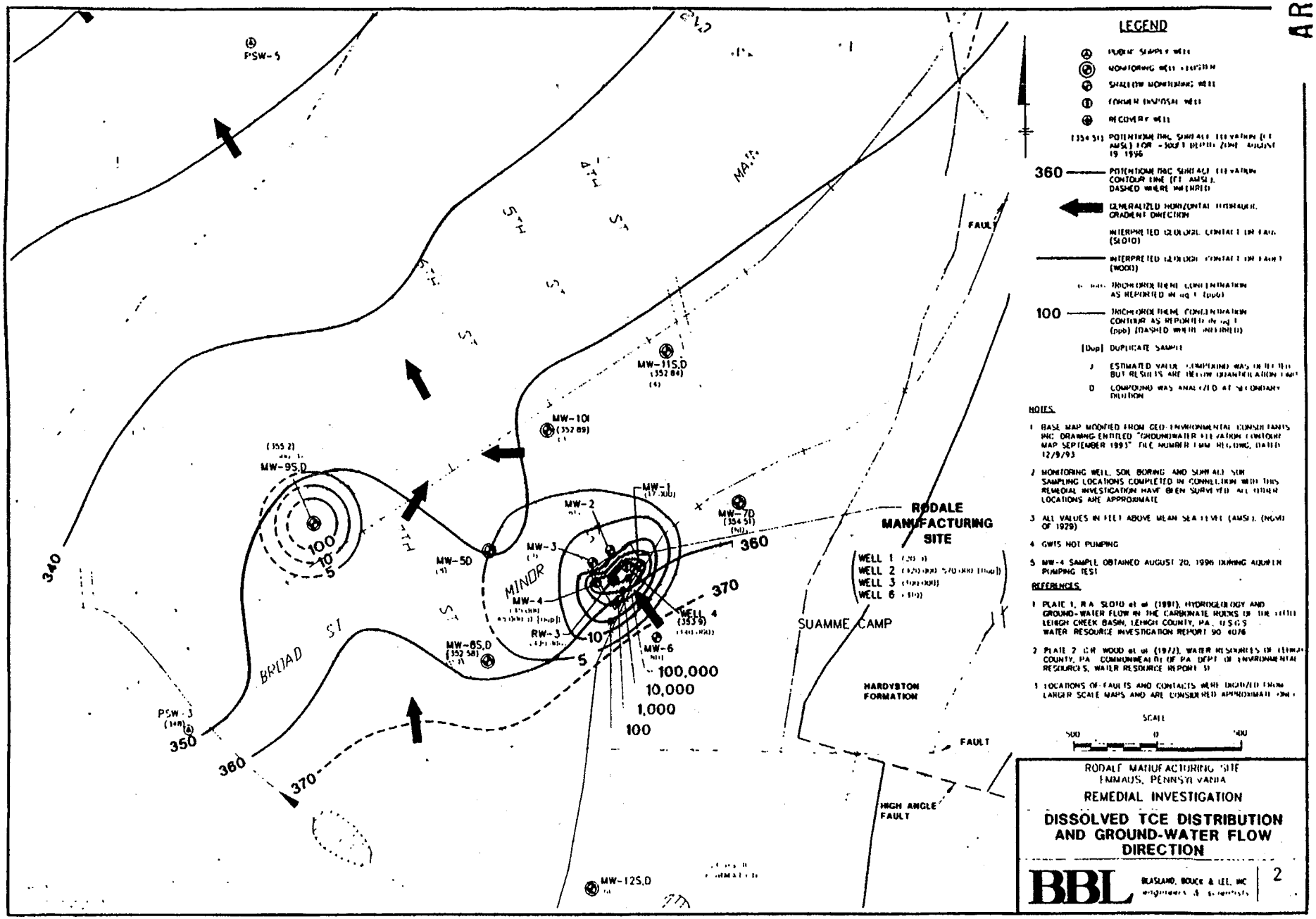
Figure 2



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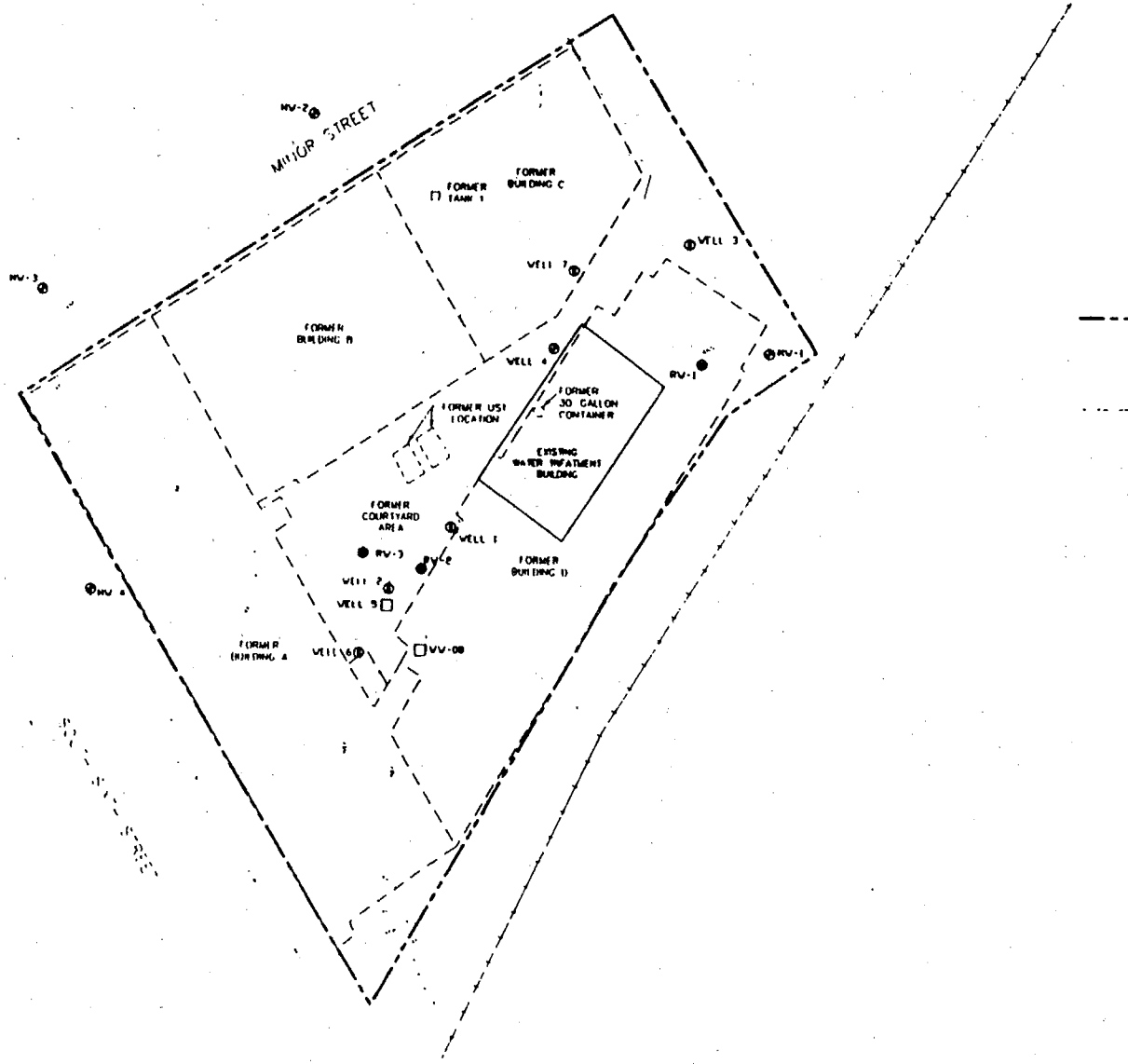

LEGEND

WELL 1	FORMER DISPOSAL WELL
RW-2	GROUND WATER MONITORING WELL
RW-1	RECOVERY WELL
VV-00	CISTERN
	PROPERTY BOUNDARY
	GROUND SURFACE ELEVATION CONTOUR IN FEET ABOVE MEAN SEA LEVEL
	FOOTPRINT OF FORMER BUILDING

NOTES

1. BASE MAP DIGITIZED FROM SITE PLAN PROVIDED IN RI/FS WORK PLAN (GEC, 1994)
2. MONITORING WELL, SOIL BORING, AND SURFACE SOIL SAMPLE LOCATIONS COMPILED IN CONNECTION WITH THIS REMEDIAL INVESTIGATION HAVE BEEN SURVEYED. ALL OTHER LOCATIONS ARE APPROXIMATE

SCALE

0 40 80

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

REMEDIAL INVESTIGATION

SITE PLAN/WELL LOCATION MAP

BBI BASLAND, BOUCK & LEE, INC. engineers & scientists

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AR300963

Figure 4

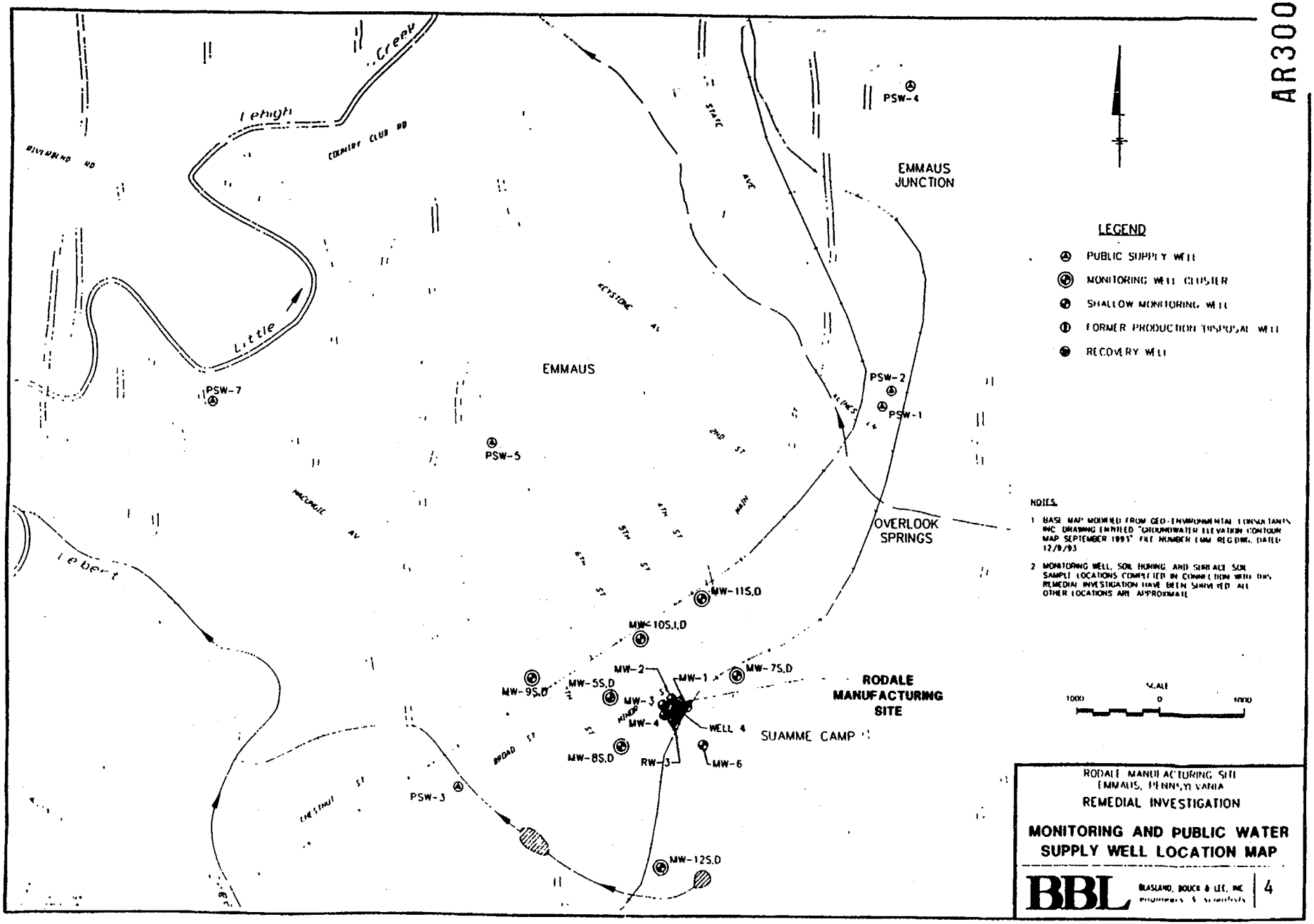

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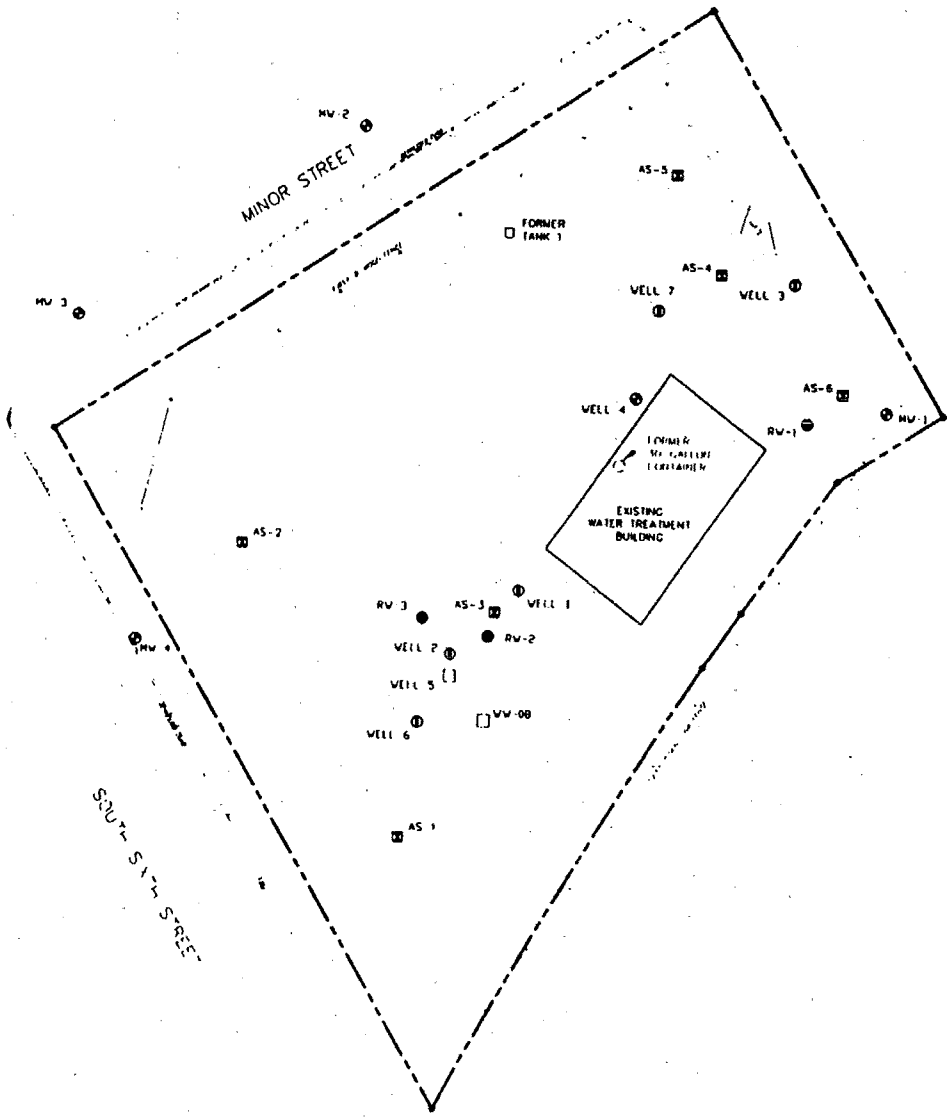
Figure 5



