FIRST FIVE-YEAR REVIEW REPORT

For

Rodale Manufacturing Superfund Site

Emmaus, Borough

Lehigh County, PA

September, 2008

PREPARED BY:

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Date: 9/30/08

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List of Acronyms

AOC	Administrative Order on Consent
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
EPA	United States Environmental Protection Agency
DNAPL	Dense Non-Aqueous Phase Liquids
GWTS	Ground Water Treatment System
MCL	Maximum Contaminant Level
MNA	Monitored Natural Attenuation
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operations and Maintenance
PADEP	Pennsylvania Department of Environmental Protection
PCE	Perchloroethene (also known as Tetrachloroethene)
PCOR	Preliminary Closeout Report
ppb	parts per billion
ppm	parts per million
PRP	Potentially Responsible Party
RA	Remedial Action
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
SVOC	Semi-Volatile Organic Compounds
SI	Site Investigation
TAL	Target Analyte List
TCL	Target Compound List
TI	Technical Impracticability
TCE	Trichloroethene
VOC	Volatile Organic Compounds
VI	Vapor Intrusion

Executive Summary

All portions of the remedy as described in the September 30, 1999 Record of Decision (ROD) for the Rodale Manufacturing Superfund Site Emmaus Borough, Lehigh County, Pennsylvania, with the exception of the final long term institutional controls, have been implemented. There is a ground water treatment system (GWTS) currently operating as intended at the Site, which provides hydraulic containment and treatment of Site contaminants in the Probable Dense Non-Aqueous Phase Liquid (DNAPL) portion of the plume. A Technical Impracticability Waiver of the Applicable or Relevant and Appropriate Requirements (ARARs) for trichloroethene (TCE) in ground water and TCE and tetrachloroethene (PCE) in the subsurface soils in the probable DNAPL zone was granted as part of the ROD. Routine sampling of ground water which has migrated beyond the probable DNAPL zone has been evaluated for Monitored Natural Attenuation (MNA) to determine if clean-up standards established in the ROD will be met in a reasonable timeframe. Analysis of the MNA samples indicate that a number of natural attenuation processes are occurring at the Site including, dispersion, dilution, insitu biodegradation and matrix diffusion. The trigger for this five year review was the actual remedial action start date of October 28, 2002.

The remedy is being implemented in accordance with the Record of Decision. The groundwater treatment system is functioning as expected and is providing hydraulic containment for the probable DNAPL zone. Monitoring wells with the historically highest levels of contamination have shown an order of magnitude decrease in contaminant levels. Contaminant levels in the monitoring wells at the plume margin have fluctuated within an order of magnitude. These trends suggest that the overall mass of the contaminant plume is decreasing, but that the area of contamination has largely remained unchanged

While the groundwater remedy is expected to achieve protectiveness in the long-term, EPA is deferring a protectiveness statement until the vapor intrusion issue is evaluated. In addition, EPA will work with the Responsible Party to implement the institutional controls called for in the Record of Decision and sample for 1,4 dioxane in extraction and monitoring wells to determine if it is present at the Site. It is expected that these actions will take approximately 18 months to complete, at which time a protectiveness determination will be made.

Executive Summary (cont.)

GPRA Measure Review

As part of this Five Year Review the GPRA Measures have also been reviewed. The GPRA Measures and their current status are provided as follows:

Environmental Indicators
Human Health: HEUC, Human Exposure Under Control.
Groundwater Migration: GMUC, Ground Water Migration Under Control

Sitewide RAU: The Site is not Site-Wide Ready for Anticipated Use (SWRAU) but is expected to achieve SWRAU on September 30, 2010.

As a result of this Five Year Review, the Human Health Environmental Indicator will be changed to HEID, Human Health Insufficient Data (Due to the need to evaluate Vapor Intrusion). The date that the Site is expected to achieve SWRAU will be changed to March 31, 2010.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name: Rodale Manufacturing Superfund Site		
EPA ID: PAD981033285		
Region: 3	**State:** PA	**City/County:** Emmaus Borough /Lehigh County

SITE STATUS	
NPL status: ✓Final □ Deleted □ Other (specify)_____	
Remediation status (choose all that apply) □ Under Construction ✓Operating □ Complete	
Multiple OUs?* □ Yes ✓No	**Construction Completion date:** 09/29/2003
Has site been put into reuse? □ Yes ✓No	

REVIEW STATUS	
Lead agency: ✓EPA □ State □ Tribe □ Other Federal Agency_____	
Author name: Charlie Root	
Author title: Remedial Project Manager	**Author Affiliation:** EPA Region 3
Review period: May 2008 to September 2008	
Date(s) of site inspection: June 11, 2008	
Type of review: ✓ Post-SARA □ Pre-SARA □ NPL-Removal only □ Non-NPL Remedial Action Site □ NPL State/Tribe-lead □ Regional Discretion	
Review number: ✓ first □ second □ third □ other _____	
Triggering action: □ Actual RA Onsite Construction ✓ Actual RA Start □ Construction Completion □ Previous Five-Year Review Report □ Other (specify) _____	
Triggering action date: 10/28/2002	
Due Date (five years after triggering action date): 10/28/2007	

* "OU" refers to operable unit.

Five-Year Review Summary Form, cont'd

Issues: Vapor intrusion, institutional controls, 1,4-dioxane

Recommendations: Conduct an evaluation to determine if vapor intrusion is a concern at the Site. Implement permanent institutional controls. Sample extraction and monitoring wells for 1,4-dioxane.

Protectiveness Statement: The remedy is being implemented in accordance with the Record of Decision. The groundwater treatment system is functioning as expected and is providing hydraulic containment for the probable DNAPL zone. Monitoring wells with the historically highest levels of contamination have shown an order of magnitude decrease in contaminant levels. Contaminant levels in the monitoring wells at the plume margin have fluctuated within an order of magnitude. These trends suggest that the overall mass of the contaminant plume is decreasing, but that the area of contamination has largely remained unchanged

While the groundwater remedy is expected to achieve protectiveness in the long-term, EPA is deferring a protectiveness statement until the vapor intrusion issue is evaluated. In addition, EPA will work with the Responsible Party to implement the institutional controls called for in the Record of Decision and sample for 1,4 dioxane in extraction and monitoring wells to determine if it is present at the Site. It is expected that these actions will take approximately 18 months to complete, at which time a protectiveness determination will be made.

Other Comments: N/A

Five-Year Review Report
For
Rodale Manufacturing Superfund Site
Emmaus Borough, Lehigh County, Pennsylvania

I. Introduction

The purpose of the Five-Year review is to determine whether the remedy at a Site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and recommendations to address them.

The United States Environmental Protection Agency (EPA) is preparing this Five-Year Review report pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) § 121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The Agency interpreted this requirement further in the NCP; 40 Code of Federal Regulations §300.430(f)(4)(ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

This is the first five-year review for the Rodale Manufacturing Superfund Site. The triggering action for this statutory review is the date on-Site construction started. On-site construction started on October 28, 2002. The five-year review is required due to the fact that hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure. This review was conducted by the EPA Remedial Project Manager (RPM) for the Site from May 2008 through September 2008.

II. Site Chronology

Table 1: Chronology of Site Events

Date	Event
1920's	The site was used for commercial or manufacturing purposes including a silk mill since at least the 1920's.
1930's – 1950's	Rodale Press, a manufacturing and printing business, occupied portions of the building.
1950's - 1975	The site was operated by Rodale Manufacturing to make wiring devices and electrical connectors. Various electroplating techniques were used. Pennsylvania Department of Environmental Protection (PADEP) files indicate that significant quantities of rinse water were discharged into a 452 foot deep borehole on site.
1975	Site is sold to Bell Electric, a wholly owned subsidiary of Square D, which manufactured similar electrical components.
1981	Square D discovers a capped disposal borehole during installation of new equipment. Later, long-time Rodale employees indicate that two other wells on site were used for disposal purposes.
1984	In coordination with PADEP, Square D commenced pumping contaminated ground water from one of the disposal wells. Extracted ground water is treated via an air stripping tower. Air stripper operated until 1989.
January, 1989	A Site inspection was conducted at the site on behalf of EPA.
July 29, 1991	The Site was proposed for listing on the National Priorities List (NPL) and then listed on October 4, 1991
September 21, 1992	An Administrative Order on Consent (AOC) to conduct a Remedial Investigation and Feasibility Study (RI/FS) was executed between EPA and Square D.
September 30, 1994	Based on the findings of a well survey investigation under the above AOC, a separate AOC for a Removal Response Action for a ground water treatment system (GWTS) was executed between EPA and Square D.

August 1996	Construction of the GWTS is completed.
1996 - 1999	RI/FS is conducted at the Site under the 1992 AOC and GWTS is operated.
September 30, 1999	EPA issues the ROD for the Site.
September 24, 2001	An AOC for Remedial Design was executed between EPA and Square D.
March 22, 2002	A Consent Decree (CD) is entered for Remedial Design and Remedial Action.
September 30, 2002	Remedial Design (RD) calling for the installation of an additional extraction well, replacement of an existing extraction well, a capture zone analysis and sampling is completed.
October 28, 2002	On-site construction of the additional extraction well begins.
February 2003	Remedial Action (RA) called for in the RD is completed.
September 29, 2003	Preliminary Closeout Report (PCOR) is signed.
November 2003	RD/RA Report is completed.
August 2004	First Annual Ground Water Monitoring Report completed.
August 2005	Second Annual Ground Water Monitoring Report completed.
August 2006	Third Annual Ground Water Monitoring Report completed.
September 2007	Fourth Annual Ground Water Monitoring Report completed.
November 2007	Revised Operation & Maintenance Manual is completed.
November 8, 2007	Rodale Manufacturing Site Five Year Review Memo, ARCADIS BBL submitted.
June 11, 2008	Five Year Review Site Inspection

III. Background

Physical Characteristics

The Rodale Manufacturing Superfund Site is located on approximately 1 acre of land at Sixth and Minor Streets in the Borough of Emmaus, Lehigh County, Pennsylvania about 5 miles south of the city of Allentown (see Figure 1 & Figure 2). The Site is bordered by Minor Street to the North, Sixth Street to the west, an alleyway to the east and the Perkiomen railroad line to the South.

Prior to final demolition in 1993, the Site consisted of a three story building that occupied most of the Site (designated as three interconnected sections: Buildings A, B, and C) which served as a manufacturing, warehouse and office facility (see Figure 2). An exterior, open space courtyard area existed on the south side of the facility. This open area was expanded in 1989 as a result of the demolition of the southern wing of Building D. The disposal wells (Wells 1, 2, and 3) were located in the open area, along with several other wells and cisterns (see Figure 2). Final demolition activities were conducted at the Site from August to December 1993.

Following demolition in 1993, the Site was graded with quarry fill and #2A modified stone. The basement under Building A, which measured approximately 170 feet in length by 50 feet in width, was backfilled with clean quarry fill prior to final grade level application of #2A modified stone. The walls were left in place, and the floor of the basement broken up prior to back filling to allow for proper drainage.

Currently the only structure on the property is the Ground Water Treatment System (GWTS) and recovery well protective enclosures. Water is supplied by a two inch water service connection to two fire hydrants on the north side of the Site. A storm water catch basin near the southwest corner of the Site is connected to the storm water sewer along Sixth Street. The Site is bounded by a six foot high chain link security fence on the south property line and an eight foot high red cedar security fence on the north, east, and west sides. The Site is accessible through locking gates on the east and west sides of the Site.

Land and Resource Use

Land use in the area has been commercial, industrial, and residential. The Site includes approximately 1.2 acres of land at Sixth and Minor Streets in the Borough of Emmaus, Lehigh County approximately five miles south of the City of Allentown. The future land use for the Site and surrounding properties is expected to be a mix of commercial, industrial and residential.

History of Contamination

The Site property had been used for commercial or manufacturing purposes since at least the 1920's. Prior to the 1930's, the Site was occupied by the D.G. Dery Silk

Corporation and later by Amalgamated Silk Corporation. According to annual versions of the Pennsylvania Industrial Directory, Rodale Press, a publishing and printing business, occupied portions of the building from at least 1938 until 1959. From the late 1950s until 1975, the Site was operated by Rodale Manufacturing to make wiring devices and electrical connectors. The manufacturing process involved various electroplating techniques. In 1975, the Site was sold to Bell Electric, a wholly owned subsidiary of Square D, which manufactured similar electrical components. In 1986, Square D closed manufacturing operations at the Site. Buildings at the Site were partially demolished in 1989: the remaining portions were demolished in 1993. Previously used waste disposal wells were identified during demolition activities.