LEGEND

- MW-2 — GROUND-WATER MONITORING WELL
- WELL 7 — FORMER PRODUCTION/DISPOSAL WELL
- RW-1 — RECOVERY WELL
- VV 08 — CISTERN
- PROPERTY BOUNDARY
- AS-2 — PASSIVE AIR SAMPLING LOCATION (APPROXIMATE)

NOTE

1. BASE MAP MODIFIED FROM BARRY ISETT AND ASSOCIATES, P.C. SURVEY, DATED 10/31/96
2. AIR SAMPLES COLLECTED BY GEC ON OCTOBER 5 & 12, 1995
3. MONITORING WELL, SOIL BORING, AND SURFACE SOIL SAMPLE LOCATIONS COMPLETED IN CONNECTION WITH THE REMEDIAL INVESTIGATION HAVE BEEN SURVEYED. ALL OTHER LOCATIONS ARE APPROXIMATE

SCALE

40' 0 40'

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA
REMEDIAL INVESTIGATION

AIR SAMPLING LOCATION MAP

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

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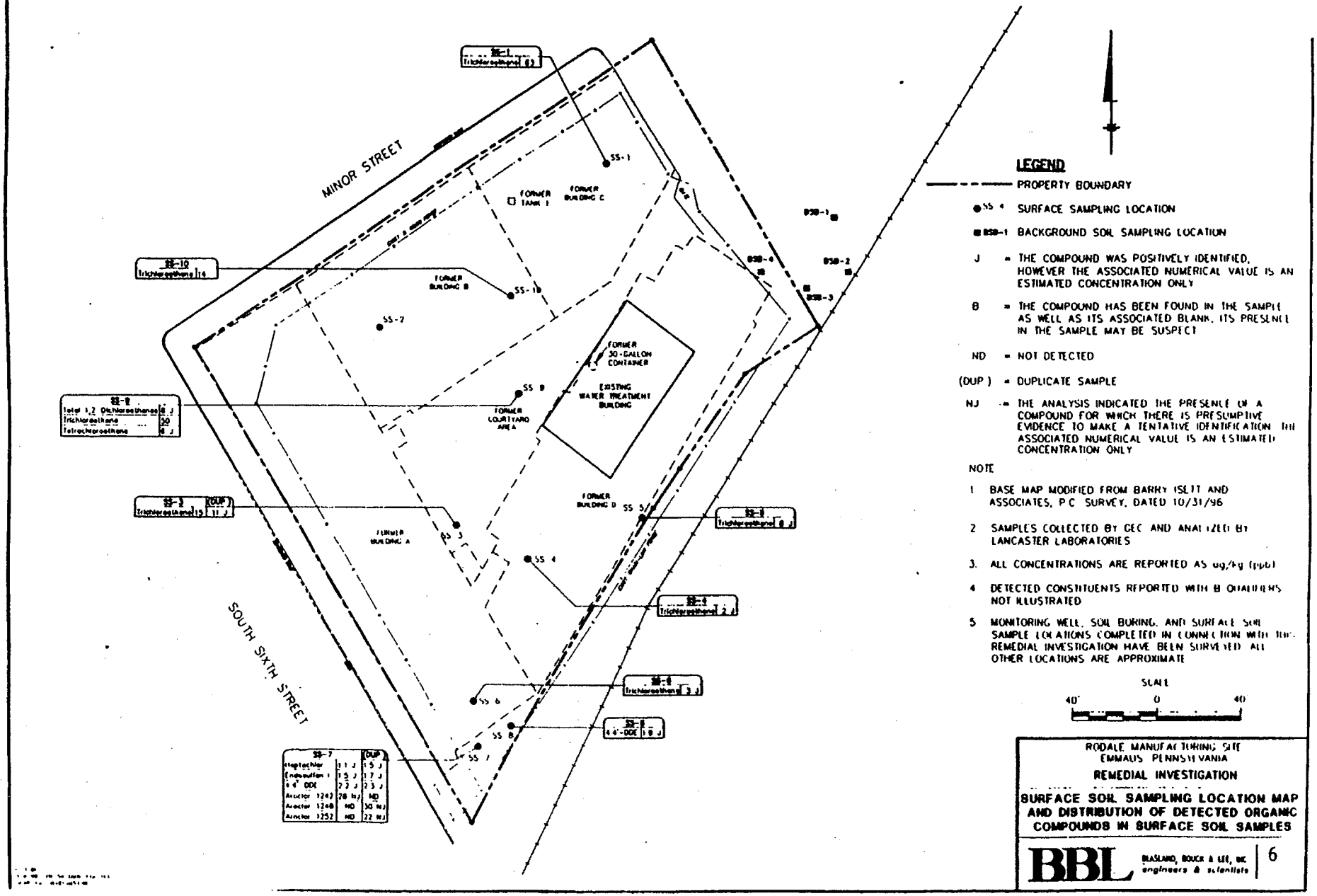
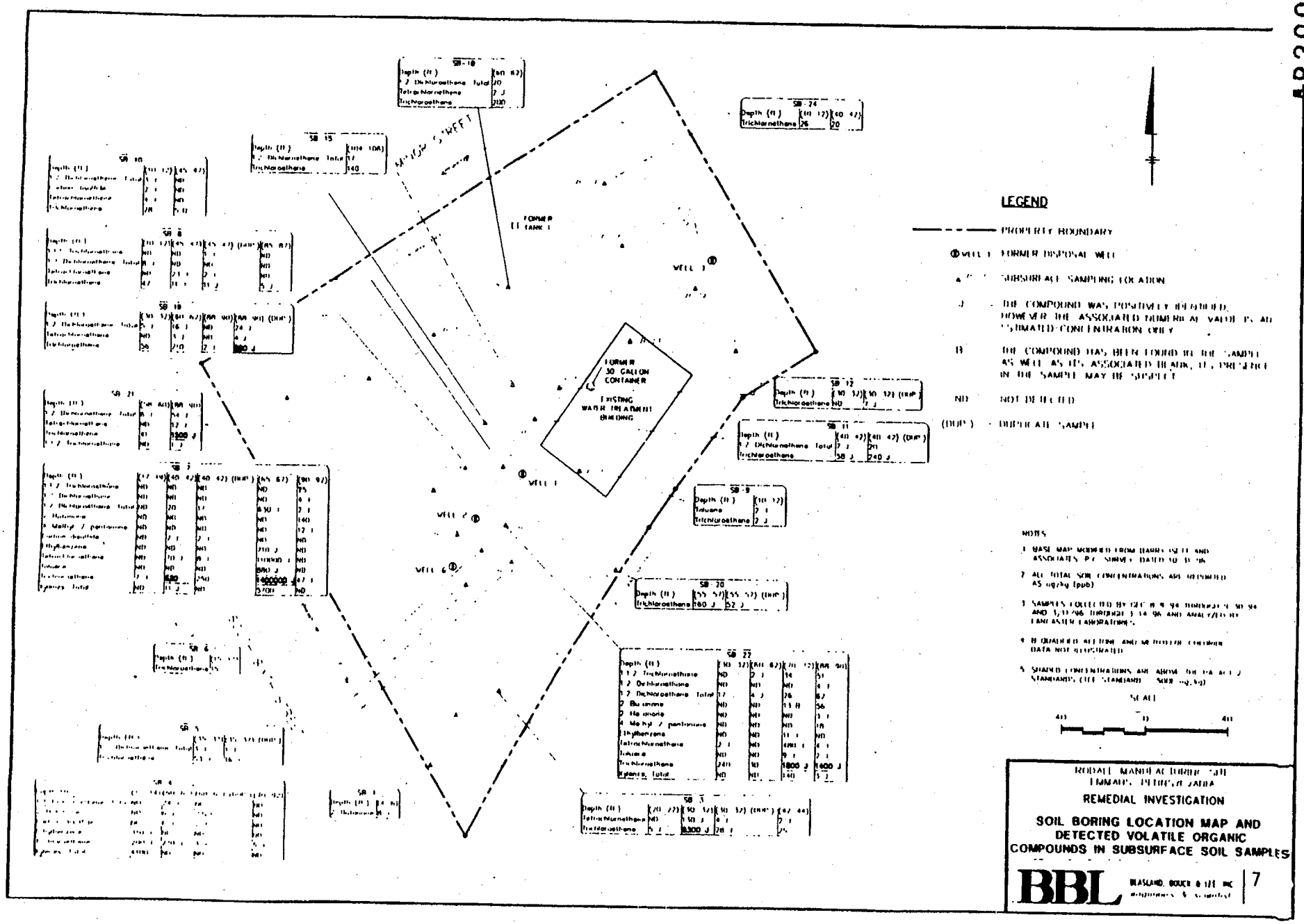
AR300965

Figure 6



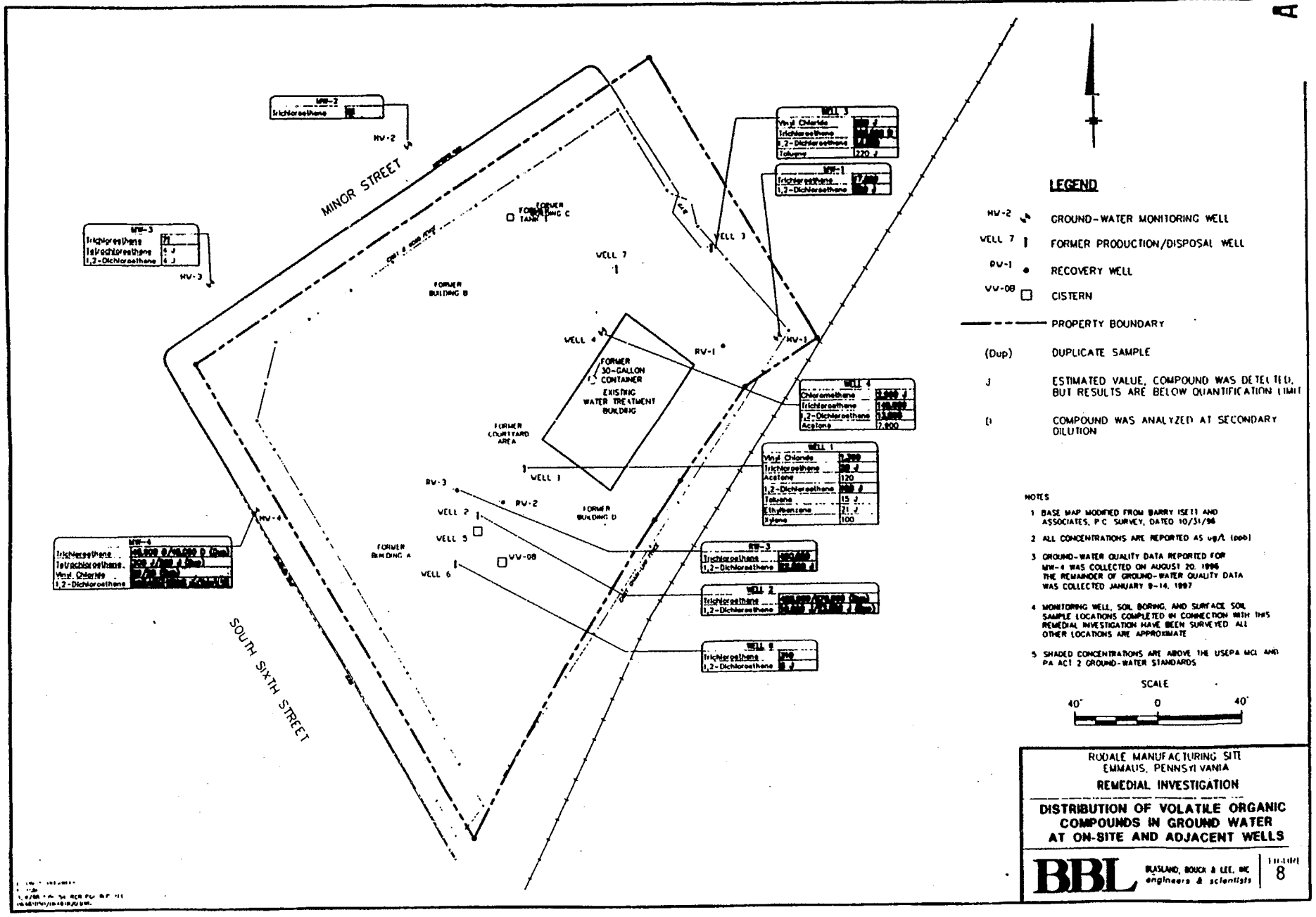
AR300096

Figure 7



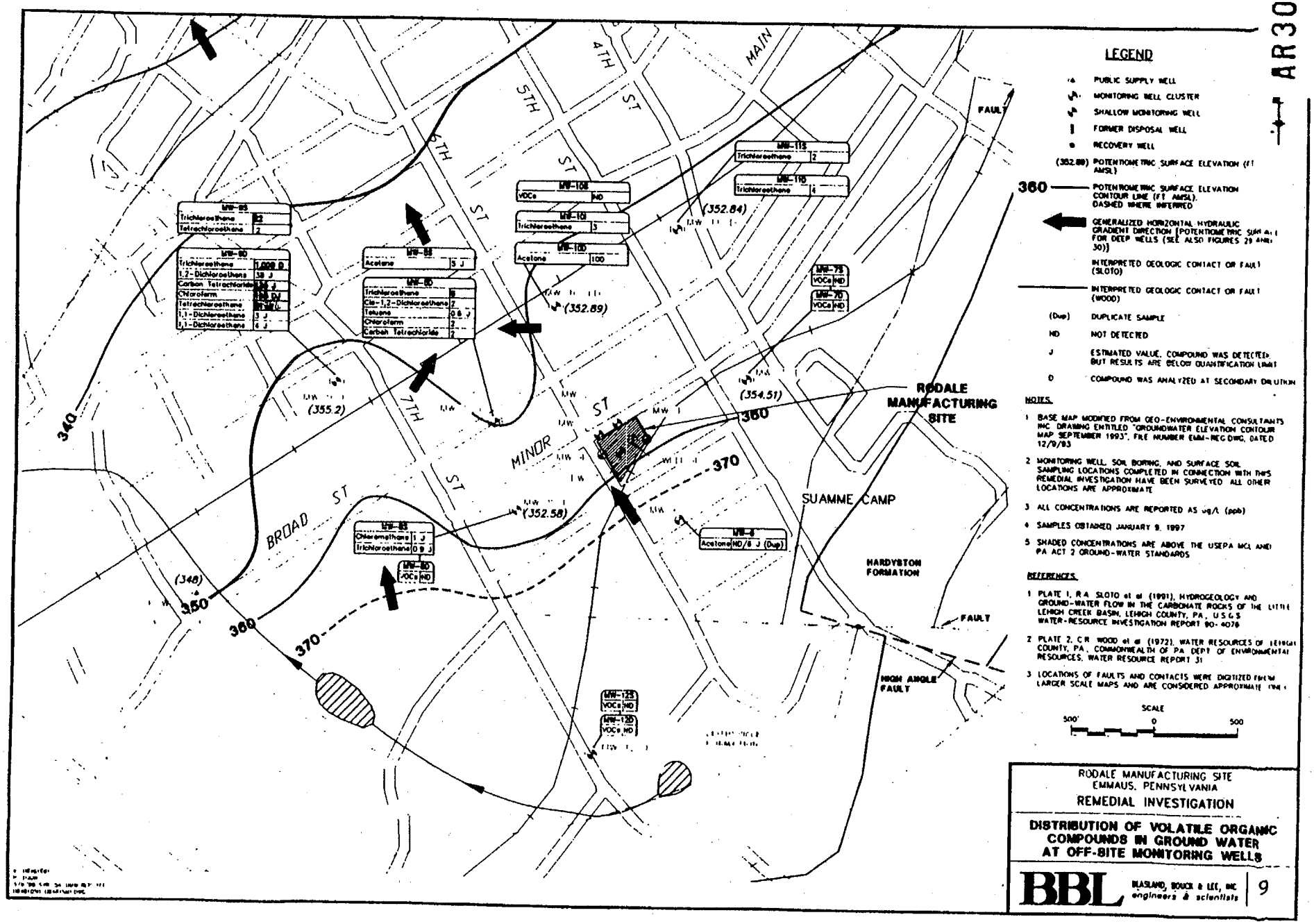
AR300967

FIGURE 8



AR3009

Figure 9



AR300999

APPENDIX B

Table 1
Ground water Cleanup Standards and Basis

Chemical	Cleanup Standard Micrograms/ Liter (UG/L)	Basis
Cloroform	0.15	RBC
1,1-Dichloroethene	4	RBC
Carbon Tetrachloride	0.16	RBC
Perchloroethene	1.1	RBC
Trichloroethene	1.6	RBC
1,1,2-Trichloroethane	0.19	RBC
Chloromethane	2	RBC
Vinyl Chloride	0.019	RBC
1,4-Dichlorobenzene	0.47	RBC
Bis(2-ethylhexyl)phathalate	4.8	RBC
Pentachlorophenol	0.56	RBC
Arsenic	0.045	RBC
Ammonia	200	Federal MCL
Antimony	6	RBC
Copper	150	RBC
Iron	300	PA Act 2 (SMCL)
Thallium	0.5	MCLG
Lead	5	PA Act 2 (MCL)
Chromium	100	Federal MCL
Benzene	0.4	RBC
Benzo[k]fluoranthene	0.55	PA Act 2 (S)
Dibenzo[a,h]anthracene	0.0092	RBC
Benzo[b]fluoranthene	0.0092	RBC
N-nitrosodiphenylamine	14	RBC