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 indicated that in 1962, approximately 3,000 gallons per day of wastewater, including rinse water from copper and zinc plating and acid brass dipping, were discharged to a 452 foot deep borehole (subsequently identified as Well 1) located in the former Courtyard Area (see Figure 2). Borough of Emmaus files indicate that the electroplating room was connected to the sanitary sewer by January 1967.

Past disposal practices were first identified by Square D in March 1981, when a capped borehole (Well 1) was discovered during the installation of new equipment. Long time employees of Rodale Manufacturing indicated that two other wells (Well 2 and Well 3) were also used for disposal purposes, and the locations of these wells were identified (Figure 2). From June to September 1981, Square D arranged for liquid wastes and some impacted ground water to be removed from Wells 1, 2 and 3 and disposed of by licensed haulers at licensed disposal facilities. A monitoring well (Well 4) was installed to a depth of 342 feet below ground surface (bgs) in June 1981 by Gill Enterprises on behalf of Square D. Water samples collected from the monitoring well and the three identified disposal wells revealed the presence of varying concentrations of volatile organic chemicals (VOCs), metals and cyanide.

In 1984, in coordination with PADEP, Square D commenced operation of an air stripper tower for removal of VOCs from ground water pumped from Well 1. The pumping and air stripping activities continued until 1989, when Square D proceeded with demolition of Building D and discontinued operation of the interim ground water pumping and air stripping program. Ground water monitoring results obtained between 1981 and 1988 indicated that the pumping and air stripping activities were effective in lowering VOC concentrations in Well 1 from hundreds of parts per million (ppm) to less than 1 ppm.

Following closure of the facility in 1986, investigative and remedial activities continued. In 1988, Square D retained SNR Company of Laguna Hills, California to prepare a ground water monitoring plan. During preparation of the plan, SNR installed four ground water monitoring wells now referred to as MW-1 through MW-4 around the perimeter of the building (see Figure 2).

Initial Response

In January 1989, a Site Inspection (SI) was conducted by NUS Corporation on behalf of EPA at the Site. The SI consisted of the collection of water samples from the three former on site disposal wells, four on site monitoring wells, three of the six Borough of Emmaus water supply wells and three residential wells. In November 1989 the PADEP collected several water samples from wells located down gradient of the study area, including one Borough of Emmaus water supply well and five down gradient private wells in Lower Macungie Township. A hydrogeologic investigation was completed by Roy F. Weston, Inc. (Weston) during 1989, as well. Ground water data indicated a historical presence of VOCs (predominantly TCE, semi-volatile organic compounds (SVOCs), metals and cyanide at concentrations above regulatory guidance values and standards. The off site sampling by PADEP revealed TCE in three of the wells, with two of the detections being above the federal and state drinking water maximum contaminant limits (MCLs), and Commonwealth of Pennsylvania Human Health standard for ground water. The Weston study identified an apparent primary set of fractures trending nearly east-west, and a secondary set of fractures trending approximately north-south in the vicinity of the Site. The Weston study also identified a regional distribution of low concentrations of VOCs in five Borough of Emmaus supply wells up gradient and cross gradient from the Site suggesting that additional sources of dissolved phase TCE exist in the Borough. Borough Wells 1, 2, 4 and 7 are currently treated via air stripping for VOCs. Well 5 (6th & Berger) was abandoned in 1981 due to TCE concentrations and Well 3 was taken out of service and placed on emergency status.

On July 29, 1991, following the Hazard Ranking System evaluation process by EPA, 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 the Remedial Investigation/Feasibility Study (RI/FS) was executed between EPA 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 water bodies. Based on the results of this investigation, which were documented in a September 1994 report, a separate AOC for a Removal Response Action calling for a ground water treatment system (GWTS) to be constructed at the Site was executed between EPA and Square D and became effective September 30, 1994. The purpose of the GWTS was to recover and treat contaminated ground water to limit further migration of the contamination. The GWTS utilized four existing on-site wells (Well 3, Well 4, RW-3 and MW-4) as extraction points. The construction of the GWTS was completed in August 1996 and the GWTS has been operational 24 hours a day, unattended under automatic conditions since February 5, 1997, with the exception of occasional maintenance shut downs. The GWTS will be further discussed in Section IV, Remedy Implementation.

Remedial investigation activities were conducted concurrently with the construction of the GWTS. These activities included ambient air sampling, soil sampling, ground water sampling both on and off the Rodale Manufacturing property, hydrogeologic mapping, pump tests, and installation of eight monitoring cluster wells beyond the boundary of the Rodale Manufacturing property. The well clusters consist of one shallow and one deep well except for one well cluster which also includes an intermediate well. 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, an evaluation of the potential for natural attenuation processes to effectively treat the dissolved phase portion of the contaminant plume, and an evaluation of the technical practicability of achieving ARARs with regard to restoration of ground water within a time frame that is reasonable given the circumstances at the Site.

An RI Report was submitted in March 1998 and a Feasibility Study (FS) in 1999. The Proposed Remedial Action Plan (PRAP) was released by EPA to the public for comment on June 20, 1999. The June 23, 1999 public meeting was attended by eight people and no written comments were received during the thirty day comment period. The September 30, 1999 Record of Decision (ROD), presented the selected remedial action for the Site.

Basis for Taking Action

Two types of significant contamination were identified at the site:

- Groundwater contamination by chlorinated and non-chlorinated VOCs;
- Subsurface soil contamination by various organic compounds including volatile, semivolatile, and pesticide/PCB compounds, and to a lesser degree, heavy metals;

During the RI/FS a risk assessment was performed to determine the level of risk the contaminants in on site soil and ground water and off site ground water presented to an individual in various scenarios.

The risk assessment found that there are unacceptable risks for potential future adult and child residents to on-site ground water utilized for potable use. The assessment also found that there were unacceptable risks posed by sub surface soils below 15 feet to future on-site adult and child residents. A summary of site risks are presented in Table 4.

In order to reduce the risks associated with exposure to site ground water and subsurface soil, the ROD presented performance standards to be met for ground water in the dissolved phase ground water plume outside the probable DNAPL zone as set forth in Table 2. The ROD also included a provision to waive the ARAR for: 1) the MCL for TCE in the probable DNAPL Zone, and 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 in subsurface soil below 15 feet (see Table 3).

IV. Remedial Actions

Remedial Action Objectives

The primary objective of EPA's remedy described in the September 30, 1999 ROD is to reduce or eliminate the potential for human exposure to contaminated soil and ground water at the Site.

Remedy Selection

On September 30, 1999, EPA signed a ROD documenting the remedial actions for the Site. The necessary remedial actions selected in the 1999 ROD included:

- Hydraulic containment of the dissolved phase VOC plume in the Probable DNAPL Zone (see detailed DNAPL discussion below). 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 of the dissolved phase plume will continue until cleanup standards listed in Table 2 are met. Full implementation of the hydraulic containment may require installation and operation of additional wells and/or equipment, to supplement the GWTS.

- Decontamination of ground water through Monitored Natural Attenuation (MNA) outside the GWTS capture zone until cleanup standards listed in Table 2 are met. MNA relies on natural processes to decontaminate contaminated ground water. These processes include dilution, biodegradation volatilization, adsorption, and chemical reactions with subsurface materials. During MNA, monitoring of the contaminants of concern in the monitoring wells is conducted to determine if MNA 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. MNA will remediate the ground water dissolved plume beyond the GWTS capture zone to cleanup standards in Table 2. Results of the monitoring will be used to determine if MNA is decreasing the concentrations of 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 five 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.

- The Technical Impracticability Waiver (see TI Waiver discussion below) in the Probable DNAPL Zone, and

- Institutional controls, in the form of land use restrictions within 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.

Dense Nonaqueous Phase Liquids (DNAPL)

Data collected during the RI revealed concentrations of TCE detected in ground water samples from six wells that are indicative of the presence of DNAPLs. 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 from the six wells at the Site revealed concentrations of up to 45 percent of TCE's single component solubility. Figure **2** shows the locations of the wells indicating the likelihood of proximal DNAPLs. DNAPLs tend to adhere to soil and aquifer material and are very difficult to remove. DNAPL remedial technologies are limited, and none are able to recover all trapped DNAPL. Most DNAPLs persist for long periods while slowly releasing soluble organic contaminants 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 ground water to cleanup standards.

Similarly, the presence of DNAPLs in deep subsurface soil makes remediation of the contaminated soils in the probable DNAPL zone impracticable. Where DNAPLs remain in the ground water, they will continue to act as a source of contamination to the ground water for the foreseeable future, as discussed above. Therefore, removal of subsurface soils in the probable DNAPL zone would have a negligible long term beneficial effect on the ground water, since the ground water would remain subject to the source contamination caused by the DNAPLs.

Waiver of Specific ARARs on Technical Impracticability (TI Waiver)

EPA, by signature of the September 30, 1999 ROD, issued a waiver of certain applicable or relevant and appropriate requirements, criteria, and limitations (collectively referred to as "ARARs") on the basis of technical impracticability. Generally a remedy must meet ARARs or provide grounds for invoking a waiver. ARARs may be waived for any of six reasons specified by CERCLA Section 121(d)(4) and the National Contingency Plan (NCP). One of the bases for an ARAR waiver is technical impracticability from an engineering perspective.

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 ground water in the probable

DNAPL zone to its beneficial use in a reasonable time frame given the conditions of the Site. This report is in the administrative record for the Site. The report incorporated all the required components for the evaluation per EPA's TI guidance including: 1) specific ARAR(s) for which TI determination(s) are sought; 2) spatial area over which the TI decision will apply; 3) conceptual model that describes site geology, hydrology, ground water and 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.

A TI determination was appropriate for the Site due to the presence of substantial quantities of DNAPL in the subsurface, the highly heterogeneous nature of the geologic formations at the Site, and the influence of bedrock matrix diffusion. The probable DNAPL zone at the Site covers approximately 1.2 acres. The probable DNAPL zone extends to an estimated depth of up to 420 feet below ground surface. The estimated volume of probable DNAPL zone is approximately 830,000 cubic yards. VOC mass calculations indicate the estimated total subsurface VOC mass may range up to 647,000 kilograms (kg), with up to 592,000 kg in the form of DNAPLs and the remainder of the mass is in dissolved, sorbed, or vapor phase. Estimates of the time required to dissolve the probable DNAPL zone range up to 2,370 years at current removal rates of the GWTS.

EPA determined that the August 1999 TI Evaluation report fully and adequately identified and evaluated existing on-site conditions that support the issuance of a TI waiver, pursuant to the TI Guidance. The TI Evaluation Report demonstrated the need for a waiver of ARARs because it was technically impracticable from an engineering perspective to meet TCE ground water and subsurface soils ARARs in the Probable DNAPL zone in a reasonable time frame. Complete restoration of these areas was unlikely, because currently known remedial technologies cannot eliminate the DNAPLs. Hence, it was appropriate to waive the following ARARs:

(1) the MCL for TCE in the Probable DNAPL Zone depicted in Figure 2.

(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 ground water 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." While ground water restoration to performance standards in the probable DNAPL zone is not technically practicable the hydraulic containment called for in the ROD will prevent further

migration of site contaminants and allow MNA processes to reduce the dissolved phase portion of the plume to performance standards in a reasonable time frame.

Institutional Controls

Proposed land use restrictions were submitted for EPA review and comment by Schneider Electric, the current Site property owner, in November 2006. EPA is evaluating the proposed restrictions to determine if they meet the ROD requirements. EPA will complete this evaluation shortly and work with Schneider Electric to finalize restrictions which are most appropriate for the Site and meet the ROD requirements. Also, EPA evaluated Chapter 26 Water, Code of Ordinances of Emmaus Borough, PA to determine if the Ordinance was sufficient to prevent the drilling of wells in the vicinity of the Site contaminant plume. While the ordinance does require that any property adjacent to a Borough water main connect to such main, it does not explicitly prohibit the drilling of wells in the Borough. Therefore, another means of meeting the ROD requirements for the portions of the dissolved plume off the Schneider Electric property will need to be explored.

Remedy Implementation

An AOC for Remedial Design was issued by EPA on September 24, 2001 and a Consent Decree for RD/RA was entered on March 22, 2002. The RD/RA work plan was approved by EPA in May 2002. Blasland, Bouck & Lee, Inc. (BBL) on behalf of Square D Company – Schneider Electric prepared the Remedial Design Summary Report, in August 2002.

As discussed above the GWTS has been operational 24 hours a day unattended under automatic conditions since February 5, 1997 with the exception of occasional maintenance shut downs. The purpose of the GWTS was to recover and treat contaminated ground water to limit further migration of the contamination. The September 30, 1999 ROD called for utilizing the existing GWTS to hydraulically contain the dissolved plume in the probable DNAPL zone and to allow for MNA processes to treat the dissolved plume beyond the area of ground water capture. The GWTS utilized four existing on-site wells (Well 3 (EXW-1), Well 4 (EXW-2), RW-3 (EXW-3) and MW-4 (EXW-4) as extraction points. The GWTS included 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 was designed based on an average flow rate of 45 gallons per minute (GPM) and a maximum flow rate of 90 gpm. Treated ground water is discharged to a storm sewer located on site which discharges to an unnamed tributary of the Leibert Creek pursuant to the substantive PADEP National Pollutant Discharge Elimination System (NPDES) requirements.

Due to the fact that the GWTS was constructed as part of the previous removal action, no major construction activities were required in the remedial action. The only physical construction activities involved the installation of additional wells as discussed

below. Other activities included the evaluation of the hydraulic containment provided by the GWTS as modified by the upgraded wells, a preliminary evaluation of natural attenuation in ground water in the dissolved plume area outside the capture zone and four quarterly sampling events completed in May 2002, August 2002, November/December 2002 and February 2003 (see Figure 5). Water level data and ground water quality samples were collected from up to 22 new and existing wells. The samples were analyzed for TCL VOCs, TCL SVOCs, and six metals (arsenic, beryllium, copper, chromium, lead and manganese) for both total and dissolved concentrations.

As part of the remedy implementation wells RW-3 (EXW-3) and MW-4 (EXW-4) were replaced to better provide hydraulic containment of the deep and shallow ground water. An additional monitoring well cluster, MW-13S and MW13D, was also installed to demonstrate that the dissolved VOC plume outside the capture zone of the GTWS is effectively attenuating. Subsequently, in November 2002 an additional intermediate well MW13I was added to the cluster.

BBL on behalf of Square D Company – Schneider Electric prepared the Remedial Design/Remedial Action Completion Report, in November 2003 which summarized the activities undertaken to carry out the remedy. Figure 5 summarizes the findings of the VOC sampling as of February 2003 as provided in the RD/RA completion report. Evaluation of the ground water elevations and the capture zone showed that the GWTS was hydraulically containing the probable DNAPL zone plume. The ROD, as described above, included a contingency that if it was demonstrated that MNA could not remediate the plume beyond the probable DNAPL zone to performance standards in a reasonable time frame, the GWTS would be expanded. The evaluation of historic and quarterly contaminant concentration data collected as part of the RA, as well as MNA indicator parameters showed that a number of natural attenuation processes were occurring at the Site including dispersion, dilution, in-situ bio-degredation, and matrix diffusion. BBLs evaluation of the effectiveness of MNA was found to be consistent with EPA technical guidance and therefore it was determined that contaminants of concern were adequately being addressed by MNA in the dissolved contaminant portion of the plume outside the hydraulic containment area.

The RD/RA Completion Report also provided an outline of the long term ground water monitoring program for the Site. The program called for the collection of semi annual water level data from the extraction/monitoring well network in conjunction with the ongoing GWTS operation program. Collection of annual ground water samples from a subset of the monitoring well network to be analyzed for TCL VOCs and three TAL metals including arsenic, lead and manganese was also outlined in the report. Finally, the report stated that a modified MNA program would be implemented concurrently with the annual ground water sampling.

EPA signed the Preliminary Close Out Report (PCOR) for the Site, documenting that construction activities were complete on September 29, 2003. An estimate of $600,000 for the costs of the remedy was provided by Schneider Electric. The estimate of annual operation and maintenance costs provided was $100,000.

System Operation and Maintenance

EPA has received monthly progress reports each month from December 2003 through July, 2008 summarizing the activities performed at the Site, a look ahead to the next months activities, results of required monthly GWTS performance sampling and how it compares to the PADEP NPDES permit requirements, a summary graph of TCE levels over time in the extracted ground water and the treated water discharged, the estimated cumulative TCE removed and the volume of ground water treated and discharged cumulatively and per month.

As of the July 2008 Monthly Progress Report an estimated 130,188,590 gallons of ground water have been treated and discharged by the GWTS. An estimated 9,354 kg of TCE have been removed cumulatively during the time the GWTS has operated.

BBL, on behalf of Schneider Electric, has submitted Annual Ground Water Monitoring Reports, on August 19, 2004, August 26, 2005, August 30, 2006 and September 18, 2007. These reports all presented the findings of the required annual long term monitoring and evaluated if the GWTS was maintaining hydraulic containment, as well as if MNA was reducing contaminant concentrations outside the area of hydraulic containment.

In November 2007 a revised Ground Water Treatment System Operations and Maintenance Manual for the Rodale Manufacturing Site, was submitted by Curt Christensen, PE of the Square D Company. The revised Operation & Maintenance Manual updates all Site personnel who will perform work on the GWTS with the current procedures to operate the system in a safe and reliable manner. The update details the most current operations of the system and its components.

On November 8, 2007 ARCADIS BBL, on behalf of Schneider Electric, submitted a memo, at EPA's request, providing relevant information and figures for the five year review and outlining a proposed approach to investigating vapor intrusion. Figure 3 and Figure 4, as well as Figures 6 through 19 of this five year review, illustrating the distribution of dissolved TCE in shallow and deep ground water wells and ground water contours as of May 2007 along with concentration trend graphs over time for TCE and PCE in on site extraction wells and off site monitoring wells were submitted in this report.

Vapor intrusion is a source of exposure that EPA has recently begun to explore at all sites with ground water contamination. It is of potential concern where VOCs are present in subsurface material such as soil, gas, or ground water. The contaminated ground water from the Site does travel under several residences. The potential for vapor intrusion from the ground water should be explored. The investigation approach submitted by ARCADIS proposes a step wise approach to investigate if vapor intrusion is occurring. First, an evaluation of existing Site contaminant data using appropriate modeling would be performed and then as a second step soil vapor samples would be collected at the Site property boundary. Together, these initial steps would be used to

guide potential next steps in the vapor intrusion investigation and to build a weight of evidence approach to the vapor intrusion investigation at the Site. Upon EPA approval of the proposed vapor intrusion investigation approach, ARCADIS, on behalf of Schneider Electric, will submit a work plan for the vapor intrusion investigation.

V. Progress Since Last Five-Year Review

This is the first Five-Year Review for the Rodale Manufacturing Superfund Site.

VI. Five-Year Review Process

Administrative Components

The five year review for the Rodale Manufacturing Superfund Site was conducted by Charlie Root, EPA Remedial Project Manager and supported by the EPA technical review team members including, Bruce Rundell, Hydrogeologist and Linda Watson, Toxicologist. Ron Schock, PADEP and Jim Kunkle, PADEP also provided input into the Five Year Review.

Community Involvement

The EPA RPM has been in communication with personnel of the Borough of Emmaus regarding the water supply regulations and has discussed the five year review process with them. An ad was placed in the Allentown Morning Call on September 19, 2008 announcing that EPA was conducting a five year review of the Rodale Manufacturing Superfund Site. No concerns or comments have been received from the local community, or local borough personnel regarding the five year review. A notice of the availability of the five year review will be placed in the Allentown *Morning Call* upon completion of the five year review and a copy of the review will be placed in the local Site repository at the Emmaus Public Library, 11 East Main Street, Emmaus, PA as well as on the Internet.

Document Review

This five-year review included the review of a number of relevant documents including:

- September 30, 1999 Record of Decision.
- Remedial Design Summary Report, BBL, August 2002.
- Preliminary Close-out Report (PCOR), September 29, 2003.
- Remedial Design/Remedial Action Report, BBL, November 2003.
- Annual Ground Water Monitoring Report, BBL, August 19, 2004.
- Annual Ground Water Monitoring Report, BBL, August 26, 2005.
- Annual Ground Water Monitoring Report, BBL, August 30, 2006.
- Final Sampling Summary and Data Evaluation Report, CDM, April 18, 2005.
- Annual Ground Water Monitoring Report, ARCADIS BBL, September 18, 2007.

- Ground Water Treatment System Operations and Maintenance Manual, Rodale Manufacturing Site, November 2007, revision.
- RD/RA Monthly Progress Reports December 2003 – July, 2008.
- Rodale Manufacturing Site Five Year Review Memo, ARCADIS BBL, November 8, 2007.
- Chapter 26 Water, Code of Ordinances of Emmaus Borough, PA.

Data Review

Data from on-site extraction and monitoring wells and system influent and effluent has been routinely collected since the extraction and treatment system became operational and functional. Influent and effluent sampling is conducted monthly and compared against the substantive PADEP NPDES requirements for discharge. Since the groundwater treatment system was placed in operation, a comprehensive long term groundwater monitoring plan has been implemented. Currently extraction and monitoring wells are sampled on an annual basis.

The extraction and monitoring wells are monitored to help track the extent of the contaminated plume, to track the progress of MNA in the dissolved contaminant plume and to evaluate the performance of the groundwater treatment system in maintaining hydraulic control. The attached Figures 3, 4 & 5 show the results of the long term monitoring conducted just after system start up in February 2003 (Figure 5) and most recently in May 2007 (Figure 3, Figure 4). Table 5 lists the detected constituents in ground water in May 2007. The attached Figures 6 through 19 depict the dissolved TCE and PCE concentration trends in on site extraction wells and off site monitoring wells from1997 through 2007. Monitoring wells with the historically highest level of contamination have shown one or more order of magnitude decreases in contaminant levels. This trend is best seen in down gradient MW-13D (Figure 12). MW-13 is located along the center-line of the plume near the leading edge. Contaminant levels in monitoring wells located at the plume margin have fluctuated within an order of magnitude. These trends indicate that the overall mass of the contaminant plume is decreasing, but the area of contamination has largely remained unchanged. The attached Figures 20 and 21 depict the ground water elevation data of shallow and deep wells as of May 2007 respectively. Figure 21 depicts the area of hydraulic containment in the deep wells associated with the probable DNAPL zone.

Parameters in addition to the VOCs which are monitored annually as part of the MNA evaluation program include, field measurement of dissolve oxygen (DO), oxidation reduction potential (ORP), pH, temperature, specific conductivity and lab analysis of nitrate, ferrous iron (total and dissolved), sulfate, methane, ethane, ethene, alkalinity, chloride, carbon dioxide and total organic carbon. The results of the annual MNA monitoring in conjunction with the results of the initial MNA program evaluation presented in the 2003 RD/RA Completion Report indicate that natural attenuation processes may be expected to result in attenuation of peak VOC concentrations in ground water which have migrated beyond the probable DNAPL zone. MNA appears to be effectively reducing the dissolved contaminant plume outside the probable DNAPL zone,

however, sampling will continue and MNA will be evaluated again in the next 5 year review to assess the adequacy of MNA to address the dissolved ground water plume outside the probable DNAPL zone in a reasonable time frame.

Five down gradient residential wells near the Little Lehigh Creek that are still used for consumptive purposes were monitored in November, 2004 by EPA's contractor CDM Federal. These wells, which are far down gradient of the Site, may be in an area where deep ground water comes near the surface near the Little Lehigh Creek. All the samples were analyzed for target compound list (TCL) VOC's, SVOCs, and target analyte list (TAL) metals. No contaminants were found above the Maximum Contaminant Levels (MCLs) in any of the wells sampled, except for one sample that had a minor exceedance for one contaminant, bis(2-ethylhexyl) phthalate. While it may be difficult to link the exceedance to the Rodale Manufacturing Site due to other possible sources in the area, EPA in consultation with PADEP is recommending that these wells be sampled again during the next five year review cycle.

Site Inspection

The site inspection occurred on June 11, 2008 and was conducted by Charlie Root of EPA, Ron Schock of PADEP, Rakesh Patel, Schneider Electric, Curt Christenson, Schneider Electric, David Lay, Alex Carpenter and William McCune, ARCADIS, the contractor tasked to operate the extraction and treatment system. The extraction & treatment system was operating as intend during the inspection. The overall site conditions, with regard to the perimeter fence and gravel areas were good. The fence was intact and the gates appeared to be in good working condition. There were no visible signs of subsistence in the gravel areas. The on site extraction and monitoring wells, were inspected and were in good operational condition. The physical condition of the off-site monitoring wells was also inspected and they were found to be intact.

Interviews

The US EPA project manager contacted the Emmaus Borough engineer on September 9, 2008 to notify the Borough of the Five Year Review, relay Site progress, and discuss any concerns the Borough may have with the EPA remedy at the Rodale Manufacturing Superfund Site. The Borough did not voice any concerns regarding the Site. Also, routine contact has been maintained with the Site property owner during operation of the extraction and treatment system.