Phenanthrene	110	RBC
Ethylbenzene	700	Federal MCL
2-methylnaphthalene	120	RBC
Benzo[a]anthracene	0.0092	RBC
Barium	2,000	Federal MCL
Cadmium	5	Federal MCL
Cyanide	200	Federal MCL
Nickel	100	PA Act 2 (H)
Vanadium	2.1	PA Act 2 (G)
Zinc	2,000	PA Act 2 (H)
Aluminum	200	PA Act 2 (SMCL)
Indeno[1,2,3-cd]pyrene	0.092	RBC
Naphthalene	6.5	RBC
Pyrene	13	PA Act 2 (S)
Xylenes, total	4,000	Federal MCL
Benzo[a]pyrene	0.0092	RBC
Di-n-octyl phthalate	730	RBC
Manganese	50	PA Act 2 (SMCL)
cis 1,2-dichloroethene	40	RBC
trans 1,2-dichloroethene	50	RBC
4-methylphenol	60	RBC
Toluene	380	RBC

RBC Risk-Based Concentration
MCL Maximum Contaminant Level
MCLG Maximum Contaminant Level Goal
SMCL Secondary Maximum Contaminant Level
H Lifetime Health Advisory Level
G Ingestion
S Aqueous Solubility Cap

Table 2

COMPARISON OF SURFACE SOIL SAMPLES WITH USEPA REGION III RBCs

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

Constituent	Detected Frequency	Range of Detected Concentrations (mg/kg)	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Concentration	Number of RBC Exceedances (Soil Ingestion - Industrial)/Number of Detections (1)	RBC (Soil Ingestion Industrial) (mg/kg)	Number of RBC Exceedances (Soil Ingestion - Residential)/Number of Detections (1)	RBC (Soil Ingestion - Residential) (mg/kg)	Exceeds Any RBC
Aluminum	8/8	[illegible] - 12800	12,800	SS-2	0/8	200,000 N	0/8	7,800 N	R
Antimony	1/8	0.306	0.306	SS-3	0/1	82.0 N	0/1	3.1 N	
Arsenic	8/8	2.8 - 11	11	SS-1	7/8	3.8 C	8/8	0.43 C	I/R
Barium	8/8	8.6 - 136.8	136.8	SS-3	0/8	14,000 N	0/8	550 N	
Beryllium	8/8	0.32 - 1.1	1.1	SS-9	0/8	410 N	0/8	16.0 N	
Cadmium	1/8	0.508	0.508	SS-3	0/1	100 N	0/1	3.8 N	
Calcium (3)	8/8	6260 - 258000	258,000	SS-4	0/8	NC	0/8	NC	
Chromium	8/8	2 - 18.8	18.8 J	SS-2	0/8	1,000 N	0/8	38.0 N	
Cobalt	8/8	2.2 - 21.8	21.8	SS-8	0/8	12,000 N	0/8	470 N	
Copper	8/8	4.8 - 96.2	96.2	SS-3	0/8	8,200 N	0/8	310 N	
Iron (3)	8/8	6140 - 38000	38,000	SS-9	0/8	61,000 N	0/8	2,300 N	R
Lead (2)	8/8	1.4 - 141.86	141.8	SS-3	0/8	400 (2)	0/8	400 (2)	
Magnesium (3)	8/8	1710 - 36100	36,100	SS-4	0/8	NC	0/8	NC	
Manganese	8/8	72.1 - 888	888	SS-8	0/8	4,100 N	0/8	160 N	R
Mercury	6/8	0.02 - 0.76	0.76	SS-6	0/8	61.0 N	0/8	2.3 N	
Nickel	8/8	5.5 - 18.8	18.8	SS-8	0/8	4,100 N	0/8	160 N	
Potassium (3)	8/8	519 - 944	944	SS-1	0/8	NC	0/8	NC	
Selenium	2/8	0.8 - 0.89	0.89 J	SS-1	0/2	1,000 N	0/2	39.0 N	
Thallium	1/8	0.76	0.76	SS-6	0/1	14.0 N	1/1	0.55 N	R
Vanadium	8/8	3.4 - 38.6	38.6	SS-9	0/8	1,400 N	0/8	55.0 N	
Zinc	8/8	18.6 - 283.5	283.5	SS-3	0/8	61,000 N	0/8	2,300 N	
4,4' DDE	2/2	0.0019 - 0.00228	0.00228	SS-7	0/2	17.0 C	0/2	1.8 C	
Endosulfan I	1/2	0.0016	0.0016	SS-7	0/1	1,200 N	0/1	47.0 N	
Heptachlor	1/2	0.0013	0.0013	SS-7	0/1	1.3 C	0/1	0.14 C	
Aroclor 1242	1/2	0.02328	0.02328	SS-7	0/1	2.8 C	0/1	0.32 C	
Aroclor-1248	1/2	0.02428	0.02428	SS-7	0/1	2.8 C	0/1	0.32 C	
Aroclor-1254	1/2	0.02028	0.02028	SS-7	0/1	2.8 C	0/1	0.32 C I	
1,2 Dichloroethane, Total	1/8	0.009	0.009 J	SS-9	0/1	1,600 N	0/1	70.0 N	
Tetrachloroethene	1/8	0.008	0.008 J	SS-8	0/1	110 C	0/1	12.0 C	
Trichloroethene	7/8	0.002 - 0.083	0.083	SS-1	0/7	520 C	0/7	58.0 C I	

AR300973

Table 2 continued

COMPARISON OF SURFACE SOILS WITH USEPA REGION III RISK BASED CONCENTRATIONS

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

AR300974

Notes:

RBC = Risk Based Concentrations.
(1) Exceedance of RBC value for carcinogens; exceedance of one-tenth the RBC value for non-carcinogens.
(2) United States Environmental Protection Agency (USEPA) screening value for lead in soil (residential settings), USEPA 1994, OSWER Directive #9355 4-12.
(3) Essential nutrient.
I = Exceedance of RBC Soil Ingestion-Industrial Criteria.
R = Exceedance of RBC Soil Ingestion-Residential Criteria.

Lab Data Qualifiers:

B = Compound has been found at comparable concentrations in the sample as well as its associated blank, its presence in the sample is suspected to be laboratory introduced.
J = Compound was positively identified; however, the associated numerical value is an estimated concentration only.
NJ = Analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification. The associated numerical value is an estimated concentration only.

RBC Criteria Qualifiers:

C = Carcinogenic effects.
N = Noncarcinogenic effects.
NC = No criteria.
CI = RBC at HI of 0.1 is less than RBC (C); value shown is value provided in USEPA Region III RBC table

References:

United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania, Memorandum dated March 17, 1997, from Ray L. Smith, Ph.D., Toxicologist, to RBC Table mailing list, Subject: Updated Risk-Based Concentration Table.

United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania, Memorandum dated April 1, 1998 from Jennifer Hubbard, Toxicologist, to RBC Table mailing list, Subject: Risk-Based Concentration Table.

Table 3

COMPARISON OF SUBSURFACE SOIL SAMPLES WITH USEPA REGION III RBCs

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

Constituent	Detection Frequency	Range of Detected Concentrations (mg/kg)	Location Of Maximum Detected Concentration	Maximum Detected Concentration	Number of RBC Exceedances (Soil Ingestion - Industrial)/ Number of Detections(1)	RBC (Soil Ingestion Industrial) (mg/kg)	Number of RBC Exceedances (Soil Ingestion - Residential)/Number of Detections(1)	RBC (Soil Ingestion - Residential) (mg/kg)	Exceeds Any RBC
Aluminum	8 / 8	8,980 - 22,100	SB-20 (10-12)	22,100	0 / 8	200,000 N	0 / 8	7,800 N	N
Arsenic	7 / 7	0.66 - 14.4	SB-20 (10-12)	14.4	2 / 7	3.8 C	7 / 7	0.43 C	UR
Barium	8 / 8	32.9 - 297	SB-8 (10-12)	297	0 / 8	14,000 N	0 / 8	550 N	
Beryllium	7 / 7	0.69 - 1.3	SB-8 (10-12)	1.3 L	0 / 7	410 N	0 / 7	16.0 N	
Cadmium	1 / 8	2.4	SB-8 (10-12)	2.4	0 / 1	100 N	0 / 1	3.9 N	
Calcium (3)	8 / 8	230 - 2,360	SB-11 (10-12)	2,360	0 / 8	NC	0 / 8	NC	
Chromium	7 / 7	3.6 - 27.8	SB-16 (10-12)	27.8	0 / 7	1,000 N	0 / 7	39.0 N	
Cobalt	8 / 8	11.6 - 108	SB-8 (10-12)	108 J	0 / 8	12,000 N	0 / 8	470 N	
Copper	7 / 7	26.0 - 68.4	SB-11 (10-12)	68.4	0 / 7	8,200 N	0 / 7	310 N	
Iron (3)	8 / 8	31,800 - 77,300	SB-12 (10-12)	77,300	1 / 8	61,000 N	6 / 8	2,300 N	UR
Lead (2)	7 / 7	4.1 - 48.3	SB-20 (10-12)	48.3 J	0 / 7	400	0 / 7	400	
Magnesium (3)	8 / 8	641 - 967	SB-20 (10-12)	967 L	0 / 8	NC	0 / 8	NC	
Manganese	7 / 7	139 - 2,630	SB-8 (10-12)	2,630 J	0 / 7	4,100 N	6 / 7	160 N	R
Mercury	8 / 8	0.027 - 0.180	SB-20 (10-12)	0.18	0 / 8	61.0 N	0 / 8	2.3 N	
Nickel	8 / 8	13.1 - 36.7	SB-8 (10-12)	36.7	0 / 8	4,100 N	0 / 8	160 N	
Potassium (3)	8 / 8	439 - 987	SB-12 (10-12)	987	0 / 8	NC	0 / 8	NC	
Selenium	6 / 8	0.33 - 2.2	SB-20 (10-12)	2.2	0 / 6	1,000 N	0 / 6	39.0 N	
Silver	2 / 8	1.3 - 2.6	SB-16 (10-12)	2.6	0 / 2	1,000 N	0 / 2	39.0 N	
Sodium (3)	8 / 8	14.9 - 89.0	SB-12 (10-12)	89.0	0 / 8	NC	0 / 8	NC	
Thallium	4 / 8	0.063 - 7.8	SB-8 (10-12)	7.8	0 / 4	14.0 N	1 / 4	0.55 N	R
Vanadium	8 / 8	16.9 - 51.6	SB-16 (10-12)	51.6	0 / 8	1,400 N	0 / 8	55.0 N	
Zinc	8 / 8	69.7 - 340	SB-8 (10-12)	340 K	0 / 8	61,000 N	0 / 8	2,300 N	
1,2-Dichloroethene, Total	2 / 16	0.003 - 0.008	SB-8 (10-12)	0.008 J	0 / 2	1,800 N	0 / 2	70.0 N	
2 Butanone	1 / 16	0.008	SB-1 (4-6)	0.008 J	0 / 1	120,000 N	0 / 1	4,700 N	
Carbon disulfide	1 / 16	0.002	SB-10 (10-12)	0.002 J	0 / 1	20,000 N	0 / 1	780 N	
Tetrachloroethene	1 / 16	0.004	SB-10 (10-12)	0.004 J	0 / 1	110 C	0 / 1	12.0 C	
Toluene	1 / 16	0.002	SB-9 (10-12)	0.002 J	0 / 1	41,000 N	0 / 1	1,600 N	
Trichloroethene	4 / 16	0.002 - 0.047	SB-8 (10-12)	0.047	0 / 4	520 C	0 / 4	58.0 C I	

AR300975

COMPARISON OF SUBSURFACE SOILS WITH USEPA REGION III RISK BASED CONCENTRATIONS

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

AR300976

Notes:

RBC = Risk Based Concentrations.
(1) Exceedance of RBC value for carcinogens; exceedance of one-tenth the RBC value for non-carcinogens
(2) United States Environmental Protection Agency (USEPA) screening value for lead in soil (residential setting). USEPA 1994, OSWER Directive #9355.4-12.
(3) Essential nutrient.
I = Exceedance of RBC Soil Ingestion Industrial Criteria
R = Exceedance of RBC Soil Ingestion Residential Criteria.