VII. Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

Yes, the ground water treatment system is operating as intended maintaining hydraulic containment of the probable DNAPL zone. In the dissolved contaminant portion of the plume, outside the area of hydraulic containment MNA appears to be reducing the contaminant concentrations. Continued monitoring is warranted to ensure that

performance standards will be met in a reasonable time frame. There is no current exposure to contaminated ground water due to the connection of residents and businesses to the public water supply. 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 have yet to be implemented, but are currently being evaluated.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Since the 1999 ROD, there have been numerous changes in exposure assumptions and toxicity data, however, these changes do not result in changes to the original risk decisions made for the Site or the protectiveness of the remedies selected.

Assuming that the ground water contaminant concentrations equal the current MCL concentrations, or the 1999 ROD risk-based performance standards (Table2), then the risks could be estimated using current methodology and assumptions, as in Table 6. This assessment shows that at the current performance standards, lifetime residential cancer risk (3.6E-04) exceeds EPA's cancer range (1E-04 to 1E-06) and non-cancer risk is above EPA benchmark of 1.0 for adult residents (7.4) and child residents (16). See Table 6. However, the contaminants that primarily contribute to the cumulative risk calculation have not been found to be present during long term monitoring. A final determination as to whether the 1999 ROD performance standards are protective is premature since the contaminants driving the cumulative risk may not be present and current standards may change again, protectiveness is best assessed at the time when it is believed that groundwater cleanup has been achieved.

Vapor intrusion is a source of exposure that EPA has recently begun to explore at all sites with ground water contamination. It is of potential concern where VOCs are present in subsurface material such as soil, gas, or ground water. The contaminated ground water from the Site does travel under several residences. The potential for vapor intrusion from the ground water should be explored. In November 2007, ARCADIS BBL submitted an outline for investigation of vapor intrusion at the Site. Upon EPA approval, ARCADIS, on behalf of Schneider Electric, will submit a work plan for the vapor intrusion investigation.

EPA has recently become aware that sites with VOC contamination sometimes have 1,4-dioxane, a solvent stabilizer, as a contaminant as well. Analysis of this compound was not included in the remedial sampling and analysis to date. This can be of concern since, unlike VOCs 1,4-dioxane can not be removed by air stripping and carbon filtration. This compound can also be of concern since 1,4-dioxane can travel ahead of a VOC ground water plume. The VOC most closely associated with dioxane is 1,1,1 trichloroethane, which does not appear to be of concern at the Rodale Manufacturing Site, however sampling for this contaminant is still recommended since 1,1,2-tricholorethane is identified as a contaminant of concern. Therefore, sampling for 1,4-dioxane is recommended to determine if this chemical is of concern at the site.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No new information has come to light regarding the protectiveness of the remedy other than the potential for vapor intrusion and the presence of 1,4-dioxane as discussed above and listed below as issues. While the vapor intrusion and 1,4-dioxane concerns were not identified in past Site studies, awareness of the possible problems of vapor intrusion and 1,4-dioxane has emerged as scientific understanding has evolved.

Technical Assessment Summary

According to the data, monitoring reports and operating reports, and the site inspection, the remedy is functioning as intended by the ROD. Due to the proximity of residential homes to the contaminated ground water plume, vapor intrusion into basements may be an issue and will need to be investigated in the near future as discussed above. There have been no changes to the physical conditions of the Site, or the surrounding land use that would affect the protectiveness of the remedy. The ground water treatment system is functioning as expected and is providing hydraulic containment of the probable DNAPL zone. Monitoring wells with the historically highest level of contamination have shown one or more order of magnitude decreases in contaminant levels. This trend is best seen in down gradient MW-13D. Contaminant levels in monitoring wells located at the plume margin have fluctuated within an order of magnitude. These trends indicate that the overall mass of the contaminant plume is decreasing, but the area of contamination has largely remained unchanged. MNA appears to be effectively reducing the dissolved contaminant plume outside the probable DNAPL zone, however, sampling will continue and MNA will be evaluated again in the next five year review. EPA recommends that 1,4 dioxane be analyzed for in extraction and monitoring wells at the site to determine if this contaminant is present in ground water.

VII. Issues

Table 7: Issues

Issues		Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
#1	Vapor intrusion	Y	Y
#2	Institutional controls	N	Y
#3	1,4 dioxane	N	Y

IX. Recommendations and Follow-Up Actions

Table 8: Recommendations and Follow-up Actions

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current / Future	
Vapor Intrusion	Conduct a vapor intrusion investigation.	**PRP**	**EPA**	**03/31/2010**	**Y**	**Y**
Institutional Controls	Implement Institutional Controls called for in the ROD.	**PRP**	**EPA**	**03/31/2010**	**N**	**Y**
1,4-dioxane	Sample for 1,4 dioxane	**PRP**	**EPA**	**03/31/2009**	**N**	**Y**

X. Protectiveness Statement

The remedy is being implemented in accordance with the Record of Decision. The groundwater treatment system is functioning as expected and is providing hydraulic containment for the probable DNAPL zone. Monitoring wells with the historically highest levels of contamination have shown an order of magnitude decrease in contaminant levels. Contaminant levels in the monitoring wells at the plume margin have fluctuated within an order of magnitude. These trends suggest that the overall mass of the contaminant plume is decreasing, but that the area of contamination has largely remained unchanged

While the groundwater remedy is expected to achieve protectiveness in the long-term, EPA is deferring a protectiveness statement until the vapor intrusion issue is evaluated. In addition, EPA will work with the Responsible Party to implement the institutional controls called for in the Record of Decision and sample for 1,4 dioxane in extraction and monitoring wells to determine if it is present at the Site. It is expected that these actions will take approximately 18 months to complete, at which time a protectiveness determination will be made.

XI. Next Review

Once the vapor intrusion evaluation is complete, an addendum to this five year review will be issued with a final protectiveness determination. The next five year review for the Rodale Manufacturing Site is to be completed within five years from the completion of this review in September 2013.

TABLES

TABLE 2.
Ground Water Cleanup Standards and Basis

Chemical	Cleanup Standard Micorgrams/Liter (ug/l)	Basis
Chloroform	0.15	RBC
1,1-Dichloroethene	4	RBC
Carbon Tetrachloride	.16	RBC
Perchloroethene	1.1	RBC
Trichloroethene	1.6	RBC
1,1,2-Trichloroethane	.19	RBC
Chloromethane	2	RBC
Vinyl Chloride	.019	RBC
1,4-Dichlorobenzene	.47	RBC
Bis(2-ethylhexyl)phathalate	4.8	RBC
Pentachlorophenol	.56	RBC
Arsenic	.045	RBC
Ammonia	200	Federal MCL
Antimony	6	RBC
Copper	150	RBC
Iron	300	PA Act 2 (SMCL)
Thallium	.5	MCLG
Lead	5	PA Act 2 (SMCL)
Chromium	100	Federal MCL
Benzene	.4	RBC
Benzo[k]fluoranthene	.55	PA Act 2 (s)
Dibenzo[a,h]anthracene	.0092	RBC
Benzo[b]flouranthene	.0092	RBC
N-nitrosodiphenlamine	14	RBC
Phenathrene	110	RBC
Ethylbenzene	700	Federal MCL
2-methylnaphthalene	120	RBC
Benzo[a]anthracene	.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	.092	RBC
Naphthalene	6.5	RBC

TABLE 2. (cont.)
Ground Water Cleanup Standards and Basis

Chemical	Cleanup Standard Micorgrams/Liter (ug/l)	Basis
Pyrene	13	PA Act 2 (S)
Xylenes, total	4,000	Federal MCL
Benzo[a]pyrene	.0092	RBC
Di-n-octyl phthalate	730	RBC
Manganese	50	PA Act 2 (SMCL)
cis 1,2-dichloroethene	40	RBC
trans 1,2-dichlorethene	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 3.
PA Act 2 Residential Soil Standards for Substances detected below 15 feet which have been waived.

Chemical	Standards Micrograms/Kilogram (mg/kg)	Basis
Trichloroethene	500	PA Act 2
Perchloroethene	500	PA Act 2

Table 4.
Summary of Site Risks

Non-Cancer Hazard Index			
	Soil	Ground Water	Spring
Adult Industrial Worker	0.2		
Child Resident	5.6	119,666	0.4
Adult Resident	1.1	76,057	0.1
Trespasser	0.59		
			(HI greater than 1 = potential risk)
Incremental Cancer Risk			
	Soil	Ground Water	Spring
Adult Industrial Worker	4E-06		
Child Resident	1E-05	0.8	
Adult Resident	1E-05	3.0	6E-06
Trespasser	2E-05		
			(1E-04 to 1E-06 EPA Acceptable Risk Range)

Table 5 – Detected Constituents in Ground Water, May 2007

Plant Area Location ID Date Sampled Sample Type	Groundwater Cleanup Standard	On-Site MW-1 5/8/2007 FS	On-Site MW-2 5/10/2007 FS	On-Site MW-3 5/9/2007 FS	On-Site MW-4 5/11/2007 FS	On-Site RW-3R 5/7/2007 FS	On-Site RW-4 5/7/2007 FS	On-Site Well 3 5/7/2007 FS	On-Site Well 4 5/7/2007 FS	On-Site Well 4 5/7/2007 DUP	On-Site Well 6 5/8/2007 FS	Off-Site, upgradient MW-7D 5/16/2007 FS	Off-Site MW-10D 5/9/2007 FS	Off-Site MW-10I 5/9/2007 FS
Volatile Organic Compounds														
Acetone	3,700 G	100 U	10 U	10 U	100 U	5000 U	200 U	10 U	100 U	100 U	200 U	10 U	47	7 J
Carbon tetrachloride	0.16	100 U	10 U	10 U	100 U	5000 U	200 U	10 U	100 U	100 U	200 U	10 U	10 U	10 U
Chloroform	0.15	100 U	10 U	10 U	100 U	5000 U	200 U	10 U	100 U	100 U	200 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	40	86 J	10 U	1 J	47 J	28000	540	15	1600	1700	1600	10 U	10 U	10 U
Methyl tert-butyl ether	NA	100 U	10 U	10 U	100 U	5000 U	200 U	10 U	100 U	100 U	200 U	10 U	10 U	10 U
Methylcyclohexane	NA	100 U	10 U	10 U	100 U	5000 U	200 U	1 J	100 U	100 U	200 U	10 U	10 U	10 U
Tetrachloroethene	1.1	22 J	2 J	5 J	62 J	3200 J	210	10 U	74 J	77 J	70 J	10 U	10 U	10 U
Trichloroethene	1.6	3400 D	55	55	5800 D	420000 D	23000 D	66	17000 D	19000 D	16000 D	10 U	10 U	7 J
Vinyl chloride	0.019	100 U	10 U	10 U	100 U	5000 U	200 U	5 J	89 J	96 J	200 U	10 U	10 U	10 U
Inorganics, Dissolved														
Ferrous Iron	300 SMCL	37 J	100 U	100 U	100 U	19200	16 J	24 J	14 J	20 J	510	19 J	8 U	8 U
Lead	5	2.2 U	2.2 U	2.2 U	2.2 U	3 U	2.2 U	2.2 U	3.2 U	2.2 U	2.2 U	2.4 B	2.2 U	2.2 U
Manganese	50 SMCL	203	21.2	9.1 B	2.1 B	4260	46.2	22.2 J	239	238	37.2	15.5	0.18 U	0.18 U
Inorganics, Total														
Ferrous Iron	300 SMCL	44 J	36 J	49 J	50 J	21900	8 U	8.2 J	19 J	18 J	770	23 J	8 U	8 U
Lead	5	2.2 U	2.2 U	2.2 U	2.2 U	32.3	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
Manganese	50 SMCL	242	32.4 J	11.6 B	13.7 J	4430	50.6	19.2 J	254	253	43.1	18.2 J	15 U	15 U
Miscellaneous Parameters														
Alkalinity to pH 4.5	NA	4000	9700	13200	34400	152000	25300	166000	31500	31200	131000	5600	337000	116000
Alkalinity to pH 8.3	NA	460 U	460 U	460 U	460 U	460 U	460 U	460 U	460 U	460 U	460 U	460 U	266000	67500
Chloride	250,000 SMCL	14100	57800 D	81200 D	12200	57400 D	13400	11400	20400	20100	9100	34000 D	81300 D	12600
Nitrogen, Nitrate	10,000 M	17200 D	10500	5800	640	250 U	4300	3200	7100	7200	250 U	2200	250 U	6500
Sulfate	NA	2600 J	1600 J	2600 J	30900	112000 D	13600	16100	10000	9400	30000	2900 J	20100	2200 J
Total Organic Carbon	NA	1000 U	1000 U	1000 U	1000 U	10400	1000 U	1000 U	1000 U	1000 U	1500 J	1000 U	1900 J	1000 U
Gasses														
Carbon Dioxide	NA	90000	110000	97000	60000	110000	93000	7000 J	130000	130000	2500 U	110000	44000	2500 U
Ethane	NA	1 U	1 U	1 U	1 U	4.2 J	1 U	1 U	1 U	1 U	46	1 U	1 U	1 U
Ethene	NA	1 U	1 U	1 U	1 U	38	1 U	1 U	6.2	6.1	20	1 U	1.2 J	1 U
Methane	NA	2 U	2 U	2 U	2 U	210 D	17	11	120	120	15	2 U	2 U	2 U

See Notes on Page 3.

Table 5 – Detected Constituents in Ground Water, May 2007

Plant Area Location ID Date Sampled Sample Type	Groundwater Cleanup Standard	Off-Site MW-10S 5/9/2007 FS	Off-Site MW-11D 5/11/2007 FS	Off-Site MW-11S 5/14/2007 FS	Off-Site MW-13D 5/10/2007 FS	Off-Site MW-13I 5/10/2007 FS	Off-Site MW-13I 5/10/2007 DUP	Off-Site MW-13S 5/10/2007 FS	Off-Site MW-5D 5/15/2007 FS	Off-Site MW-5D 5/15/2007 DUP	Off-Site MW-5S 5/15/2007 FS	Off-Site MW-6 5/14/2007 FS	Off-Site MW-8S 5/15/2007 FS
Volatile Organic Compounds													
Acetone	3,700 G	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon tetrachloride	0.16	10 U	10 U	10 U	10 U	2 J	2 J	10 U	10 U	10 U	10 U	10 U	10 U
Chloroform	0.15	1 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	40	10 U	10 U	10 U	10 U	10 U	10 U	3 J	10 U	10 U	10 U	10 U	10 U
Methyl tert-butyl ether	NA	10 U	10 U	5 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methylcyclohexane	NA	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	1.1	10 U	10 U	10 U	10 U	1 J	2 J	3 J	10 U	10 U	4 J	10 U	10 U
Trichloroethene	1.6	2 J	3 J	10 U	10 U	12	13	13	2 J	3 J	10 U	10 U	10 U
Vinyl chloride	0.019	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Inorganics, Dissolved													
Ferrous Iron	300 SMCL	8 U	8 U	36 J	100 U	100 U	100 U	100 U	8 U	8 U	31 J	8 U	8 U
Lead	5	2.2 U	2.2 U	2.7 B	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
Manganese	50 SMCL	146	0.19 U	26	13.4 B	15 U	15 U	30	0.9 B	0.87 B	26.8	3.4 B	217
Inorganics, Total													
Ferrous Iron	300 SMCL	8 U	8 U	32 J	13 J	8 U	8 U	8 U	8 U	8 U	41 J	8 U	8 U
Lead	5	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 B	2.7 B	3.6
Manganese	50 SMCL	152	19.1 J	34.5 J	14.8 B	15 U	2.8 B	111	2.4 J	1.3 J	37 J	53.9 J	656 J
Miscellaneous Parameters													
Alkalinity to pH 4.5	NA	9600	118000	3300	26800	84300	85800	174000	104000	104000	5200	186000	4200
Alkalinity to pH 8.3	NA	460 U	112000	460 U	460 U	460 U	460 U	460 U	2100	2100	460 U	460 U	460 U
Chloride	250,000 SMCL	11900	37700 D	25700	3300	14000	14000	6200	8600	7700	54500 D	19300	17500
Nitrogen, Nitrate	10,000 M	15700 D	6700	25100 D	4300	8800	9100	3700	730	780	4100	3400	11200
Sulfate	NA	24800 D	10100	4200 J	1500 U	3300 J	3200 J	2000 J	19400	18800	26500	15400	4200 J
Total Organic Carbon	NA	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
Gasses													
Carbon Dioxide	NA	99000	R	110000	54000	2500 U	2500 U	11000	2500 U	2500 U	180000	10000	99000
Ethane	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethene	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methane	NA	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U

See Notes on Page 3.

Table 5 – Detected Constituents in Ground Water, May 2007

Notes:
Results reported in micrograms per liter (ug/L); also expressed as parts per billion (ppb).
Cleanup standards provided in Table 1 of the ROD (USEPA, September 30, 1999). Where no cleanup standard was established, the Pennsylvania Act 2 standard was applied.
Bolded values were detected.
Shaded values exceed applicable criteria value.
-- = Not Analyzed.

Criteria Qualifiers:
G = Ingestion.
M = Maximum Contaminant Level.
NA = Not Available.
SMCL = Secondary Maximum Contaminant Level.

Data Qualifiers:
B = The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.
D = Concentration is based on a diluted sample analysis.
J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.
R = Unusable result. Analyte may or may not be present in the sample.
U = The compound was analyzed for but not detected. The associated numerical value is the compound quantitation limit.

Table 6. - <u>Risk at current Performance Standards</u> – risks were calculated using the reported concentrations within the 1999 ROD, Table 1.0.

The risks are summarized as follows:

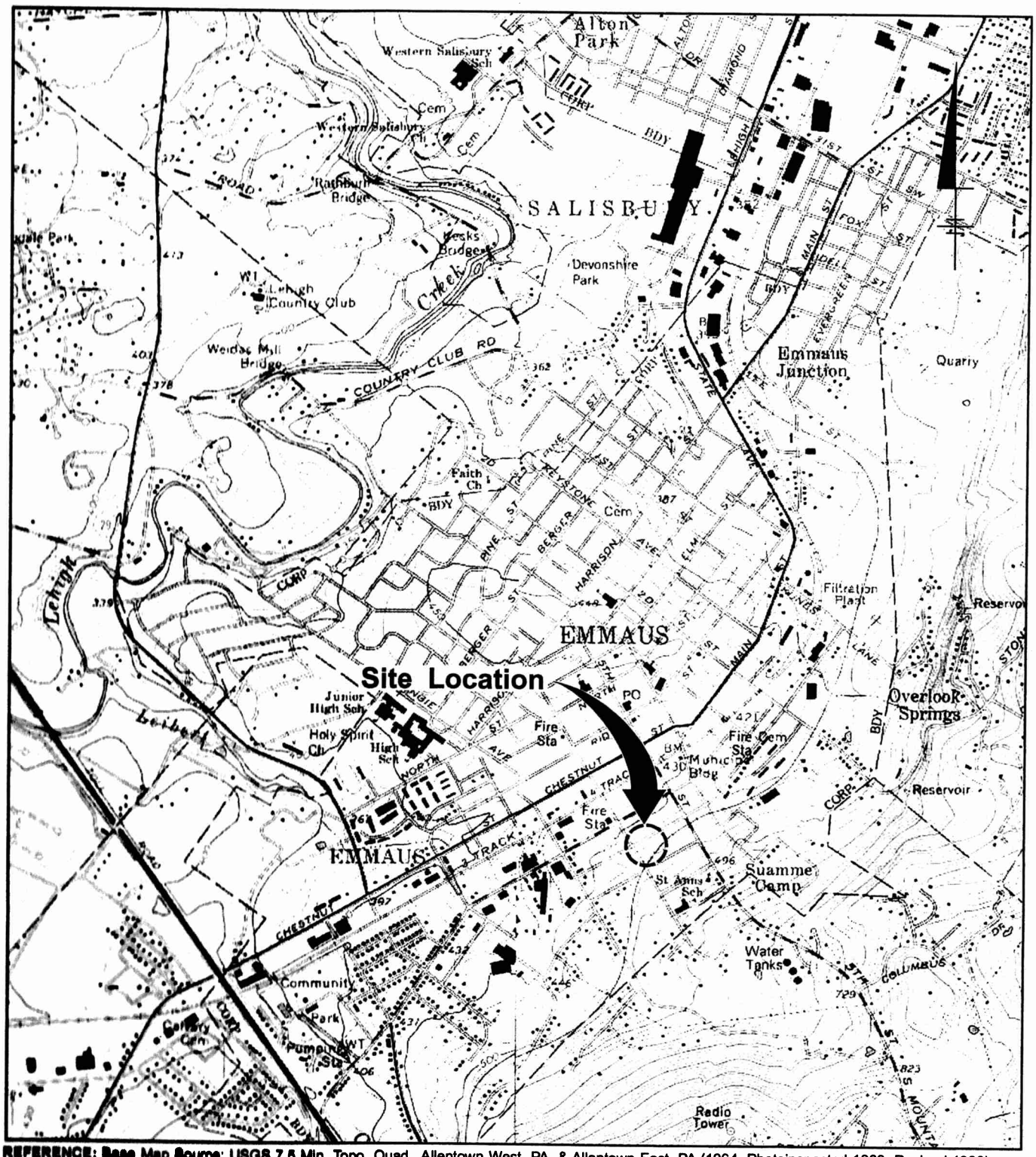
Chemical	Child HI	Adult HI	Lifetime Cancer Risk
Vinyl chloride	4.3E-04	2.0E-04	2.2E-07
Chloroform	1.0E-03	5.4E-04	1.5E-07
1,1-DCE	5.8E-03	3.9E-03	--
Carbon Tetrachloride	1.8E-02	7.9E-03	4.3E-07
1,1,2-TCA	3.3E-03	1.4E-03	2.5E-07
Benzene	7.4E-03	4.2E-03	4.6E-07
PCE	1.1E-02	4.9E-03	1.4E-05
1,4-dichloro benzene	--	3.3E-05	1.6E-07
TCE	9.2E-03	3.9E-03	4.3E-07
chloromethane	--	2.1E-03	5.2E-07
BEHP	4.4E-02	1.8E-02	2.9E-06
PCP	1.5E-02	6.3E-03	1.2E-05
Benzo(k)fluoranthene	--	--	3.5E-05
Dibenzo(a,h)anthracene	--	--	3.2E-05
Benzo(b)fluoranthene	--	--	2.2E-06
N-nitrosodiphenylamine	--	--	1.6E-06
Phenanthracene	--	--	--
Ethylbenzene	7.1E-01	3.5E-01	**2.2E-04**
2-methylnapthalene	**4.5E+00**	**1.9E+00**	--
Benzo(a)anthracene	--	--	1.3E-06
Indeno(1,2,3)pyrene	--	--	2.2E-05
Naphthalene	3.4E-02	1.1E-01	3.2E-06

Chemical	Child HI	Adult HI	Lifetime Cancer Risk
Pyrene	1.4E-01	6.0E-02	--
Xylene	2.1E-01	8.8E-02	--
Benzo(a)pyrene	1.8E-06	7.3E-07	--
Cis-1,2-dichloroethene	2.8E-01	1.2E-01	--
Trans-1.2-dichloroethene	1.7E-01	4.1E-01	--
4-methylphenol	8.4E-01	3.6E-01	--
Toluene	4.1E-01	1.8E-01	--
Arsenic	9.7E-03	4.1E-03	1.0E-06
Antimony	1.0E+00	4.2E-01	--
Copper	2.4E-01	1.0E-01	--
Iron	2.8E-02	1.2E-02	--
Thallium	4.9E-01	2.1E-01	--
Chromium	**3.3E+00**	**1.2E+00**	--
Barium	**1.2E+00**	4.5E-01	--
Cadmium	7.2E-01	3.0E-01	--
Cyanide	6.4E-01	2.8E-01	--
Nickel	3.3E-01	1.4E-01	--
Vanadium	2.4E-02	9.6E-03	--
Zinc	4.3E-01	1.8E-01	--
Aluminum	1.3E-02	5.5E-03	--
Manganese	1.6E-01	6.3E-02	--
TOTAL	**1.6E+01**	**7.0E+00**	**3.6E-04**

EPA's non-cancer threshold value of 1.0 is exceeded for 2-methylnapthalene, chromium, and barium.

Cumulative cancer risk results exceeds EPA's acceptable cancer risk range 1E-04-1E-06 for the lifetime resident (3.6E-04). The risk is primarily due to ethylbenzene, PCP, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

FIGURES



REFERENCE: Base Map Source: USGS 7.5 Min. Topo. Quad., Allentown West, PA. & Allentown East, PA (1964, Photoinspected 1983, Revised 1992).