Lab Data Qualifiers:

B = Compound has been found at comparable concentrations in the sample as well as its associated blank. Its presence in the sample is suspected to be laboratory introduced
J = Compound was positively identified; however, the associated numerical value is an estimated concentration only
NJ = Analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification. The associated numerical value is an estimated concentration only

RBC Criteria Qualifiers:

C = Carcinogenic effects.
N = Noncarcinogenic effects.
NC = No criteria.
C1 = RBC at HI of 0.1 is less than RBC (C); value shown is value provided in USEPA Region III RBC table

References:

United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania, Memorandum dated March 17, 1997, from Roy L. Smith, Ph.D., Toxicologist, to RBC Table mailing list, Subject: Updated Risk-Based Concentration Table.
United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania, Memorandum dated April 1, 1998 from Jennifer Hubbard, Toxicologist, to RBC Table mailing list, Subject: Risk-Based Concentration Table

Table 4

COMPARISON OF ON-SITE GROUNDWATER SAMPLES FROM MONITORING WELLS WITH USEPA REGION III RBCs
PRE-REMEDIAL INVESTIGATION SAMPLING EVENT

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

Constituent	Detection Frequency	Maximum Detected Concentration (ug/L)	RBC (Tap Water) (ug/L)	Number of RBC Exceedances (Tap Water)/Number of Detections (ug/L) (1)	Range of Detected Concentrations (ug/L)	Location of Maximum Detected Concentration	PCOC
Volatile Organic Compounds							
1,1,2-Trichloroethane	3 / 13	350 J	0.19 C	3 / 3	12.0 - 350	RW-3	Yes
1,1-Dichloroethane	1 / 13	3.5	80.0 N	0 / 1	3.5	Well 4	No
1,1-Dichloroethene	1 / 13	20.5	0.044 C	1 / 1	20.5	Well 4	Yes
1,2-Dichloroethane	1 / 13	2.0	0.12 C	1 / 1	2	Well 4	Yes
1,2-Dichloroethene, Total	10 / 13	43,000 J	5.5 N	10 / 10	89.5 - 43,000	Well 2	Yes
2-Butanone	1 / 13	13.0	100 N	0 / 1	13	Well 5	No
Acetone	3 / 8	43.5	370 N	0 / 3	3.5 - 43.5	Well 3	No
Benzene	1 / 10	13.0 J	0.36 C	1 / 1	13	Well 7	Yes
Carbon disulfide	1 / 13	2.0 J	100 N	0 / 1	2	Well 7	No
Chloroform	1 / 13	5.0	0.15 C	1 / 1	5	Well 4	Yes
Ethylbenzene	3 / 13	440	130 N	1 / 3	9.5 - 440	Well 3	Yes
Tetrachloroethene	8 / 13	3,900	1.1 C	8 / 8	3.0 - 3,900	Well 2	Yes
Toluene	6 / 13	485	75.0 N	3 / 6	1.5 - 485	Well 3	Yes
Trichloroethene	12 / 12	400,000	1.6 C	12 / 12	21.5 - 400,000	RW-3	Yes
Vinyl chloride	7 / 13	3,200	0.019 C	7 / 7	71.0 - 3,200	Well 3	Yes
Xylenes, Total	6 / 13	3,850	1,200 N	1 / 6	15.5 - 3,850	Well 3	Yes
Semivolatile Organic Compounds							
2,4,5-Trichlorophenol	1 / 12	8.0 J	370 N	0 / 1	8	Well 2	No
2,4-Dimethylphenol	1 / 12	3.0 J	73.0 N	0 / 1	3	Well 2	No
2-Methylnaphthalene	4 / 12	420	150 N	1 / 4	1.0 - 420	Well 3	Yes
2-Methylphenol	1 / 12	3.0 J	180 N	0 / 1	3	Well 2	No
4-Methylphenol	3 / 12	39.0	18.0 N	1 / 3	6.5 - 39.0	Well 5	Yes
Acenaphthene	1 / 12	2.0 J	220 N	0 / 1	2	Well 5	No
Anthracene	1 / 12	2.0 J	1,100 N	0 / 1	2	Well 5	No
Benzo(a)anthracene	1 / 12	6.0 J	0.092 C	1 / 1	6	Well 5	Yes
Benzo(a)pyrene	1 / 12	6.0 J	0.0092 C	1 / 1	6	Well 5	Yes
Benzo(b)fluoranthene	1 / 12	10.0 J	0.092 C	1 / 1	10	Well 5	Yes
Benzo(g,h,i)perylene	1 / 12	5.0 J	NC	0 / 1	5	Well 5	No
Benzo(k)fluoranthene	1 / 12	10.0 J	0.92 C	1 / 1	10	Well 5	Yes
bis(2-Ethylhexyl)phthalate	2 / 5	4,900	4.8 C	2 / 2	170 - 4,900	Well 3	Yes
Carbazole	1 / 12	2.0 J	3.3 C	0 / 1	2	Well 5	No
Chrysene	1 / 12	7.0 J	9.2 C	0 / 1	7	Well 5	No
Di-n-butyl phthalate	2 / 12	14.0	370 N	0 / 2	1.0 - 14.0	Well 5	No
Di-n-octyl phthalate	1 / 12	135	73.0 N	1 / 1	135	Well 3	Yes
Dibenz(a,h)anthracene	1 / 12	1.0 J	0.0092 C	1 / 1	1	Well 5	Yes
Dibenzofuran	1 / 12	1.0 J	15.0 N	0 / 1	1	Well 5	No
Diethyl phthalate	1 / 12	3.0	2,900 N	0 / 1	3	Well 6	No
Fluoranthene	1 / 12	11.0	150 N	0 / 1	11	Well 5	No
Fluorene	2 / 12	2.0 J	150 N	0 / 2	4	Well 7, Well 5	No
Indeno(1,2,3-cd)pyrene	1 / 12	6.0 J	0.092 C	1 / 1	6	Well 5	Yes
N-Nitrosodiphenylamine	1 / 12	71.5	14.0 C	1 / 1	71.5	Well 3	Yes
Naphthalene	6 / 12	1,600	150 N	1 / 6	4.0 - 1,600	Well 3	Yes
Pentachlorophenol	1 / 12	5.0 J	0.56 C	1 / 1	5	Well 2	Yes
Phenanthrene	4 / 12	115	110 N	1 / 4	2.0 - 115	Well 3	Yes
Phenol	5 / 12	64.0 J	2,200 N	0 / 5	1.5 - 64.0	Well 5	No
Pyrene	2 / 12	160.5	110 N	1 / 2	14.0 - 161	Well 3	Yes

See Notes on Page 2.

Table 4 Continued

COMPARISON OF ON-SITE GROUNDWATER SAMPLES FROM MONITORING WELLS WITH USEPA REGION III RBCs
PRE-REMEDIAL INVESTIGATION SAMPLING EVENT

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

Constituent	Detection Frequency	Maximum Detected Concentration (ug/L)	RBC (Tap Water) (ug/L)	Number of RBC Exceedances (Tap Water/Number of Detections (ug/L) (1)	Range of Detected Concentrations (ug/L)	Location of Maximum Detected Concentration	PODC
Inorganic Constituents							
Aluminum	13 / 13	27,300 J	3,700 N	9 / 13	24.83 - 27,300	Well 2	Yes
Antimony	4 / 13	28.0	1.8 N	4 / 4	9.9 - 28.0	Well 7	Yes
Arsenic	5 / 8	10.1 K	0.048 C	5 / 5	1.2 - 10.1	Well 7	Yes
Barium	13 / 13	1,080	260 N	5 / 13	29.18 - 1,080	Well 1	Yes
Beryllium	6 / 13	6.0 J	7.3 N	0 / 6	0.72 - 6.0	Well 2	No
Cadmium	5 / 13	35.8 J	1.8 N	5 / 5	1.7 - 35.8	Well 2	Yes
Calcium (3)	13 / 13	294,500	NC	0 / 13	1,740 - 294,500	Well 7	No
Chromium	9 / 13	174	18.0 N	5 / 9	6.6 - 174	Well 7	Yes
Cobalt	13 / 13	186 J	220 N	0 / 13	3.8 - 186	Well 2	No
Copper	12 / 13	708	150 N	3 / 12	6.86 - 708	Well 6	Yes
Cyanide, Total	7 / 13	357.6	73.0 N	3 / 7	2.8 - 357.6	Well 1	Yes
Iron (3)	13 / 13	87,400 J	1,100 N	13 / 13	2,520 - 87,400	Well 2	Yes
Lead (2)	13 / 13	656	15.0	8 / 13	0.86 - 656	Well 6	Yes
Magnesium (3)	13 / 13	58,400	NC	0 / 13	2,806 - 58,400	Well 7	No
Manganese	13 / 13	6,230 J	73.0 N	11 / 13	35.46 - 6,230	Well 2	Yes
Mercury	10 / 13	1.066	1.1 N	0 / 10	0.06 - 1.066	Well 6	No
Nickel	12 / 13	116 J	73.0 N	2 / 12	3.86 - 116	Well 2	Yes
Potassium (3)	13 / 13	32,400	NC	0 / 13	4,500 - 32,400	Well 7	No
Selenium	3 / 13	6.35	18.0 N	0 / 3	1.8 - 6.35	Well 7	No
Silver	2 / 13	13.075	18.0 N	0 / 2	5.1 - 13.075	MW-2	No
Sodium (3)	13 / 13	74,000	NC	0 / 13	3,140 - 74,000	RW-3	No
Thallium	1 / 13	1.6 L	0.28 N	1 / 1	1.6	Well 2	Yes
Vanadium	9 / 13	97.6 J	26.0 N	4 / 9	2.876 - 97.6	Well 2	Yes
Zinc	13 / 13	2,260 J	1,100 N	5 / 13	27.0 - 2,260	Well 2	Yes

Notes:

RBC = Risk Based Concentrations.
(1) Exceedance of RBC value for carcinogens; exceedance of one-tenth the RBC value for non-carcinogens.
(2) USEPA 1994 Safe Drinking Water Act action level for lead in tap water.
(3) Essential nutrient.

Lab Data Qualifiers:

J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.

RBC Criteria Qualifiers:

C = Carcinogenic effects.
N = Noncarcinogenic effects.
NC = No criteria.
CI = RBC at HI of 0.1 is less than RBC (C); value shown is value provided in USEPA Region III RBC table

References:

United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania. Memorandum dated March 17, 1997, from Roy L. Smith, Ph.D., Toxicologist, to RBC Table mailing list. Subject: Updated Risk-Based Concentration Table.
United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania. Memorandum dated April 1, 1998 from Jennifer Hubbard, Toxicologist, to RBC Table mailing list. Subject: Risk-Based Concentration Table.

Table 5

COMPARISON OF ON-SITE GROUNDWATER SAMPLES FROM MONITORING WELLS WITH USEPA REGION III RBCs
REMEDIAL INVESTIGATION SAMPLING EVENT

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

Constituent	Detection Frequency	Maximum Detected Concentration (ug/L)	RBC (Tap Water) (ug/L)	Number of RBC Exceedances (Tap Water)/Number of Detections (ug/L) (1)	Range of Detected Concentrations (ug/L)	Location of Maximum Detected Concentration	POBC
Volatile Organic Compounds							
1,2-Dichloroethene, Total	11 / 14	32,000 J	5.5 N	11 / 11	190 - 32,000	RW-3	Yes
Chloromethane	1 / 11	2,800 J	1.8 C	1 / 1	2800	Well 4	Yes
Ethylbenzene	1 / 11	21.0 J	130 N	0 / 1	21	Well 1	No
Tetrachloroethene	4 / 14	2,900	1.1 C	4 / 4	4.0 - 2,900	RW-3	Yes
Toluene	2 / 11	220 J	75.0 N	1 / 2	18.0 - 220	Well 3	Yes
Trichloroethene	14 / 14	590,000	1.6 C	14 / 14	20.0 - 590,000	RW-3	Yes
Vinyl chloride	4 / 14	1,300	0.015 C	4 / 4	26.0 - 1,300	Well 1	Yes
Xylenes, Total	1 / 11	100	1,200 N	0 / 1	100	Well 1	No
Semivolatile Organic Compounds							
1,4-Dichlorobenzene	1 / 9	1.0 J	0.47 C	1 / 1	1	RW-3	Yes
2,4,5-Trichlorophenol	2 / 9	8.0 J	370 N	0 / 2	6.0 - 8.0	Well 2	No
2-Methylnaphthalene	2 / 9	14.0	150 N	0 / 2	6.0 - 14.0	Well 3	No
2-Methylphenol	1 / 9	3.0 J	180 N	0 / 1	3	Well 2	No
4-Methylphenol	2 / 9	58.0	18.0 N	1 / 2	8.0 - 58.0	Well 2	Yes
Bis(2-Ethylhexyl)phthalate	1 / 9	23.0	4.8 C	1 / 1	23	Well 3	Yes
Naphthalene	4 / 9	66.0	150 N	0 / 4	17.0 - 66.0	Well 3	No
Pentachlorophenol	2 / 9	8.0 J	0.56 C	2 / 2	2.0 - 6.0	Well 2	Yes
Phenanthrene	1 / 9	2.0 J	110 N	0 / 1	2	Well 3	No
Phenol	2 / 9	16.0	2,200 N	0 / 2	8.0 - 16.0	Well 2	No
Inorganic Constituents							
Arsenic	2 / 10	5.7 B	0.045 C	2 / 2	5.4 - 5.7	RW-3	Yes
Beryllium	1 / 12	1.7 B	7.3 N	0 / 1	1.7	RW-3	No
Chromium	177 12	129 J	18.0 N	3 / 11	3.3 - 129	Well 3	Yes
Copper	8 / 12	238	150 N	1 / 8	10.6 - 238	Well 3	Yes
Cyanide, Total	4 / 12	62.2	73.0 N	0 / 4	10.3 - 62.2	Well 3	No
Iron (3)	127 12	49,800 J	1,100 N	10 / 12	291 - 49,800	Well 6	Yes
Lead (2)	8 / 12	70.6	15.0	3 / 8	2.8 - 70.6	Well 3	Yes
Manganese	11 / 11	4,120	73.0 N	10 / 11	67.5 - 4,120	RW-3	Yes
General Parameters							
Nitrate	4 / 9	17,000	NC	0 / 4	1,580 - 17,000	MW-1	No
Nitrogen, Ammonia	5 / 9	28,300	21.0 N	5 / 5	1,210 - 28,300	Well 2	Yes
Ortho Phosphate	3 / 9	950	NC	0 / 3	410 - 950	Well 1	No
Sulfate	6 / 7	238,000	NC	0 / 6	6,250 - 238,000	Well 6	No

Notes:

RBC = Risk Based Concentrations.
(1) Exceedance of RBC value for carcinogens: exceedance of one-tenth the RBC value for non-carcinogens.
(2) USEPA 1994 Safe Drinking Water Act action level for lead in tap water.
(3) Essential nutrient.

Lab Data Qualifiers:

B (inorganics) = The reported value is less than the contract required detection limit, but greater than or equal to the instrument detection limit.
J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.

RBC Criteria Qualifiers:

C = Carcinogenic effects.
N = Noncarcinogenic effects.
NC = No criteria.

References:

United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania. Memorandum dated March 17, 1997, from Roy L. Smith, Ph.D., Toxicologist, to RBC Table mailing list. Subject: Updated Risk-Based Concentration Table.
United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania. Memorandum dated April 1, 1998 from Jennifer Hubbard, Toxicologist, to RBC Table mailing list. Subject: Risk-Based Concentration Table.