2000' 0 2000'

Approximate Scale: 1" = 2000'

QUAD LOCATION

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

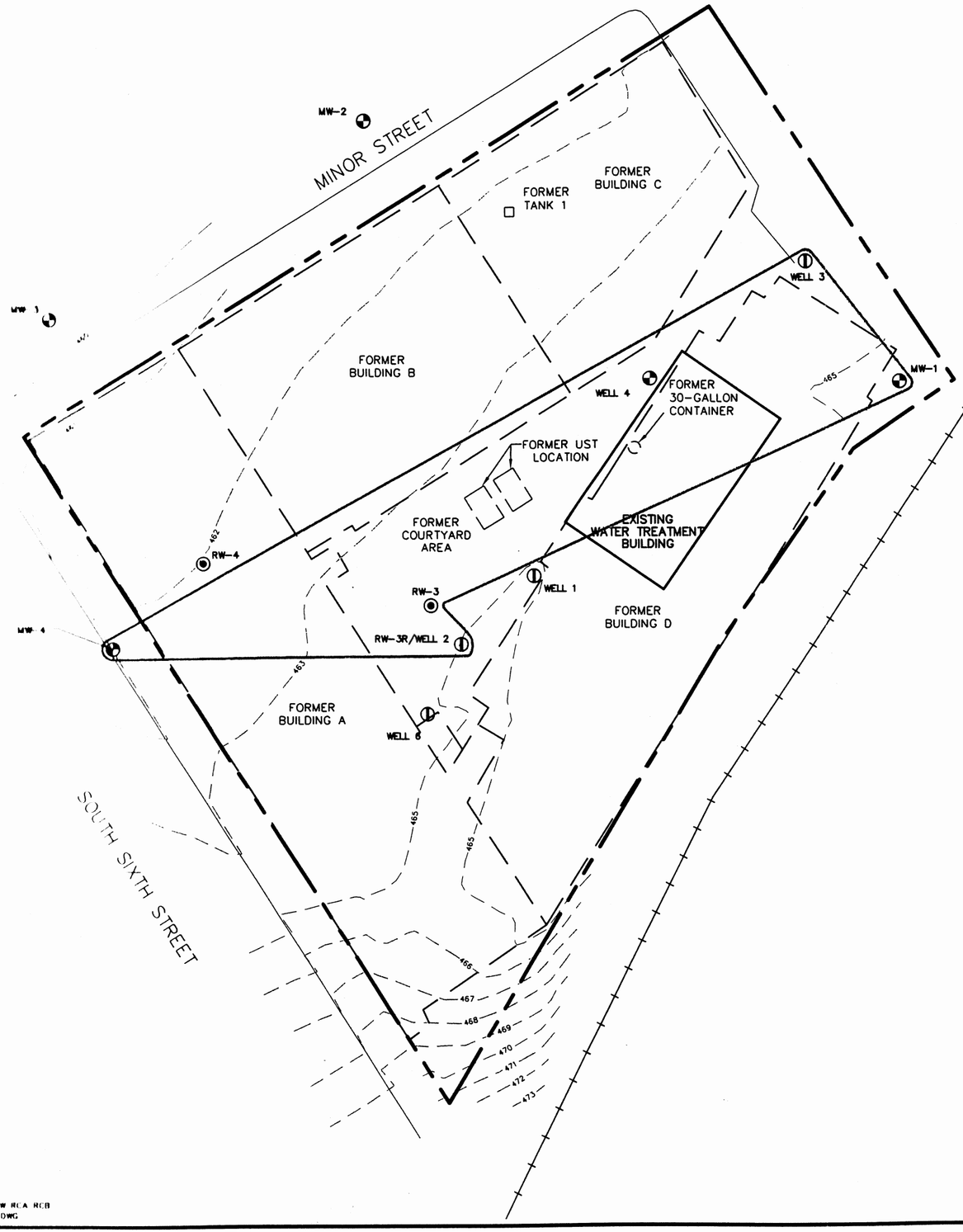
RD/RA COMPLETION REPORT

SITE LOCATION MAP

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

FIGURE 1

08/03/03 BYR-D64-LBR
06471008/06471n01.cdr



LEGEND

WELL 1	FORMER DISPOSAL WELL
MW-2	GROUNDWATER MONITORING WELL
RW-3	RECOVERY WELL
	PROPERTY BOUNDARY
465	GROUND SURFACE ELEVATION CONTOUR IN FEET ABOVE MEAN SEA LEVEL
	FOOTPRINT OF FORMER BUILDING
	LIMITS OF PROBABLE DNAPL ZONE (SEE NOTE 3)

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. LIMITS OF PROBABLE DNAPL ZONE COPIED FROM FIGURE 9 OF THE "TECHNICAL IMPRACTICABILITY EVALUATION FOR THE RODALE MANUFACTURING SITE, EMMAUS, PENNSYLVANIA" REPORT BY OBE, DATED SEPTEMBER 1999

0 40 80

GRAPHIC SCALE

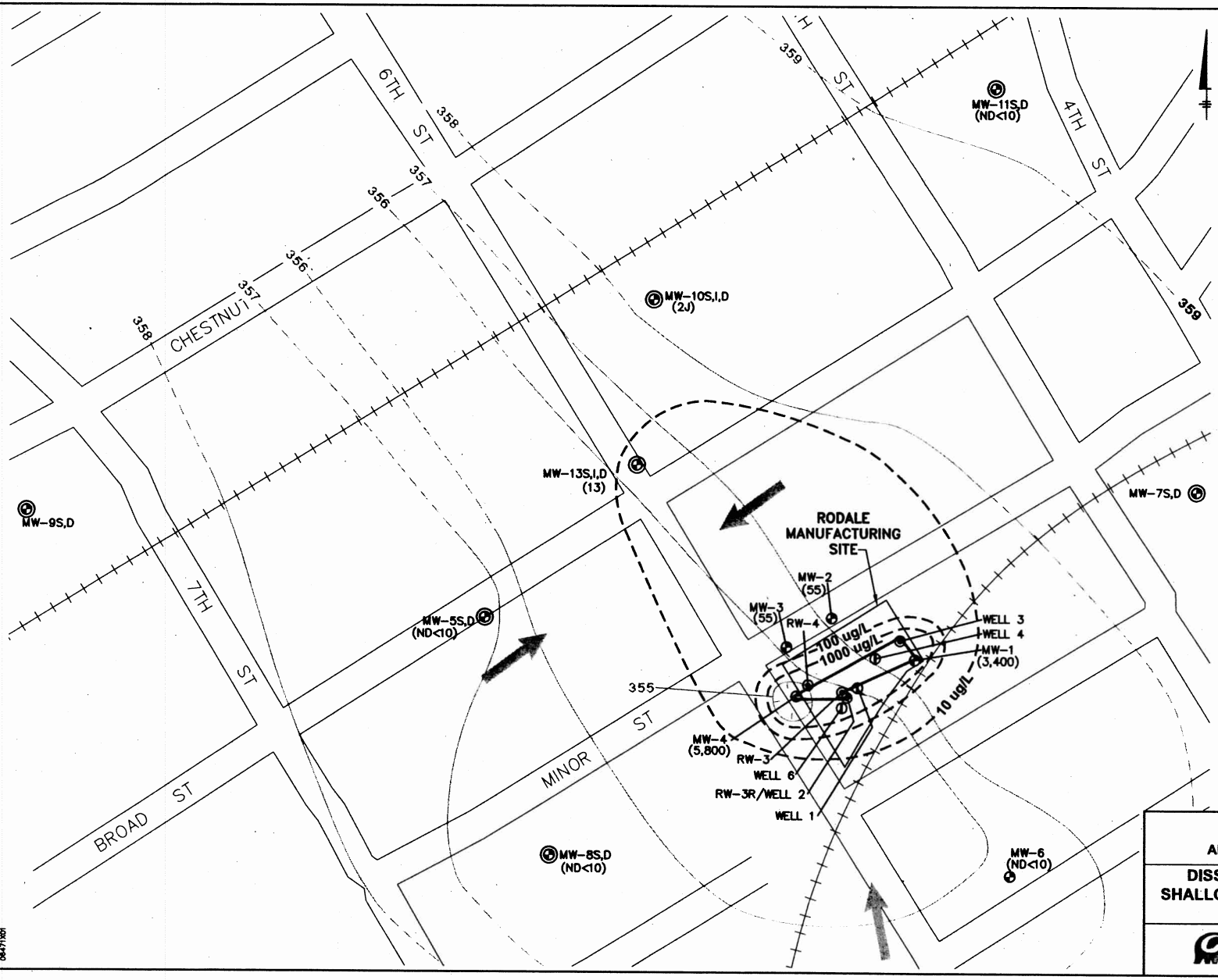
RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

RD/RA COMPLETION REPORT

SITE PLAN/WELL LOCATION MAP

BBL

FIGURE 2



LEGEND

- MONITORING WELL CLUSTER
- SHALLOW MONITORING WELL
- FORMER PRODUCTION/ DISPOSAL WELL
- RECOVERY WELL
- (55) TCE CONCENTRATION IN ug/L
- (ND) NOT DETECTED ABOVE THE QUANTITATION LIMIT PRESENTED
- LIMITS OF PROBABLE DNAPL ZONE (SEE NOTE 3)
- 357 GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- GROUNDWATER FLOW DIRECTION
- ug/L = MICROGRAMS PER LITER

NOTES:

1. BASE MAP MODIFIED FROM GEO-ENVIRONMENTAL CONSULTANTS, INC. DRAWING ENTITLED "GROUNDWATER ELEVATION CONTOUR MAP SEPTEMBER 1993", FILE NUMBER EMM-REG.DWG, DATED 12/9/93.
2. MONITORING WELLS COMPLETED IN CONNECTION WITH THE REMEDIAL INVESTIGATION AND THE RD/RA HAVE BEEN SURVEYED. ALL OTHER LOCATIONS ARE APPROXIMATE.
3. LIMITS OF PROBABLE DNAPL ZONE COPIED FROM FIGURE 9 OF THE "TECHNICAL IMPRACTICABILITY EVALUATION FOR THE RODALE MANUFACTURING SITE EMMAUS, PENNSYLVANIA" REPORT BY BBL, DATED SEPTEMBER 1999.

0 200' 400'
GRAPHIC SCALE

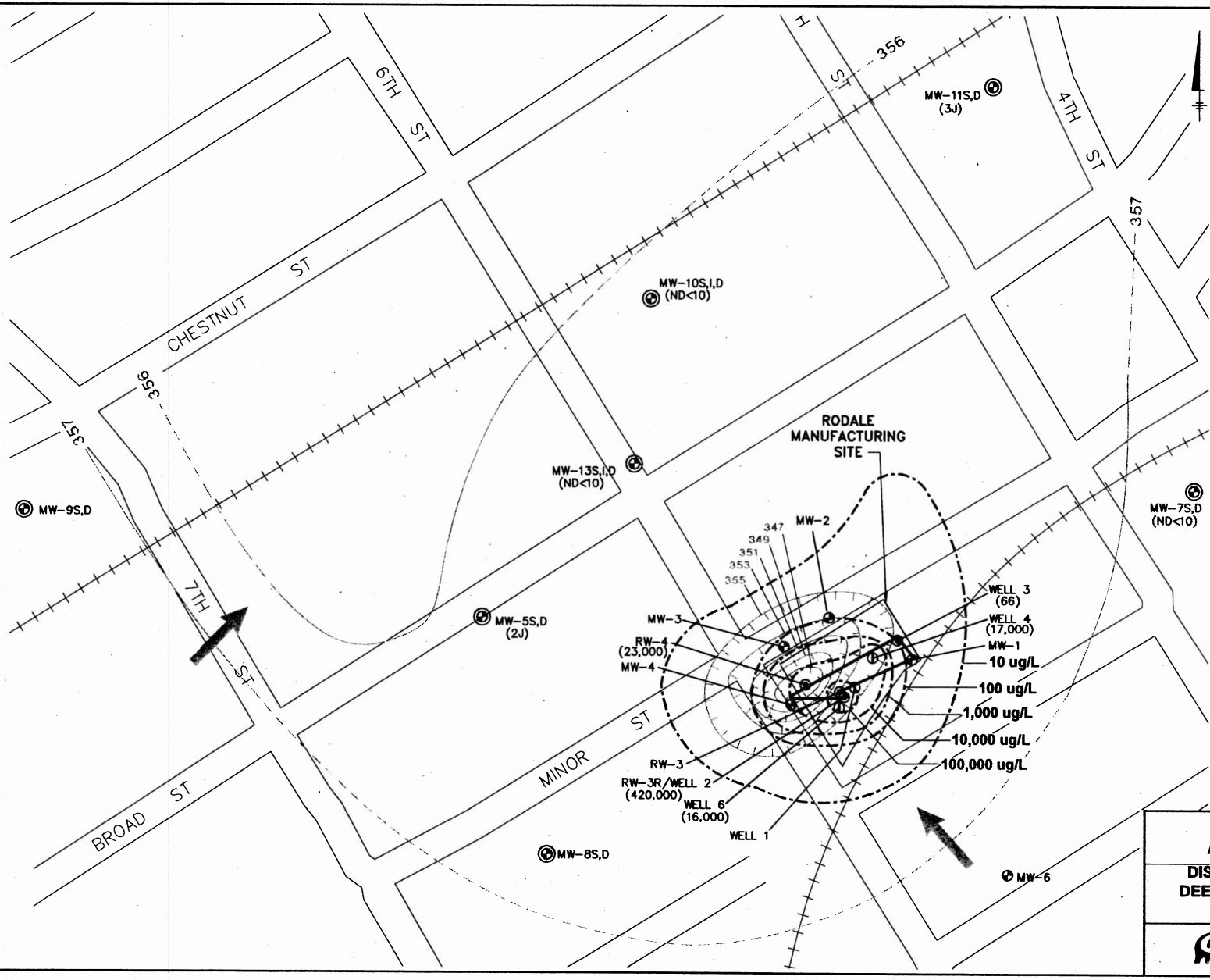
RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA
ANNUAL MONITORING REPORT