Table 6

COMPARISON OF POTENTIALLY SITE-RELATED OFF-SITE GROUNDWATER SAMPLES FROM PRIVATE OR PUBLIC SUPPLY WELLS TO USEPA REGION III RBCs
PRE-REMEDIAL INVESTIGATION SAMPLING EVENT

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

Well Location	Constituent	Detection Frequency	Maximum Detected Concentration (ug/L)	RBC (Tap Water) (ug/L)	Number of RBC Exceedances (Tap Water/Maximum Detection (ug/L) (1))	PCOC
PSW-7	Barium	1 / 1	42.2 J	260 N	0 / 1	No
	Beryllium	1 / 1	0.63 B	7.3 N	0 / 1	No
	Calcium (3)	1 / 1	54,000	NC	0 / 1	No
	Iron (3)	1 / 1	17.7 B	1,100 N	0 / 1	No
	Lead (2)	1 / 1	0.78 B	15.0	0 / 1	No
	Magnesium (3)	1 / 1	31,400	NC	0 / 1	No
	Manganese	1 / 1	4.1 B	73.0 N	0 / 1	No
	Potassium (3)	1 / 1	2,380	NC	0 / 1	No
	Sodium (3)	1 / 1	13,700	NC	0 / 1	No
	1,1,1-Trichloroethane	1 / 1	0.1 J	54.0 N	0 / 1	No
	Carbon tetrachloride	1 / 1	0.2 J	0.16 C	1 / 1	Yes
	cis-1,2-Dichloroethene	1 / 1	0.1 J	6.1 N	0 / 1	No
	Tetrachloroethene	1 / 1	1.4	1.1 C	1 / 1	Yes
	Trichloroethene	1 / 1	14.0	1.6 C	1 / 1	Yes
PW-EM08	Antimony	1 / 1	13.4 B	1.5 N	1 / 1	Yes
	Barium	1 / 1	22.6	260 N	0 / 1	No
	Calcium (3)	1 / 1	65,800	NC	0 / 1	No
	Copper	1 / 1	11.8	150 N	0 / 1	No
	Iron (3)	1 / 1	23.2	1,100 N	0 / 1	No
	Magnesium (3)	1 / 1	31,800	NC	0 / 1	No
	Manganese	1 / 1	11.2	73.0 N	0 / 1	No
	Potassium (3)	1 / 1	2,310	NC	0 / 1	No
	Sodium (3)	1 / 1	12,100	NC	0 / 1	No
	Zinc	1 / 1	28.1	1,100 N	0 / 1	No
	Chloroform	1 / 1	0.2 J	0.15 C I	1 / 1	Yes
	Tetrachloroethane	1 / 1	0.3 J	1.1 C	0 / 1	No
	Trichloroethane	1 / 1	1.1	1.6 C	0 / 1	No
PW-EM06	Barium	1 / 1	28.2 B	260 N	0 / 1	No
	Calcium (3)	1 / 1	53,800	NC	0 / 1	No
	Copper	1 / 1	18.9	150 N	0 / 1	No
	Iron (3)	1 / 1	107	1,100 N	0 / 1	No
	Lead (2)	1 / 1	0.79 B	15.0	0 / 1	No
	Magnesium (3)	1 / 1	29,000	NC	0 / 1	No
	Manganese	1 / 1	8.2 B	73.0 N	0 / 1	No
	Potassium (3)	1 / 1	2,380	NC	0 / 1	No
	Sodium (3)	1 / 1	12,400	NC	0 / 1	No
	Thallium	1 / 1	1.9 B	0.28 N	1 / 1	Yes
	Zinc	1 / 1	11.6 B	1,100 N	0 / 1	No
	1,1,1-Trichloroethane	1 / 1	0.1 J	54.0 N	0 / 1	No
	Tetrachloroethane	1 / 1	0.2 J	1.1 C	0 / 1	No
	Trichloroethane	1 / 1	1.1	1.6 C	0 / 1	No
PW-LM20	Aluminum	1 / 1	16.8	3,700 N	0 / 1	No
	Barium	1 / 1	28.8 B	260 N	0 / 1	No
	Calcium (3)	1 / 1	46,300	NC	0 / 1	No
	Copper	1 / 1	19.9	150 N	0 / 1	No
	Iron (3)	1 / 1	15.2 B	1,100 N	0 / 1	No
	Magnesium (3)	1 / 1	31,800	NC	0 / 1	No
	Manganese	1 / 1	3.2 B	73.0 N	0 / 1	No
	Potassium (3)	1 / 1	1,790	NC	0 / 1	No
	Sodium (3)	1 / 1	8,420	NC	0 / 1	No
	Zinc	1 / 1	5.8 B	1,100 N	0 / 1	No
	Acetone	1 / 1	12.0 L	370 N	0 / 1	No
	Carbon tetrachloride	1 / 1	0.2 J	0.16 C	1 / 1	Yes
	Tetrachloroethane	1 / 1	0.5 J	1.1 C	0 / 1	No
	Trichloroethane	1 / 1	5.2	1.6 C	1 / 1	Yes

Table 6 Continued

COMPARISON OF POTENTIALLY SITE-RELATED OFF-SITE GROUNDWATER SAMPLES FROM PRIVATE OR PUBLIC SUPPLY WELLS TO USEPA REGION III RBCs
PRE-REMEDIAL INVESTIGATION SAMPLING EVENT

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

Well Location	Constituent	Detection Frequency	Maximum Detected Concentration (ug/L)	RBC (Tap Water) (ug/L)	Number of RBC Exceedances (Tap Water/Maximum Detection (ug/L))	POCC
PW-LM21	Barium	1 / 1	39.85	260 N	0 / 1	No
	Calcium (3)	1 / 1	62,350	NC	0 / 1	No
	Copper	1 / 1	29.6	150 N	0 / 1	No
	Iron (3)	1 / 1	43.85	1,100 N	0 / 1	No
	Lead (2)	1 / 1	7.95	15.0	0 / 1	No
	Magnesium (3)	1 / 1	40,300	NC	0 / 1	No
	Manganese	1 / 1	7.05	73.0 N	0 / 1	No
	Potassium (3)	1 / 1	2,290	NC	0 / 1	No
	Silver	1 / 1	6.075	18.0 N	0 / 1	No
	Sodium (3)	1 / 1	31,150	NC	0 / 1	No
	Zinc	1 / 1	20.05	1,100 N	0 / 1	No
	2-Butanone	1 / 1	8.1	190 N	0 / 1	No
	Tetrachloroethene	1 / 1	0.2	1.1 C	0 / 1	No
	Trichloroethene	1 / 1	1.9	1.8 C	1 / 1	Yes
PW-LM23	Arsenic	1 / 1	0.85	0.045 C	1 / 1	Yes
	Barium	1 / 1	34.6	260 N	0 / 1	No
	Calcium (3)	1 / 1	67,100	NC	0 / 1	No
	Copper	1 / 1	11.15	150 N	0 / 1	No
	Iron (3)	1 / 1	30.1	1,100 N	0 / 1	No
	Magnesium (3)	1 / 1	44,000	NC	0 / 1	No
	Manganese	1 / 1	3.45	73.0 N	0 / 1	No
	Potassium (3)	1 / 1	1,680	NC	0 / 1	No
	Sodium (3)	1 / 1	32,350	NC	0 / 1	No
	Thallium	1 / 1	1.95	0.26 N	1 / 1	Yes
	Zinc	1 / 1	10.35	1,100 N	0 / 1	No
PW-LM26	Aluminum	1 / 1	1,070	3,700 N	0 / 1	No
	Barium	1 / 1	48.1	260 N	0 / 1	No
	Calcium (3)	1 / 1	76,600	NC	0 / 1	No
	Copper	1 / 1	8.5	150 N	0 / 1	No
	Iron (3)	1 / 1	1,910	1,100 N	1 / 1	Yes
	Lead (2)	1 / 1	129	15.0	1 / 1	Yes
	Magnesium (3)	1 / 1	34,200	NC	0 / 1	No
	Manganese	1 / 1	188	73.0 N	1 / 1	Yes
	Potassium (3)	1 / 1	4,670	NC	0 / 1	No
	Sodium (3)	1 / 1	33,600	NC	0 / 1	No
	Vanadium	1 / 1	2.0 B	26.0 N	0 / 1	No
	Zinc	1 / 1	83.1	1,100 N	0 / 1	No
	2-Butanone	1 / 1	8.7 L	190 N	0 / 1	No
PW-SA07	Barium	1 / 1	10.7 B	260 N	0 / 1	No
	Calcium (3)	1 / 1	9,460	NC	0 / 1	No
	Copper	1 / 1	11.4	150 N	0 / 1	No
	Iron (3)	1 / 1	19.3 B	1,100 N	0 / 1	No
	Magnesium (3)	1 / 1	20,900	NC	0 / 1	No
	Manganese	1 / 1	2.1 B	73.0 N	0 / 1	No
	Potassium (3)	1 / 1	17,100	NC	0 / 1	No
	Sodium (3)	1 / 1	118,000	NC	0 / 1	No
	Thallium	1 / 1	2.0 B	0.26 N	1 / 1	Yes
	Zinc	1 / 1	17.1 B	1,100 N	0 / 1	No

Table 6 Continued

COMPARISON OF POTENTIALLY SITE-RELATED OFF-SITE GROUNDWATER SAMPLES FROM PRIVATE OR PUBLIC SUPPLY WELLS TO USEPA REGION III RBCs
PRE-REMEDIAL INVESTIGATION SAMPLING EVENT

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

Well Location	Constituent	Detection Frequency	Maximum Detected Concentration (ug/L)	RBC (Tap Water) (ug/L)	Number of RBC Exceedances (Tap Water/Number of Detections (ug/L) (1)	PCOC
PW-SA08	Barium	1 / 1	24.9	260 N	0 / 1	No
	Calcium (3)	1 / 1	34,350	NC	0 / 1	No
	Copper	1 / 1	6.65	150 N	0 / 1	No
	Iron (3)	1 / 1	7.95	1,100 N	0 / 1	No
	Lead (2)	1 / 1	1.7	15.0	0 / 1	No
	Magnesium (3)	1 / 1	22,150	NC	0 / 1	No
	Manganese	1 / 1	2.5	73.0 N	0 / 1	No
	Potassium (3)	1 / 1	2,120	NC	0 / 1	No
	Sodium (3)	1 / 1	6,925	NC	0 / 1	No
	Thallium	1 / 1	1.575	0.28 N	1 / 1	Yes
	Zinc	1 / 1	5.45	1,100 N	0 / 1	No
	1,1,1-Trichloroethane	1 / 1	0.35	54.0 N	0 / 1	No
	2-Butanone	1 / 1	9.5	190 N	0 / 1	No
	Tetrachloroethene	1 / 1	5.1	1.1 C	1 / 1	Yes
	Trichloroethene	1 / 1	1.2	1.6 C	0 / 1	No
SP-03	Barium	1 / 1	30.2	260 N	0 / 1	No
	Beryllium	1 / 1	0.3 B	7.3 N	0 / 1	No
	Calcium (3)	1 / 1	43,000	NC	0 / 1	No
	Iron (3)	1 / 1	8.8 B	1,100 N	0 / 1	No
	Magnesium (3)	1 / 1	27,200	NC	0 / 1	No
	Manganese	1 / 1	1.3	73.0 N	0 / 1	No
	Potassium (3)	1 / 1	2,690	NC	0 / 1	No
	Sodium (3)	1 / 1	9,820	NC	0 / 1	No
	1,1,1-Trichloroethane	1 / 1	0.1 J	54.0 N	0 / 1	No
	Benzene	1 / 1	0.1 J	0.36 C	0 / 1	No
	Carbon tetrachloride	1 / 1	0.5 J	0.16 C	1 / 1	Yes
	cis-1,2-Dichloroethene	1 / 1	0.1 J	6.1 N	0 / 1	No
	Tetrachloroethene	1 / 1	8.7	1.1 C	1 / 1	Yes
	Trichloroethene	1 / 1	14.0	1.6 C	1 / 1	Yes

Notes:

RBC = Risk Based Concentrations.
(1) Exceedance of RBC value for carcinogens; exceedance of one-tenth the RBC value for non-carcinogens.
(2) USEPA 1994 Safe Drinking Water Act action level for lead in tap water.
(3) Essential nutrient.

Lab Data Qualifiers:

B = The reported value is less than the contract required detection limit, but greater than or equal to the instrument detection limit.
J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.

RBC Criteria Qualifiers:

C = Carcinogenic effects.
N = Noncarcinogenic effects.
NC = No criteria.
C1 = RBC at HI of 0.1 is less than RBC (C); value shown is value provided in USEPA Region III RBC table

References:

United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania. Memorandum dated March 17, 1997, from Ray L. Smith, Ph.D., Toxicologist, to RBC Table mailing list. Subject: Updated Risk-Based Concentration Table.
United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania. Memorandum dated April 1, 1998 from Jennifer Hubbard, Toxicologist, to RBC Table mailing list. Subject: Risk-Based Concentration Table.

Table 7

COMPARISON OF POTENTIALLY SITE-RELATED OFF-SITE GROUNDWATER SAMPLES FROM MONITORING WELLS TO USEPA REGION III RBCs
REMEDIAL INVESTIGATION SAMPLING EVENT

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

Well Location	Chemical	Detection Frequency	Maximum Detected Concentration (ug/L)	RBC (Top Sheet) (ug/L)	Number of RBC Exceedances (Top Sheet) Number of Detections (ug/L) (1)	Chemical of Potential Concern
MW-10D	Nitrogen, Ammonia	1 / 1	14,200	21.0 N	1 / 1	Yes
	Sulfate	1 / 1	32,200	NC	0 / 1	No
	Acetone	1 / 1	100 J	370 N	0 / 1	No
MW-10I	Nitrate	1 / 1	6,770	NC	0 / 1	No
	Trichloroethane	1 / 1	3.0	1.8 C	1 / 1	Yes
MW-10S	Nitrate	1 / 1	17,400	NC	0 / 1	No
	Nitrogen, Ammonia	1 / 1	2,840	21.0 N	1 / 1	Yes
	Sulfate	1 / 1	30,100	NC	0 / 1	No
MW-11D	Nitrate	1 / 1	6,870	NC	0 / 1	No
	Sulfate	1 / 1	11,900	NC	0 / 1	No
	Trichloroethane	1 / 1	4.0	1.8 C	1 / 1	Yes
MW-11S	Nitrate	1 / 1	20,000	NC	0 / 1	No
	Trichloroethane	1 / 1	2.0	1.8 C	1 / 1	Yes
MW-5D	Nitrate	1 / 1	1,070	NC	0 / 1	No
	Sulfate	1 / 1	24,900	NC	0 / 1	No
	Carbon tetrachloride	1 / 1	2.0	0.18 C	1 / 1	Yes
	Chloroform	1 / 1	2.0	0.18 C1	1 / 1	Yes
	cis-1,2-Dichloroethene	1 / 1	2.0	6.1 N	0 / 1	No
	Toluene	1 / 1	0.6 J	75.0 N	0 / 1	No
	Trichloroethene	1 / 1	9.0	1.8 C	1 / 1	Yes
MW-6S	Nitrate	1 / 1	4,880	NC	0 / 1	No
	Ortho Phosphate	1 / 1	440	NC	0 / 1	No
	Sulfate	1 / 1	49,800	NC	0 / 1	No
	Acetone	1 / 1	5.0 J	370 N	0 / 1	No
MW-8D	Nitrate	1 / 1	21,000	NC	0 / 1	No
MW-8S	Nitrate	1 / 1	11,300	NC	0 / 1	No
	Nitrogen, Ammonia	1 / 1	9,650	21.0 N	1 / 1	Yes
	Sulfate	1 / 1	68,800	NC	0 / 1	No
	Chloromethane	1 / 1	1.0 J	1.5 C	0 / 1	No
	Trichloroethane	1 / 1	0.9 J	1.8 C	0 / 1	No

Notes:

RBC = Risk Based Concentrations.
(1) Exceedance of RBC value for carcinogens; exceedance of one-tenth the RBC value for non-carcinogens.

Lab Data Qualifiers:

J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.

RBC Criteria Qualifiers:

C = Carcinogenic effects.
N = Noncarcinogenic effects.
NC = No criteria.
C1 = RBC at HI of 0.1 is less than RBC (C); value shown is value provided in USEPA Region III RBC table

References:

United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania. Memorandum dated March 17, 1997, from Ray L. Smith, Ph.D., Toxicologist, to RBC Table mailing list. Subject: Updated Risk-Based Concentration Table.
United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania. Memorandum dated April 1, 1996 from Jennifer Hubbard, Toxicologist, to RBC Table mailing list. Subject: Risk-Based Concentration Table.