DISSOLVED TCE DISTRIBUTION
SHALLOW WELLS (~135 FEET DEPTH)
MAY 2007

ARCADIS

FIGURE
3

SYR-54-DWW WLJ LAYER: ON=*, OFF=*REF*
G:\CAD\ACT\B0006471\0000\00024\DWG\06471W07.DWG SAVED: 6/25/2008 8:53 AM LAYOUT:1 PAGESETUP:---- PENTABLE:PLTFULL.CTB PRINTED: 6/25/2008 10:12 AM BY: NJONES
PROJECTNAME:----
XREFS: IMAGES:
06471X01



LEGEND

- MONITORING WELL CLUSTER
- SHALLOW MONITORING WELL
- FORMER PRODUCTION/ DISPOSAL WELL
- RECOVERY WELL
- (66) TCE CONCENTRATION IN ug/L
- (ND) NOT DETECTED ABOVE THE QUANTITATION LIMIT PRESENTED
- LIMITS OF PROBABLE DNAPL ZONE (SEE NOTE 3)
- 357 GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- GROUNDWATER FLOW DIRECTION
- ug/L = MICROGRAMS PER LITER
- ISOCONCENTRATION LINE (ug/L)

NOTES:

1. BASE MAP MODIFIED FROM GEO-ENVIRONMENTAL CONSULTANTS, INC. DRAWING ENTITLED "GROUNDWATER ELEVATION CONTOUR MAP SEPTEMBER 1993", FILE NUMBER EMM-REG.DWG, DATED 12/9/93.
2. MONITORING WELLS COMPLETED IN CONNECTION WITH THE REMEDIAL INVESTIGATION AND THE RD/RA HAVE BEEN SURVEYED. ALL OTHER LOCATIONS ARE APPROXIMATE.
3. LIMITS OF PROBABLE DNAPL ZONE COPIED FROM FIGURE 9 OF THE "TECHNICAL IMPRACTICABILITY EVALUATION FOR THE RODALE MANUFACTURING SITE EMMAUS, PENNSYLVANIA" REPORT BY BBL, DATED SEPTEMBER 1999.

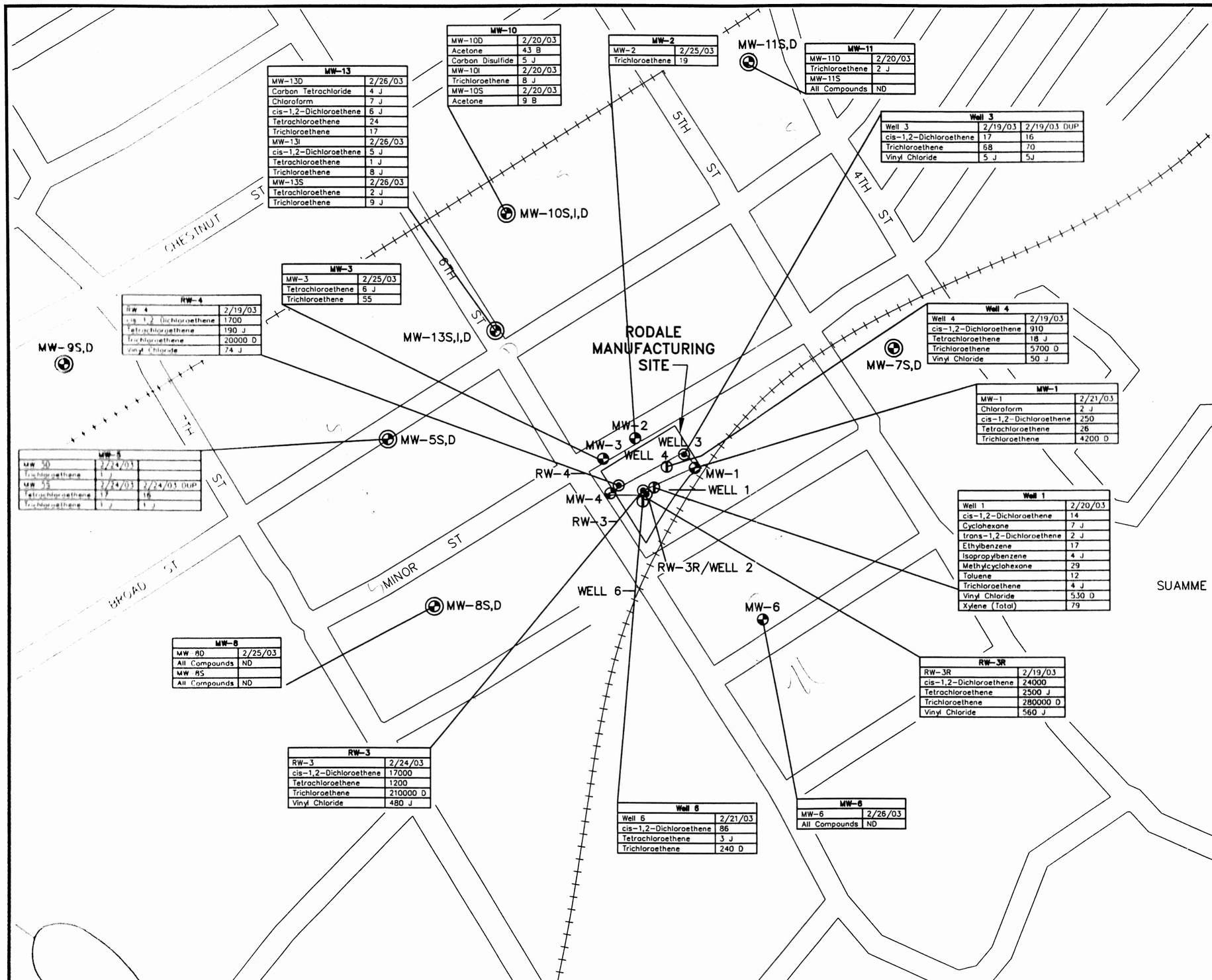
0 200' 400'
GRAPHIC SCALE

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA
ANNUAL MONITORING REPORT

DISSOLVED TCE DISTRIBUTION
DEEP WELLS (~300 FEET DEPTH)
MAY 2007

ARCADIS

FIGURE 4



MW-13	
MW-13D	2/26/03
Carbon Tetrachloride	4 J
Chloroform	7 J
cis-1,2-Dichloroethene	6 J
Tetrachloroethene	24
Trichloroethene	17
MW-13I	2/26/03
cis-1,2-Dichloroethene	5 J
Tetrachloroethene	1 J
Trichloroethene	8 J
MW-13S	2/26/03
Tetrachloroethene	2 J
Trichloroethene	9 J

MW-10	
MW-10D	2/20/03
Acetone	43 B
Carbon Disulfide	5 J
MW-10I	2/20/03
Trichloroethene	8 J
MW-10S	2/20/03
Acetone	9 B

MW-2	
MW-2	2/25/03
Trichloroethene	19

MW-11	
MW-11D	2/20/03
Trichloroethene	2 J
MW-11S	
All Compounds	ND

Well 3		
Well 3	2/19/03	2/19/03 DUP
cis-1,2-Dichloroethene	17	16
Trichloroethene	68	70
Vinyl Chloride	5 J	5J

MW-3	
MW-3	2/25/03
Tetrachloroethene	6 J
Trichloroethene	55

RW-4	
RW-4	2/19/03
cis-1,2-Dichloroethene	1700
Tetrachloroethene	190 J
Trichloroethene	20000 D
Vinyl Chloride	74 J

Well 4	
Well 4	2/19/03
cis-1,2-Dichloroethene	910
Tetrachloroethene	18 J
Trichloroethene	5700 D
Vinyl Chloride	50 J

MW-1	
MW-1	2/21/03
Chloroform	2 J
cis-1,2-Dichloroethene	250
Tetrachloroethene	26
Trichloroethene	4200 D

MW-5		
MW-5D	2/24/03	
Trichloroethene	1 J	
MW-5S	2/24/03	2/24/03 DUP
Tetrachloroethene	17	16
Trichloroethene	1 J	1 J

Well 1	
Well 1	2/20/03
cis-1,2-Dichloroethene	14
Cyclohexane	7 J
trans-1,2-Dichloroethene	2 J
Ethylbenzene	17
Isopropylbenzene	4 J
Methylcyclohexane	29
Toluene	12
Trichloroethene	4 J
Vinyl Chloride	530 D
Xylene (Total)	79

MW-8	
MW-8D	2/25/03
All Compounds	ND
MW-8S	
All Compounds	ND

RW-3R	
RW-3R	2/19/03
cis-1,2-Dichloroethene	24000
Tetrachloroethene	2500 J
Trichloroethene	280000 D
Vinyl Chloride	560 J

RW-3	
RW-3	2/24/03
cis-1,2-Dichloroethene	17000
Tetrachloroethene	1200
Trichloroethene	210000 D
Vinyl Chloride	480 J

Well 6	
Well 6	2/21/03
cis-1,2-Dichloroethene	86
Tetrachloroethene	3 J
Trichloroethene	240 D

MW-6	
MW-6	2/26/03
All Compounds	ND

LEGEND

- MONITORING WELL CLUSTER
- SHALLOW MONITORING WELL
- FORMER PRODUCTION/ DISPOSAL WELL
- RECOVERY WELL
- LIMITS OF PROBABLE DNAPL ZONE (SEE NOTE 3)

MW-10	
MW-10D	2/20/03
Acetone	43 B
Carbon Disulfide	5 J
MW-10I	2/20/03
Trichloroethene	8 J
MW-10S	2/20/03
Acetone	9 B

ALL VOC RESULTS REPORTED IN MICROGRAMS PER LITER (ug/L)

CONCENTRATIONS HIGHLIGHTED IN YELLOW EXCEED GROUNDWATER CLEANUP STANDARD

B = THE COMPOUND HAS BEEN FOUND IN THE SAMPLE AS WELL AS IN IT'S ASSOCIATED BLANK. IT'S PRESENCE IN THE SAMPLE MAY BE SUSPECT

D = COMPOUND WAS ANALYZED AT A SECONDARY DILLUTION.

J = ESTIMATED VALUE, COMPOUND WAS DETECTED BUT RESULTS ARE BELOW QUANTITATION LIMITS.

ND = NOT DETECTED

NOTES:

1. BASE MAP MODIFIED FROM GEO-ENVIRONMENTAL CONSULTANTS, INC. DRAWING ENTITLED "GROUNDWATER ELEVATION CONTOUR MAP SEPTEMBER 1993", FILE NUMBER EMM-REG.DWG, DATED 12/9/93.
2. MONITORING WELL, SOIL BORING, AND SURFACE SOIL SAMPLE LOCATIONS COMPLETED IN CONNECTION WITH THE REMEDIAL INVESTIGATION AND THE RD/RA HAVE BEEN SURVEYED. ALL OTHER LOCATIONS ARE APPROXIMATE.
3. LIMITS OF PROBABLE DNAPL ZONE COPIED FROM FIGURE 9 OF THE "TECHNICAL IMPRACTICABILITY EVALUATION FOR THE RODALE MANUFACTURING SITE EMMAUS, PENNSYLVANIA" REPORT BY BBL, DATED SEPTEMBER 1999.