Table 8

COMPARISON OF NON-SITE RELATED OFF-SITE GROUNDWATER SAMPLES FROM PRIVATE OR PUBLIC SUPPLY WELLS WITH USEPA REGION III RBCs
PRE-REMEDIAL INVESTIGATION SAMPLING EVENT

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

Constituent	Detection Frequency	Maximum Detected Concentration (ug/L)	RBC (Tap Water) (ug/L)	Number of RBC Exceedances (Tap Water/Number of Detections (ug/L) (1))	Range of Detected Concentrations (ug/L)	Location of Maximum Detected Concentration	PCOC
Volatile Organic Compounds							
1,1,1-Trichloroethane	5 / 28	0.7 J	54.0 N	0 / 5	0.1 - 0.7	PSW-8	No
2-Butanone	2 / 2	15.0 L	190 N	0 / 2	12.0 - 15.0	PW-UM63	No
Acetone	5 / 5	9.6 L	370 N	0 / 5	1.2 - 9.6	PW-UM40	No
Bromoform	1 / 28	0.2 J	2.3 C	0 / 1	0.2 - 0.2	PW-SA06	No
Carbon tetrachloride	2 / 28	0.4 J	0.16 C	2 / 2	0.2 - 0.4	PSW-3	Yes
cis-1,2-Dichloroethene	5 / 28	2.0	6.1 N	0 / 5	0.1 - 2.0	PSW-1	No
Ethylbenzene	1 / 28	0.35	130 N	0 / 1	0.35 - 0.35	PSW-4	No
Tetrachloroethene	4 / 28	20.0	1.1 C	2 / 4	0.3 - 20.0	PSW-4	Yes
Toluene	2 / 28	0.35	75.0 N	0 / 2	0.2 - 0.35	PSW-4	No
Trichloroethene	7 / 28	10.0	1.6 C	4 / 7	0.4 - 10.0	PSW-1	Yes
Xylenes, Total	3 / 28	1.9	1,200 N	0 / 3	0.35 - 1.9	PSW-4	No
Inorganic Constituents							
Aluminum	4 / 28	153	3,700 N	0 / 4	14.1 - 153	PW-1482	No
Antimony	13 / 28	21.8 B	1.5 N	13 / 13	8.6 - 21.8	PW-UM40	Yes
Arsenic	3 / 28	2.6	0.045 C	3 / 3	1.6 - 2.6	PW-UM64	Yes
Barium	27 / 28	11,563.95	260 N	2 / 27	4.65 - 11,563.95	PSW-4	Yes
Beryllium	5 / 28	0.99 B	7.3 N	0 / 5	0.63 - 0.99	PW-SA06	No
Cadmium	1 / 28	2.3 B	1.8 N	1 / 1	2.3 - 2.3	PW-UM62	Yes
Calcium (3)	28 / 28	55,300	NC	0 / 28	682 - 55,300	PW-LE411	No
Cobalt	1 / 28	2.45	220 N	0 / 1	2.45 - 2.45	PSW-4	No
Copper	17 / 28	196	150 N	2 / 17	4.75 - 196	PW-UM62	Yes
Cyanide, Total	1 / 28	3.9	73.0 N	0 / 1	3.9 - 3.9	PSW-2	No
Iron (3)	28 / 28	1,630	1,100 N	1 / 28	5.0 - 1,630	PW-SA06	No
Lead (2)	19 / 28	128.4	15.0	1 / 19	0.435 - 128.4	PW-UM61	Yes
Magnesium (3)	28 / 28	39,000	NC	0 / 28	413 - 39,000	PW-LE411	No
Manganese	23 / 28	281	73.0 N	2 / 23	1.2 - 281	PW-SA06	Yes
Mercury	3 / 28	0.11 B	1.1 N	0 / 3	0.075 - 0.11	PW-SA06	No
Nickel	3 / 28	8.1	73.0 N	0 / 3	4.5 - 8.1	PW-LE311	No
Potassium (3)	28 / 28	5,290	NC	0 / 28	382 - 5,290	PW-LE411	No
Selenium	7 / 28	965.225	18.0 N	1 / 7	0.775 - 965.225	PW-LE677	Yes
Silver	1 / 28	25.5 K	18.0 N	1 / 1	25.5 - 25.5	PW-UM26	Yes
Sodium (3)	28 / 28	99,700	NC	0 / 28	3,060 - 99,700	PW-UM27	No
Thallium	4 / 28	4.25	0.26 N	4 / 4	1.9 - 4.25	PW-UM68	Yes
Zinc	22 / 28	4,870	1,100 N	1 / 22	6.9 - 4,870	PW-LE311	Yes

Notes:

RBC = Risk Based Concentrations.
(1) Exceedance of RBC value for carcinogens; exceedance of one-tenth the RBC value for non-carcinogens.
(2) USEPA 1994 Safe Drinking Water Act action level for lead in tap water.
(3) Essential nutrient.

Lab Data Qualifiers:

B (Inorganics) = The reported value is less than the contract required detection limit, but greater than or equal to the instrument detection limit.
J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.

RBC Criteria Qualifiers:

C = Carcinogenic effects.
N = Noncarcinogenic effects.
NC = No criteria.

References:

United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania, Memorandum dated March 17, 1997, from Roy L. Smith, Ph.D., Toxicologist, to RBC Table mailing list, Subject: Updated Risk-Based Concentration Table.
United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania, Memorandum dated April 1, 1998 from Jennifer Hubbard, Toxicologist, to RBC Table mailing list, Subject: Risk-Based Concentration Table.

Tble 9

COMPARISON OF NON-SITE RELATED OFF-SITE GROUNDWATER SAMPLES FROM MONITORING WELLS TO USEPA REGION III RBCs
REMEDIAL INVESTIGATION SAMPLING EVENT

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

Constituent	Detection Frequency	Maximum Detected Concentration (ug/L)	RBC (Tap Water) (ug/L)	Number of RBC Exceedances (Tap Water)/Number of Detections (ug/L) (1)	Range of Detected Concentrations (ug/L)	Location of Maximum Detected Concentration	PRGC?
Volatile Organic Compounds							
1,1-Dichloroethane	1 / 7	4.0 J	80.0 N	0 / 1	4.0 - 4.0	MW-9D	No
1,1-Dichloroethane	1 / 7	3.0 J	0.044 C	1 / 1	3.0 - 3.0	MW-9D	Yes
Acetone	1 / 7	4.25	370 N	0 / 1	4.25 - 4.25	MW-6	No
Carbon tetrachloride	1 / 7	130 EJ	0.16 C	1 / 1	130 - 130	MW-9D	Yes
Chloroform	1 / 7	190 JD	0.15 C I	1 / 1	190 - 190	MW-9D	Yes
cis-1,2-Dichloroethene	1 / 7	38.0 J	6.1 N	1 / 1	38.0 - 38.0	MW-9D	Yes
Tetrachloroethene	1 / 7	51.0 EJ	1.1 C	1 / 1	51.0 - 51.0	MW-9D	Yes
Trichloroethene	2 / 7	1,000 D	1.8 C	2 / 2	22.0 - 1,000	MW-9D	Yes
General Parameters							
Nitrate	7 / 7	13,850	NC	0 / 7	220 - 13,850	MW-7S	No
Sulfate	7 / 7	64,750	NC	0 / 7	10,600 - 64,750	MW-7S	No

Notes:

RBC = Risk Based Concentrations.
(1) Exceedance of RBC value for carcinogens; exceedance of one-tenth the RBC value for non-carcinogens.

Lab Data Qualifiers:

B = The reported value is less than the contract required detection limit, but greater than or equal to the instrument detection limit.
J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.

RBC Criteria Qualifiers:

C = Carcinogenic effects.
N = Noncarcinogenic effects.
NC = No criteria.
CI = RBC or HI of 0.1 is less than RBC (C); value shown is value provided in USEPA Region III RBC table

References:

United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania, Memorandum dated March 17, 1997, from Ray L. Smith, Ph.D., Toxicologist, to RBC Table mailing list, Subject: Updated Risk-Based Concentration Table.
United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania, Memorandum dated April 1, 1996 from Jennifer Hubbard, Toxicologist, to RBC Table mailing list, Subject: Risk-Based Concentration Table.

COMPARISON OF OFF SITE SPRING WATER SAMPLES WITH USEPA SCREENING VALUES

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

Constituent	Detection Frequency	Range of Detected Concentration (ug/L)	Maximum Detected Concentration (ug/L)	Location of Maximum Detected Concentration	RBC (Tap Water) (ug/L)	Number of RBC Exceedances (Tap Water)/Number of Detections (1)
1,1,1-Trichloroethane	1 / 2	0.1	0.1 J	SP-03	54.0 N	0 / 1
Acetone	1 / 1	1.4	1.4 L	SP-LE(SP73	370 N	0 / 1
Benzene	1 / 2	0.1	0.1 J	SP-03	0.36 C	0 / 1
Carbon tetrachloride	1 / 2	0.6	0.6 J	SP-03	0.16 C	1 / 1
cis-1,2 Dichloroethene	1 / 2	0.1	0.1 J	SP-03	0.1 N	0 / 1
Tetrachloroethene	2 / 2	0.2 - 0.7	0.7	SP-03	1.1 C	1 / 2
Trichloroethene	2 / 2	0.2 - 14.0	14.0	SP-03	1.6 C	1 / 2
Aluminum	1 / 4	134	134	SP-02	3,700 N	0 / 1
Barium	4 / 4	23.8 - 30.2	30.2	SP-03	260 N	0 / 4
Beryllium	2 / 4	0.3 - 0.37	0.37	SP-02	7.3 N	0 / 2
Calcium (3)	4 / 4	41,700 - 42,100	42,100	SP-02	NC	0 / 4
Iron (3)	4 / 4	0.8 - 213	213	SP-02	1,100 N	0 / 4
Lead (2)	2 / 4	0.84 - 1.8	1.8 B	SP-02	15.0	0 / 2
Magnesium (3)	4 / 4	23,800 - 27,200	27,200	SP-03	NC	0 / 4
Manganese	2 / 4	1.3 - 6.9	6.9	SP-02	73.0 N	0 / 2
Potassium (3)	4 / 4	2,220 - 2,890	2,890	SP-03	NC	0 / 4
Sodium (3)	4 / 4	8,960 - 11,200	11,200	SP-02	NC	0 / 4
Zinc	3 / 4	3.976 - 8.0	8.0	SP-02	1,100 N	0 / 3

RBC = Risk Based Concentrations.

(1) Exceedance of RBC value for carcinogens; exceedance of one-tenth the RBC value for non-carcinogens

(2) USEPA 1994 Safe Drinking Water Act action level for lead in tap water.

(3) Essential nutrient

Lab Data Qualifiers:

J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.

L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.

NJ = Analyte indicates the presence of a compound for which there is presumptive evidence to make a tentative identification. The associated numerical value is an estimated concentration only.

RBC Criteria Qualifiers:

C = Carcinogenic effects.

N = Noncarcinogenic effects

NC = No criteria

References:

United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania, Memorandum dated March 17, 1997, from Roy L. Smith, Ph.D., Toxicologist, to RBC Table mailing list, Subject: Updated Risk-Based Concentration Table.

United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania, Memorandum dated April 1, 1996 from Jennifer Hubbard, Toxicologist, to RBC Table mailing list, Subject: Risk-Based Concentration Table.

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Table 11

COMPARISON OF OFF-SITE SURFACE WATER WITH USEPA SCREENING VALUES

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

Constituent	Detection Frequency	Range of Detected Concentrations (ug/L)	Maximum Detected Concentration (ug/L)	Location of Maximum Detected Concentration	RBC (Tap Water) (ug/L)	Number of RBC Exceedances (Tap Water)/Number of Detections (1)
Acetone	2 / 2	1.2 - 10.0	10.0	SW-3	3,700 N	0 / 2
Benzene	1 / 4	0.3	0.3	SW-3	3.0 C	0 / 1
Carbon disulfide	1 / 4	0.46	0.46	SW-3	1,000 N	0 / 1
cis-1,2-Dichloroethene	1 / 4	1	1.0 J	SW-11	61.0 N	0 / 1
Tetrachloroethene	1 / 4	1	1.0 J	SW-11	11.0 C	0 / 1
Toluene	1 / 4	0.16	0.16	SW-3	750 N	0 / 1
Trichloroethene	2 / 4	0.2	0.2 J	SW-10, SW-11	16.0 C	0 / 2
Aluminum	13 / 13	46.8 - 610.8	610.8	SW-9	37,000 N	0 / 13
Arsenic	3 / 13	0.9 - 1.8	1.8 K	SW-16	0.48 C	3 / 3
Barium	13 / 13	24.6 - 72.6	72.6	SW-16	2,600 N	0 / 13
Beryllium	3 / 13	0.226 - 0.3	0.3 B	SW-12	73.0 N	0 / 3
Cadmium	2 / 13	2.36 - 2.6	2.6	SW-9	18.0 N	0 / 2
Calcium	13 / 13	19,800 - 44,600	44,600	SW-9	NC	0 / 13
Copper	1 / 13	8.7	8.7 B	SW-16	1,500 N	0 / 1
Iron	13 / 13	84.6 - 741.6	741.6	SW-9	11,000 N	0 / 13
Lead (2)	13 / 13	0.81 - 2.6	2.6	SW-9	15.0	0 / 13
Magnesium	13 / 13	7,440 - 19,700	19,700	SW-12	NC	0 / 13
Manganese	13 / 13	6.2 - 36.3	36.3	SW-16	730 N	0 / 13
Mercury	1 / 13	0.1	0.1 L	SW-12	11.0 N	0 / 1
Potassium	13 / 13	1,670 - 2,068	2,068	SW-11	NC	0 / 13
Sodium	13 / 13	8,310 - 13,600	13,600	SW-9	NC	0 / 13
Vanadium	1 / 13	2.1	2.1	SW-16	260 N	0 / 1
Zinc	13 / 13	2.7 - 40.6	40.6	SW-16	11,000 N	0 / 13

RBC = Risk Based Concentrations.

(1) Exceedance of RBC value equal to 10% ground water screening value

(2) USEPA 1994 Safe Drinking Water Act action level for lead in tap water.

Lab Data Qualifiers:

J = The compound was positively identified; however, the associated numerical value is an estimated concentration only

L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.

NJ = Analyte indicates the presence of a compound for which there is presumptive evidence to make a tentative identification. The associated numerical value is an estimated concentration only.

RBC Criteria Qualifiers:

C = Carcinogenic effects

N = Noncarcinogenic effects

NC = No criteria

References:

United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania, Memorandum dated March 17, 1997, from Roy L. Smith, Ph.D., Toxicologist, to RBC Table mailing list, Subject: Updated Risk Based Concentration Table

United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania, Memorandum dated April 1, 1996 from Jennifer Hubbard, Toxicologist, to RBC Table mailing list, Subject: Risk Based Concentration Table

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Table 12

COMPARISON OF OFF-SITE SEDIMENT SAMPLES WITH USEPA SCREENING VALUES

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

Compound	Detection Frequency	Range of Detected Concentrations (mg/kg)	Location of Maximum Detected Concentration	Maximum Detected Concentration (mg/kg)	RBC Risk Equivalent (mg/kg)	Number of RBC Exceedances (Risk Equivalent of Maximum Hit)
4-Methyl-2-pentanone	1/14	0.004	SD-1	0.004 J	6,300 N	0/1
Acetone	1/1	0.20	SD-9	0.20	7,800 N	0/1
Methylene chloride	1/9	0.002	SD-11	0.002	900 C	0/1
Toluene	1/14	0.0005	SD-9	0.0005	10,000 N	0/1
Aluminum	14/14	1,930 - 17,400	SD-4	17,400	78,000 N	0/14
Antimony	2/14	4.4 - 107	SD-3	107 UL	31 N	1/2
Arsenic	14/14	0.70 - 9.7	SD-9	9.7 J	4.3 C	0/14
Barium	14/14	19.9 - 131	SD-15	131	5,500 N	0/14
Beryllium	12/14	0.22 - 0.4	SD-10	0.4	100 N	0/12
Cadmium	12/14	0.07 - 19.2	SD-10	19.2	39.0 N	0/12
Calcium	14/14	2,550 - 50,000	SD-3	50,000	NC	0/14
Chromium	14/14	5.3 - 231	SD-10	231 J	300 N	0/14
Cobalt	14/14	4.8 - 43.8	SD-10	43.8	4,700 N	0/14
Copper	14/14	3.1 - 500	SD-10	500	3,100 N	0/14
Cyanide, Total	1/14	0.2475	SD-3	0.2475	1,000 N	0/1
Iron	14/14	8,300 - 134,000	SD-10	134,000	23,000 N	7/14
Lead	14/14	3.6 - 402	SD-10	402 J	400	1/14
Magnesium	14/14	1,300 - 10,000	SD-3	10,000	NC	0/14
Manganese	14/14	100 - 2,040	SD-10	2,040 J	1,000 N	2/14
Mercury	3/14	0.04 - 0.140	SD-4	0.140 B	23.0 N	0/3
Nickel	14/14	3.6 - 146	SD-10	146	1,000 N	0/14
Potassium	14/14	232 - 3,510	SD-4	3,510	NC	0/14
Selenium	6/14	0.34 - 0.720	SD-3	0.720	390 N	0/6
Silver	1/14	1.0	SD-3	1.0	390 N	0/1
Sodium	14/14	41.0 - 600	SD-10	600	NC	0/14
Vanadium	14/14	6.0 - 84.0	SD-10	84.0	550 N	0/14
Zinc	14/14	37.0 - 3,230	SD-10	3,230	23,000 N	0/14

Notes:

(1) Exceedance of RBC screening value equal to 10N the soil residential RBC for carcinogenic (C-qualified) compounds and to the actual RBC for non-carcinogenic (N qualified) compounds.

(2) United States Environmental Protection Agency (USEPA) screening value for lead in soil residential setting), USEPA 1994, OSWER Directive #9355 4-12.

Lab Data Qualifiers:

J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.

L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.

NJ = Analyte indicates the presence of a compound for which there is presumptive evidence to make a tentative identification. The associated numerical value is an estimated concentration only.

RBC Criteria Qualifiers:

C = Carcinogenic effects

N = Noncarcinogenic effects

NC = No criteria

References:

United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania, Memorandum dated March 17, 1997, from Ray L. Smith, Ph.D., Toxicologist, to RBC Table mailing list, Subject: Updated Risk-Based Concentration Table.

United States Environmental Protection Agency, Region III, Philadelphia, Pennsylvania, Memorandum dated April 1, 1998 from Jennifer Hubbard, Toxicologist, to RBC Table mailing list, Subject: Risk-Based Concentration Table.

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Table 13

Well Categories and Analytical Parameter Summary
Redate Manufacturing Site
Emmaus, Pennsylvania

Well ID	Well Type	Analytical Parameters					
		Pre-Remedial Investigation			Remedial Investigation		
		June-August 1993	Sept 1994	Dec 1994	Aug 1995	Oct 1996	Jan 1997
On-Site Monitoring Wells							
MW-1	M	VOC, SVOC, PCB, Inorganic	-	-	-	SVOC, Inorganic, General Chemistry	VOC
MW-2	M	VOC, SVOC, PCB, Inorganic	-	-	-	SVOC, Inorganic, General Chemistry	VOC
MW-3	M	VOC, SVOC, Inorganic	-	-	-	SVOC, Inorganic, General Chemistry	VOC
MW-4	M	VOC, SVOC, PCB, Inorganic	-	-	VOC, Inorganic	-	-
RW-3	M	-	VOC, Inorganic	-	VOC, Inorganic	SVOC, Inorganic, General Chemistry	VOC
Well 1	M	VOC, SVOC, PCB, Inorganic	-	-	-	SVOC, Inorganic, General Chemistry	VOC
Well 2	M	VOC, SVOC, PCB, Inorganic	-	-	-	SVOC, Inorganic, General Chemistry	VOC
Well 3	M	VOC, SVOC, PCB, Inorganic	-	-	-	SVOC, Inorganic, General Chemistry	VOC
Well 4	M	VOC, SVOC, PCB, Inorganic	-	-	-	SVOC, Inorganic, General Chemistry	VOC
Well 5	M	VOC, SVOC, PCB, Inorganic	-	-	-	-	-
Well 6	M	VOC, SVOC, PCB, Inorganic	-	-	-	SVOC, Inorganic, General Chemistry	VOC
Well 7	M	-	VOC, SVOC, Inorganic	VOC, SVOC, Inorganic	-	-	-
Off-Site Potentially Site-Related Potable Wells							
EM08	P	VOC, SVOC, Inorganic	-	-	-	-	-
EM09	P	VOC, SVOC, Inorganic	-	-	-	-	-
LM20	P	VOC, SVOC, Inorganic	-	-	-	-	-
LM21	P	VOC, SVOC, Inorganic	-	-	-	-	-
LM23	P	VOC, SVOC, Inorganic	-	-	-	-	-
LM28	P	VOC, SVOC, Inorganic	-	-	-	-	-
SA07	P	VOC, SVOC, Inorganic	-	-	-	-	-
SA08	P	VOC, SVOC, Inorganic	-	-	-	-	-
PSW-7	B	VOC, SVOC, Inorganic	-	-	-	-	-
Off-Site Potentially Site-Related Monitoring Wells							
MW-5S	M	-	-	-	-	SVOC, General Chemistry	VOC
MW-5D	M	-	-	-	-	SVOC, General Chemistry	VOC
MW-9S	M	-	-	-	-	SVOC, General Chemistry	VOC
MW-9D	M	-	-	-	-	SVOC, General Chemistry	VOC
MW-10S	M	-	-	-	-	SVOC, General Chemistry	VOC
MW-10I	M	-	-	-	-	SVOC, General Chemistry	VOC
MW-10D	M	-	-	-	-	SVOC, General Chemistry	VOC
MW-11S	M	-	-	-	-	SVOC, General Chemistry	VOC
MW-11D	M	-	-	-	-	SVOC, General Chemistry	VOC
Off-Site Non-Site Related Potable Wells							
0361	P	VOC, SVOC, Inorganic	-	-	-	-	-
1462	P	VOC, SVOC, Inorganic	-	-	-	-	-
1501	P	VOC, SVOC, Inorganic	-	-	-	-	-
LE311	P	VOC, SVOC, Inorganic	-	-	-	-	-
LE312	P	VOC, SVOC, Inorganic	-	-	-	-	-
LE411	P	VOC, SVOC, Inorganic	-	-	-	-	-
LE577	P	VOC, SVOC, Inorganic	-	-	-	-	-
LE1293	P	VOC, SVOC, Inorganic	-	-	-	-	-
LM10	P	VOC, SVOC, Inorganic	-	-	-	-	-
LM26	P	VOC, SVOC, Inorganic	-	-	-	-	-
LM27	P	VOC, SVOC, Inorganic	-	-	-	-	-
SA05	P	VOC, SVOC, Inorganic	-	-	-	-	-
SA09	P	VOC, SVOC, Inorganic	-	-	-	-	-
UM40	P	VOC, SVOC, Inorganic	-	-	-	-	-
UM43	P	VOC, SVOC, Inorganic	-	-	-	-	-
UM45	P	VOC, SVOC, Inorganic	-	-	-	-	-
UM56	P	VOC, SVOC, Inorganic	-	-	-	-	-
UM59	P	VOC, SVOC, Inorganic	-	-	-	-	-
UM60	P	VOC, SVOC, Inorganic	-	-	-	-	-
UM61	P	VOC, SVOC, Inorganic	-	-	-	-	-
UM62	P	VOC, SVOC, Inorganic	-	-	-	-	-
UM63	P	VOC, SVOC, Inorganic	-	-	-	-	-
UM64	P	VOC, SVOC, Inorganic	-	-	-	-	-
PSW-1	B	VOC, SVOC, Inorganic	-	-	-	-	-
PSW-2	B	VOC, SVOC, Inorganic	-	-	-	-	-
PSW-3	B	VOC, SVOC, Inorganic	-	-	-	-	-
PSW-4	B	VOC, SVOC, Inorganic	-	-	-	-	-
PSW-6	B	VOC, SVOC, Inorganic	-	-	-	-	-
Off-Site Non-Site Related Monitoring Wells							
MW-6	M	-	-	-	-	SVOC, General Chemistry	VOC
MW-7S	M	-	-	-	-	SVOC, General Chemistry	VOC
MW-7D	M	-	-	-	-	SVOC, General Chemistry	VOC
MW-8S	M	-	-	-	-	SVOC, General Chemistry	VOC
MW-8D	M	-	-	-	-	SVOC, General Chemistry	VOC
MW-12S	M	-	-	-	-	SVOC, General Chemistry	VOC
MW-12D	M	-	-	-	-	SVOC, General Chemistry	VOC
Off-Site Springs							
SP-02	S	Inorganic	-	-	-	-	-
SP-03	S	VOC, SVOC, Inorganic			-	-	-
SP-LESP73	S	VOC, Inorganic			-	-	-
SP-LESP78	S	Inorganic			-	-	-

Well Types:
M - Monitoring
P - Private
B - Public
S - Spring

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Table 14

Summary of Potential Exposure Pathways
Rodale Manufacturing Site
Emmaus, Pennsylvania

Source Medium	Migration/Release Mechanism	Route of Potential Human Exposure
Soil	Direct Contact	Incidental ingestion, dermal contact
	Particulate Emissions	Inhalation
	Direct Volatilization (VOCs only)	Inhalation
	Leaching of PCOCs	Ground-water exposures
	Surface Runoff	Dermal contact
Ground Water	Potable Use	Ingestion, dermal contact, inhalation of VOCS
	Discharge to Surface Water	Surface water exposures
Surface Water	Direct Contact	Incidental ingestion, dermal contact
	Direct Volatilization (VOCs only)	Inhalation
	Bioaccumulation by aquatic organisms	Ingestion
Sediment	Direct Contact	Incidental ingestion, dermal contact
	Leaching of PCOCs	Surface water exposures
	Bioaccumulation by aquatic organisms	Ingestion

VOCs - Volatile Organic Compounds
PCOCs - Potential Constituents of Concern

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Table 15

Toxicity Indices - Potential Carcinogenic Effects
Rodale Manufacturing Site
Emmaus, Pennsylvania

	SFo/SFi (kg-d/mg)	Weight-of Evidence Classification	SF Basis/ SF Source
Oral Route			
VOCs			
Carbon tetrachloride	0.13	B2	IRIS
Chloroform	6.10E-03	B2	IRIS
Chloromethane	0.013	C	HEAST
1,1-Dichloroethene	0.6	C	IRIS
Tetrachloroethene	5.20E-02		NCEA
Trichloroethene	1.10E-02		NCEA
Vinyl chloride	1.90E+00	A	HEAST
SVOCs			
1,4-Dichlorobenzene	2.40E-02	C	HEAST
Bis(2-ethylhexyl)phthalate	1.40E-02	B2	IRIS
Pentachlorophenol	1.20E-01	B2	IRIS
METALS			
Arsenic	1.50E+00	A	IRIS
Inhalation Route			
VOCs			
Carbon tetrachloride	5.30E-02	B2	IRIS
Chloroform	8.10E-02	B2	IRIS
Chloromethane	6.00E-03	C	HEAST
1,1-Dichloroethene	1.75E-01	C	IRIS
Tetrachloroethene	2.00E-03		NCEA
Trichloroethene	6.00E-03		NCEA
Vinyl chloride	3.00E-01	A	HEAST
SVOCs			
1,4-Dichlorobenzene	2.20E-02		NCEA
Bis(2-ethylhexyl)phthalate	1.40E-02		NCEA
METALS			
Arsenic	1.51E+01	A	IRIS
Cadmium	6.30E+00	B1	IRIS
Chromium VI	4.10E+01	A	IRIS

Weight-of-Evidence Classifications:
A - human carcinogen
B2 - probable human carcinogen
C - possible human carcinogen
IRIS = Integrated Risk Information System (USEPA, 1998)

Table 16

Toxicity Indices - Potential Noncarcinogenic Effects
Rodale Manufacturing Site
Emmaus, Pennsylvania

	RfD (mg/kg-d)	Confidence Level	Critical Effect	RfD/RfC Basis/ RfD/RfC Source	Uncertainty Factor	Modifying Factor
Oral Route						
VOCs						
Carbon tetrachloride	0.0007	Medium	Liver (lesions)	LOAEL/IRIS	1000	1
Chloroform	0.01	Medium	Liver (lesions)	LOAEL/IRIS	1000	1
1,1-Dichloroethene	9.00E-03	Medium	Liver (lesions)	LOAEL/IRIS	1,000	1
cis-1,2-Dichloroethene	1.00E-02	-	Blood (dec. hemoglobin)	NOAEL/HEAST	1,000	3
Tetrachloroethene	1.00E-02	Medium	Liver (hepatotoxicity)	LOAEL/IRIS	1,000	1
Toluene	2.00E-01	Medium	Liver/Kidney (weight)	NOAEL/IRIS	100	1
Trichloroethene	0.006	-	-	NCEA	-	-
SVOCs						
1,4-Dichlorobenzene	0.03	-	-	NCEA	-	-
4-Methylphenol	0.005	-	Central nervous system (hypoactivity)	NOAEL/HEAST	100	1
Bis(2-ethylhexyl)phthalate	0.02	Medium	Liver (weight)	LOAEL/IRIS	1000	1
Pentachlorophenol	0.03	Medium	Fetotoxicity	NOAEL/IRIS	100	1
METALS						
Aluminum	1.00E+00	Low	Neurotoxicity	LOAEL/USEPA Region III	100	1
Antimony	4.00E-04	Low	Longevity (dec. blood glucose)	LOAEL/IRIS	1,000	1
Arsenic	3.00E-04	Medium	Skin (hyperpigmentation, keratosis,)	NOAEL/IRIS	3	1
Barium	7.00E-02	Medium	Increased Blood Pressure	NOAEL/IRIS	3	1
Cadmium	1.00E-03	High	Kidney (proteinuria)	NOAEL/IRIS	10	1
Chromium III	1.00E+00	Low	No effects observed	NOEL/IRIS	100	10
Chromium VI	5.00E-03	Low	No effects observed	NOEL/IRIS	100	5
Copper	4.00E-02	-	G.I. Tract (irritation)	LOAEL/HEAST	100	1
Iron	3.00E-01	High	No effects observed (dietary req.)	NOAEL/USEPA Region III	1	1
Manganese	2.00E-02	Medium	Central nervous system	NOAEL/IRIS	1	3
Selenium	5.00E-03	Medium	Selenosis	NOAEL/IRIS	3	1
Silver	5.00E-03	Medium	Skin (argyria)	LOAEL/IRIS	3	1
Thallium	7.00E-05	-	-	EPA-ECAO	-	-
Zinc	3.00E-01	Medium	Blood (dec. enzyme activity)	LOAEL/IRIS	3	1
Inhalation Route						
VOCs						
Carbon tetrachloride	0.000571	-	-	NCEA	-	-
Chloroform	8.6E-06	-	-	NCEA	-	-
Tetrachloroethene	0.14	-	-	NCEA	-	-
Toluene	1.14E-01	Medium	Neurological	LOAEL/IRIS	300	1
SVOCs						
1,4-Dichlorobenzene	2.29E-01	Medium	Liver (weight)	NOAEL/IRIS	1000	1
METALS						
Aluminum	1.00E-03	-	-	NCEA	-	-
Barium	1.40E-04	-	Fetotoxicity	NOEL/HEAST	1,000	1
Chromium VI	1.00E-07	-	-	EPA-ECAO	-	-
Manganese	1.43E-05	Medium	Neurobehavioral (manganism)	LOAEL/IRIS	1000	1
Ammonia	2.86E-02	Medium	Pulmonary (no lung effects observed)	NOAEL/IRIS	30	1

LOAEL - lowest observed adverse effect level
NOAEL - no observed adverse effect level
NOEL - no observed effect level
IRIS - Integrated Risk Information System (USEPA, 1998)

Table 17

GWTS PERMITTED EFFLUENT LIMITS[1]

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA
FEASIBILITY STUDY

Parameter	Monthly Average (mg/L)	Daily Maximum (mg/L)
Tetrachloroethylene	0.01	0.02
Toluene	0.01	0.02
1,2-Trans-Dichloroethylene	0.01	0.02
1,1,2-Trichloroethane	0.01	0.02
Trichloroehtylene	0.01	0.02
Vinyl Chloride	0.0006	0.0009
Naphthalene	0.01	0.02
N-Nitrosodi-Phenylamine	0.005	0.01
Pyrere	0.01	0.02
Total Iron	2.0	4.0
Dissolved Iron	1.3	2.0

[1] As per January 31, 1995 letter from Dino R. Agustini, Sanatary Engineer, Northeast Regional Office, PA DER, to Jahan Tavagar, Principal, GEC, regarding Industrial Waste, Rodale Manufacturing Superfund Site.

Table 18
Rodale Manufacturing - Identification of ARARs

Requirement	Type	Citation
Installation of new wells (Pa.)	Action	25 Pa Code Chapter 107. These regulations are established pursuant to the Water Well Drillers Act, 32 P.S.§ 645.1 et seq.
Plug and abandon existing pumping monitoring wells which serve no useful purpose (Pa.)	Action	PADEP's Public Water Supply Manual, Part II, Section 3.3.5.11
Hazardous waste management as part of the operation of the Ground Water Treatment System (Pa.)	Action	25 Pa. Code Chapter 262 Subpart A (relating to hazardous waste determination and identification numbers), B (relating to manifesting requirements of off-site shipments of recovered VOCs, spent carbon, filter bags or other hazardous wastes); 25 Pa. Code Chapter 263 (relating to transporters of hazardous wastes); and with respect to the operation at the Site generally,, with the substantive requirements of 25 Pa. Code Chapter 264, Subparts B-D, I (in the event that hazardous water generated as part of the remedy is managed in containers), 25 Pa. Code Chapter 264, Subpart J (hazardous waste managed in containers) 25 Pa. Code Chapter 264, Subpart C, Section 268.30 and Subpart E (regarding prohibitions on storage of hazardous waste)
Comply with the discharge requirements in surface waters (Pa.)	Chemical	Pennsylvania Discharge Permit Regulations (25 Pa. Code, Chapter 92 and 93)
Soil Cleanup requirements listed on Table 19- Waived by TI Waiver (Pa.)	Chemical	Pennsylvania land Recycling and Environmental Remediation Standards Act (Act2 of 1995), Title 25, Chapter 250
Air Emissions from GWTS (Pa.)	Action	Pennsylvania Air Permitting Regulations 25 PA Code §§123 and 127.
The ground water shall be restored in the entire contaminated plume to the cleanup standards in Table 1 of the ROD, except for TCE in the Probable DNAPL Zone. (Pa. and Federal)	Chemical	The Safe Drinking Water Act 42 U.S.C. §§ 300(f)-300(j), and 40 CFR §141.11-.12 & 141.61-.62; SDW 40 CFR §§ 141.50-.51; 40 CFR §300.430 (e)(2)(I)(A)(2) and (e)(I)(D); or PA Statewide Standards for ground water promulgated under Act 2 § 303 (a) and (b), at 25 Pa. Code § 250.301 Appendix A, Tables 1 and 2.

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Table 19

PA Act 2 Residential Standards for Substances detected below 15 feet which have been waived

Chemical	Standard (Micrograms/Kilogram) MG/KG	Basis
Trichloroethene	500	PA Act 2
Perchloroethene	500	PA Act 2

Table 20 -Summary of Risks

Non-Cancer Hazard Index			
	Soil	Ground Water	Spring (SP-03)
Adult Industrial Worker	0.2		
Child Resident	**5.6**	**119,666**	0.4
Adult Resident	**1.1**	**76,057**	0.1
Trespasser	0.59		

Incremental Cancer Risk			
	Soil	Ground Water	Spring (SP-03)
Adult Industrial Worker	4E-06		
Child Resident	1E-05	**0.8**	
Adult Resident	1E-05	**3.0**	6E-06
Trespasser	2E-05		

RECORD OF DECISION

PART III - RESPONSIVENESS SUMMARY

RODALE MANUFACTURING SUPERFUND SITE

EMMAUS, LEHIGH COUNTY, PENNSYLVANIA

RODALE MANUFACTURING SUPERFUND SITE

RESPONSIVENESS SUMMARY

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Responsiveness Summary
Rodale Manufacturing Superfund Site
Borough of Emmaus, Lehigh County, Pennsylvania

The Responsiveness Summary is divided into the following sections:

Overview: This section discusses evaluation criteria that the U.S. Environmental Protection Agency (EPA) uses for determining the preferred remedial action alternative for a Superfund site.

Background: This section provides a brief history of community relations activities conducted during remedial planning at the Rodale Manufacturing Superfund site.

Summary: This section provides a summary of commentors' major issues and concerns and EPA's responses to those issues and concerns during the public meeting. "Commentors" may include local homeowners, businesses, the municipality and potentially responsible parties (PRPs).

AR300999

Overview

On June 21, 1999, EPA published the Proposed Remedial Action Plan (Proposed Plan) for the Rodale Manufacturing Superfund Site (the site), located in the Borough of Emmaus, Lehigh County, Pennsylvania. The Proposed Plan outlines EPA's preferred remedial alternative for the site, giving consideration to the following nine evaluation criteria:

Threshold Criteria

- Overall protection of human health and the environment
- Compliance with federal, state and local environmental and health laws

Balancing Criteria

- Long-term effectiveness and permanence
- Reduction of mobility, toxicity or volume of contaminants
- Short-term effectiveness
- Ability to implement
- Cost

Modifying Criteria

- State acceptance
- Community acceptance

After considering several alternatives, EPA's preferred alternative is 1) hydraulic containment of the highest levels of contaminated ground water at and in the vicinity of a portion of the aquifer at the

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Site which has been determined to have Dense Non-Aqueous Liquids (DNAPLs) (the area referred to as the "Probable DNAPL Zone") by extraction and treatment using initially an existing Ground Water Treatment System (GWTS) at the Site: 2) a Technical Impracticability waiver for the Applicable and Relevant and Appropriate Requirement (ARAR) for TCE in ground water in the Probable DNAPL Zone: and 3) passive treatment through Monitored Natural Attenuation (MNA) for the contamination which has migrated beyond the boundaries of the Probable DNAPL Zone.

Background

Site History

Prior to the 1930s, the Property (as defined in Part II, Section I) was occupied by the D.G. Dery Silk Corporation and later by Amalgamated Silk Corporation. Rodale Press, a publishing and printing business, occupied portions of the building for several years beginning in 1953. From the late 1930s until 1975, the Property was operated by Rodale Manufacturing. Rodale Manufacturing manufactured wiring devices and electrical connectors. In 1975, the Property was sold to Bell Electric, a wholly-owned subsidiary of Square D Company. Bell Electric manufactured similar electrical components.

Pennsylvania Department of Environmental Protection (PADEP) files indicate that under Rodale Manufacturing's operation of the facility, several wells were used for disposal of various wastes. PADEP files indicate that in 1962, approximately 3,000 gallons per day (gpd) of wastewater, including rinse water from copper and zinc plating and acid brass dipping, were discharged to a 452-foot deep borehole (Well 1) located in the former courtyard area. Discharge of wastes into the wells continued probably until 1967 when the electroplating room was connected to the sanitary sewer.

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Past disposal practices were first identified by Square D in March 1981, when a capped borehole was discovered during the installation of new equipment. Long-time employees of Rodale Manufacturing indicated that two other wells were also used for disposal purposes, and the locations of these wells were identified. During the course of the investigation at the Site, four additional features were found. They are: a shallow cistern; a tank possibly used for fuel oil storage; a well apparently used for makeup cooling water; and a well which is believed to have been used for septic disposal.

In 1984, in coordination with PADEP, Square D commenced pumping contaminated ground water from one of the disposal wells. The Volatile Organic Compounds (VOCs) contamination in the ground water was treated by an air-stripping tower. This air stripper was operated until 1989. In January 1989, a Site inspection was conducted at the Site on behalf of the USEPA. On July 29, 1991, the Site was proposed for placement on the National Priorities List (NPL) and then listed on October 4, 1991. An Administrative Order on Consent (AOC) to conduct a Remedial Investigation and Feasibility Study (RI/FS) was executed between the USEPA and Square D and became effective on September 21, 1992.

In September of 1992, EPA and Square D signed an Administrative Order by Consent (AOC). Under this AOC, Square D was required to conduct remedial investigation and feasibility study (RI/FS) activities. Before starting RI/FS activities, Square D was required to conduct a Well Survey Investigation which included groundwater, soil and nearby stream sediment sampling. A Well Survey report stated that ground water at the site was contaminated with VOCs that were moving off the property. Under a second AOC signed in September 1994, Square D conducted a removal action at the site and installed a GWTS. The system has been in full operation since August 1996.

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Community Relations History

EPA representatives traveled to the Site and conducted community interviews on June 3 and 4, 1997. The purpose of these interviews was to gauge residents' knowledge and concerns about the Rodale Site. The findings from these interviews were released as part of the site Community Relations Plan in January 1998, a document that describes EPA's strategy for addressing the community's site-related concerns.

EPA distributed its first site fact sheet to the community in September 1997, providing descriptions of the Superfund process, how the Site became a Superfund site, and how the ongoing cleanup activities were progressing. To facilitate the continuing availability of site-related information to the community, EPA announced the establishment of a site information repository in January 1998, through a public notice that appeared in the January 19, 1998 edition of the *Allentown Morning Call*. A second fact sheet was distributed to the community in March 1998 to further advertise the new information repository.

In November 1998, EPA distributed a third fact sheet and published a second public notice in the *Allentown Morning Call,* inviting residents to a November 24, 1998, public availability session. The purpose of this availability session was to provide community members with an update on site cleanup activities.

To maintain community involvement in the project and obtain public input on the newly released Proposed Plan, EPA established a public comment period from June 20 to July 20, 1999. On June 23, 1999, EPA held a public meeting on the Proposed Plan to provide residents with information on

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proposed cleanup alternatives. The meeting also provided residents with an opportunity to ask questions about or comment on the Site and EPA's proposed cleanup alternative.

Summary of Commentors' Major Issues and Concerns

This section provides a summary of commentors' major issues and concerns raised during the public meeting and EPA's responses to those issues and concerns. Commentors may include local homeowners, businesses, the municipality and PRPs. Major issues and concerns about the Proposed Plan for the Site received during the public meeting on June 23, 1999 and EPA's responses are presented below:

1. How deep is the groundwater below the ground surface?

EPA Response: The depth of the aquifer extends hundreds of feet. The top of the water table is approximately 60 feet below the ground surface.

2. At what depths is the groundwater most contaminated?

EPA Response: The site was contaminated by 4 injection wells, drilled to different depths. The deepest injection well is approximately 400 feet. The shallowest area of contamination is probably in the deepest part of the overburden, which is considered subsurface soil. The deepest area of contamination is in the bedrock where the groundwater is, from approximately 60 feet below ground surface to 450 feet, and possibly deeper, due to the deeply fractured nature of the bedrock..

3. Was a groundwater flow model created for the design of the groundwater pump and treat

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system?

EPA Response: No, the system was modeled on water level elevation information from shallow, intermediate and deep wells. EPA drew a potentiometric surface for each of those levels and based the range for the pumping system on the inward gradient at about 400 feet deep.

4. What is the nature of the hydrology at the site?

EPA Response: The bedrock is fractured, karstic limestone. There are some major, deep solution channels - we believe there are some faults in the area. Consequently, there are some areas where monitoring well yields exceed 300 gallons per minute and some which yield much less. There's a broad spectrum of yields, indicating complex hydrogeology. EPA did not attempt to model the hydrogeology because of this complexity.

5. Did EPA consider doing in situ, biological treatment?

EPA Response: Yes, in situ biological treatment was considered as part of the feasibility study. However, because there are areas of pure, undissolved contaminant which tend to kill the organisms used in biological treatment, EPA was not confident that this type of remedy would be successful.

6. Is there any concern for volatilization into basements?

EPA Response: No. The aquifer is deep and, more importantly, there is a 40–60 foot layer of clay-rich overburden that prevents the VOCs from migrating upward through soil and into the air. This was confirmed by ambient air monitoring in the vicinity of the Site which did not reveal any airborne volatiles.

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7. When did EPA first find out about the contaminants onsite?

EPA Response: When Square D was operating the site, they uncovered a contaminated well in 1981. However, there is some documentation in PADEP files that indicates that Rodale Manufacturing was disposing of some of their electroplating waste years earlier in onsite wells. Arrangements for Rodale to begin disposal directly into the Borough of Emmaus sanitary sewer occurred between PADEP, the Borough of Emmaus and Rodale from as early as 1967.

8. In what year did the Borough of Emmaus install air strippers on some of Rodale's wells?

EPA Response: EPA does not know exactly. PADEP representatives indicated that their information reflects that this occurred in the 1970s and 1980s.

9. Have the onsite contaminant concentrations dropped considerably?

EPA Response: The onsite wells have shown high levels of contamination that have not dropped considerably.

10. Will EPA conduct quarterly sampling?

EPA Response: EPA will determine the sampling schedule during the Remedial Design. The schedule may start quarterly and then go down to semi annually. EPA will determine the schedule based on what is necessary to ensure that levels are reducing as expected.

11. Is EPA conducting all the work?

EPA Response: No. To date, the owner of the Property, Square D Company, has conducted the response activities at the Site. In addition, EPA clarifies this response by adding that EPA anticipates that Square

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D will enter into a judicially-enforceable Consent Decree, obligating it to fully develop and implement all aspects of the proposed remedy.

12. How soon will EPA implement the Proposed Plan?

EPA Response: EPA responded to this question by explaining that after all the public comments have been reviewed, EPA will prepare its Record of Decision, a legal document describing the cleanup decision and responding to the public comments. Once the Record of Decision is issued, EPA and Square D will begin the remedial design activities which are expected to take one year. During that time, Square D will continue to operate the groundwater treatment system. By way of further clarification, EPA modifies this response by adding that, it anticipates that it will enter into a judicially-enforceable Consent Decree with Square D, which will obligate Square D to implement the proposed remedy. Also, EPA typically enters into an Administrative Consent Order to commence Site remedial design work immediately, while the Consent Decree for Remedial Action is lodged with the court for the mandatory public comment period.

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