0 300' 600'

GRAPHIC SCALE

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA

RD/RA COMPLETION REPORT

VOC CONCENTRATIONS IN GROUNDWATER (FEBRUARY 2003)

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

FIGURE
5

FIGURE 6
CHEMICAL CONCENTRATIONS VERSUS TIME (MW-2)

Rodale Manufacturing Site
Emmaus, Pennsylvania

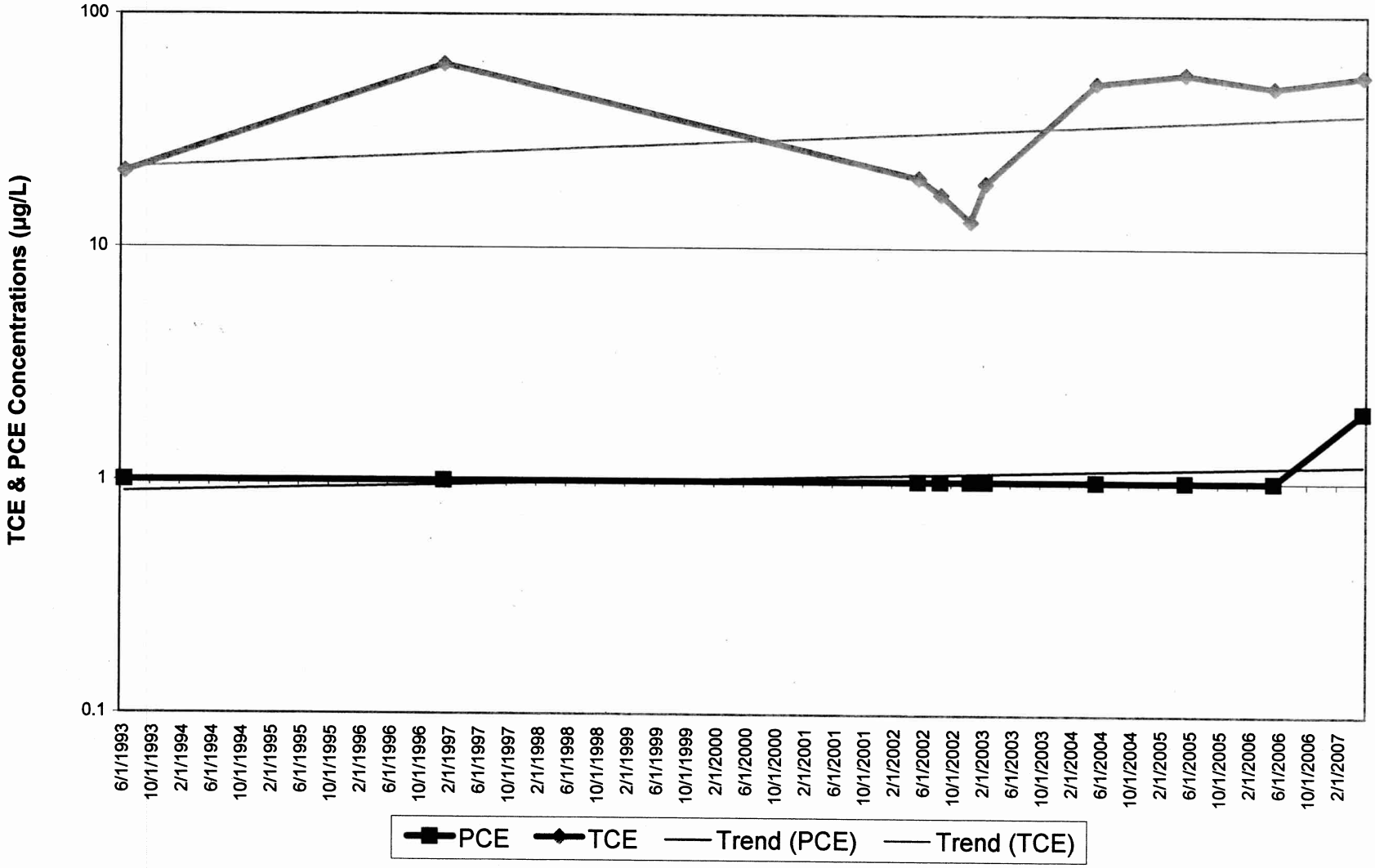


FIGURE 7
CHEMICAL CONCENTRATIONS VERSUS TIME (MW-3)

Rodale Manufacturing Site
Emmaus, Pennsylvania

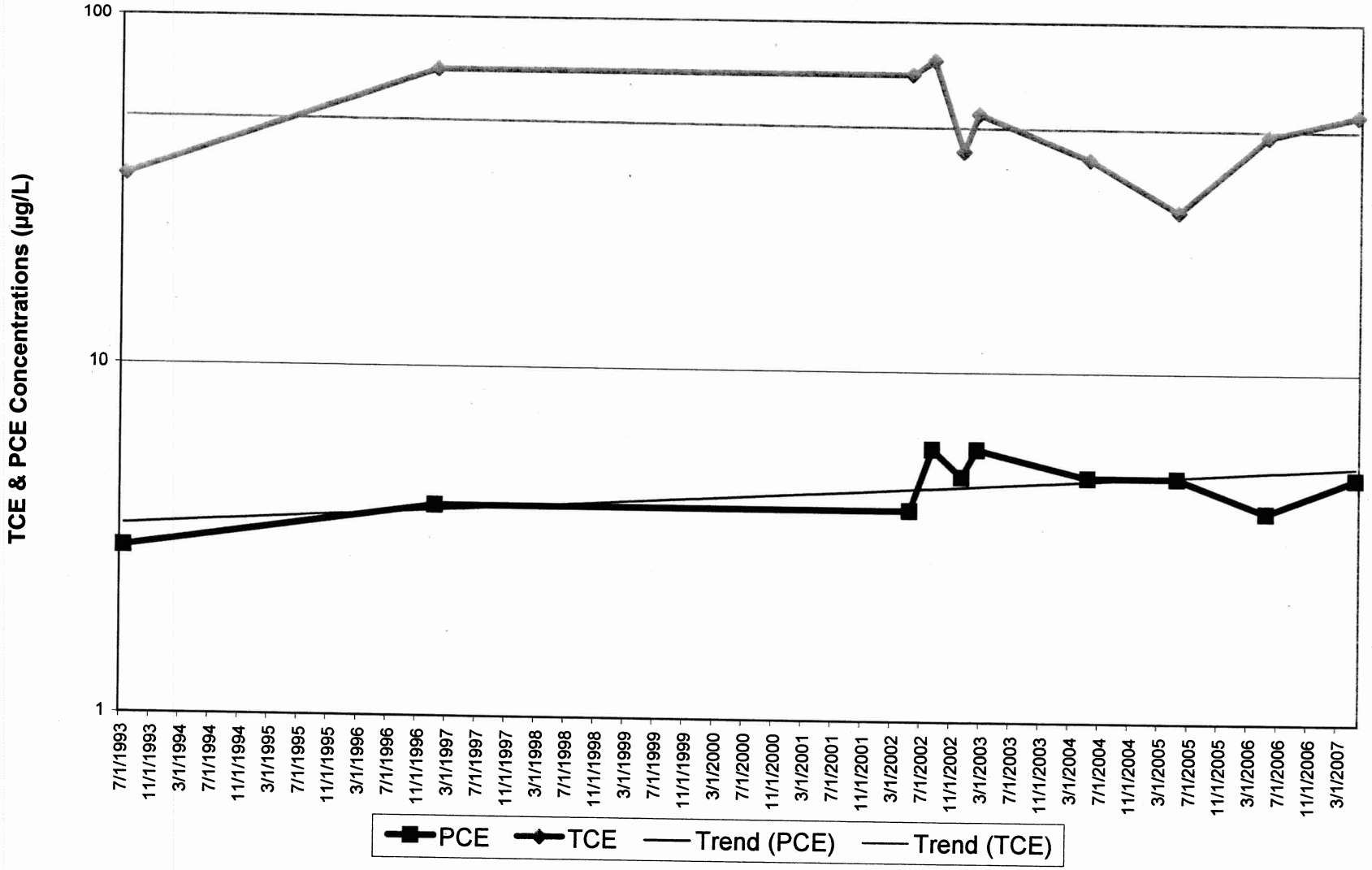


FIGURE 8

CHEMICAL CONCENTRATIONS VERSUS TIME (MW-4)

Rodale Manufacturing Site
Emmaus, Pennsylvania

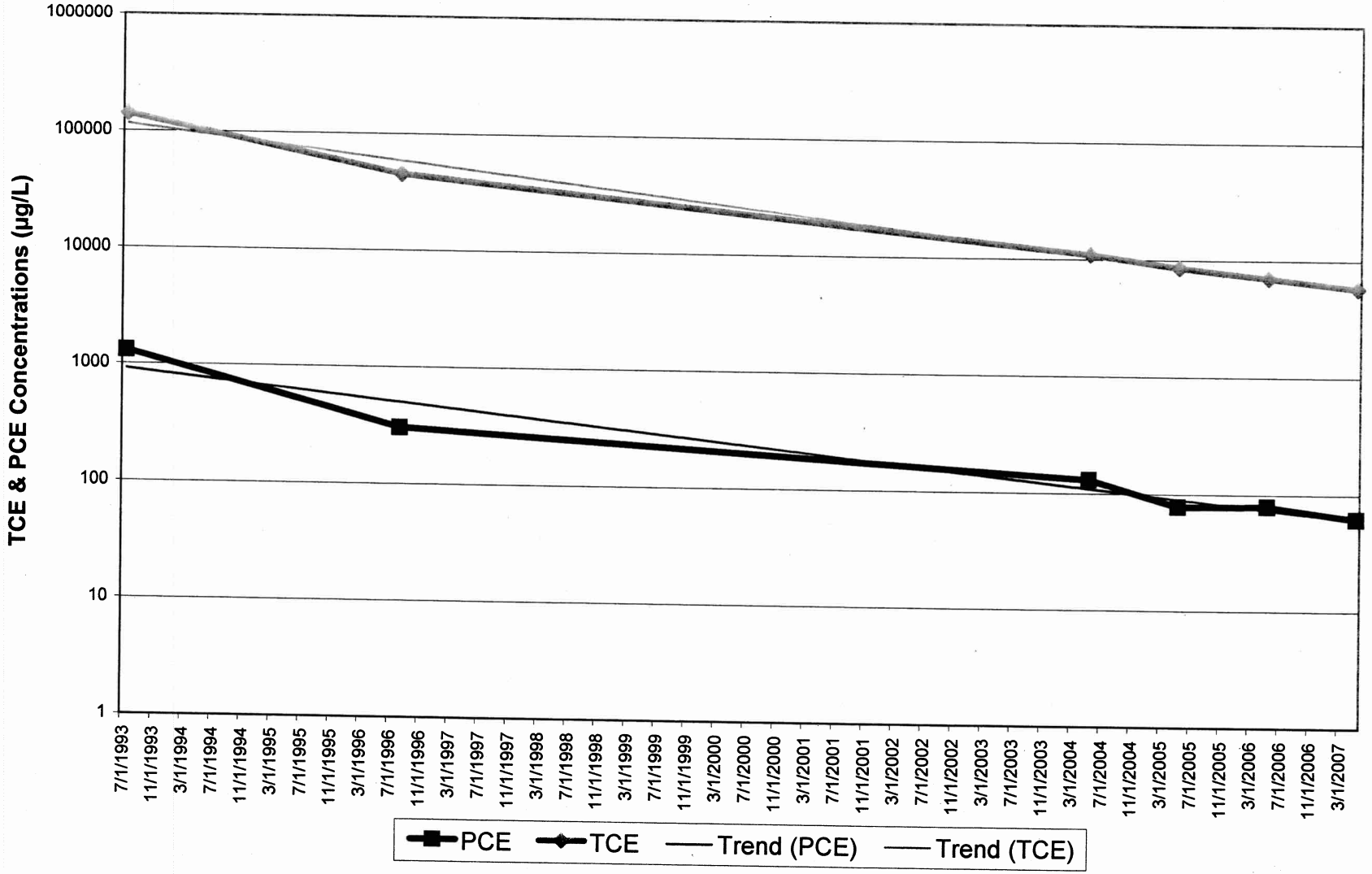


FIGURE 9

CHEMICAL CONCENTRATIONS VERSUS TIME (MW-10D)

Rodale Manufacturing Site
Emmaus, Pennsylvania

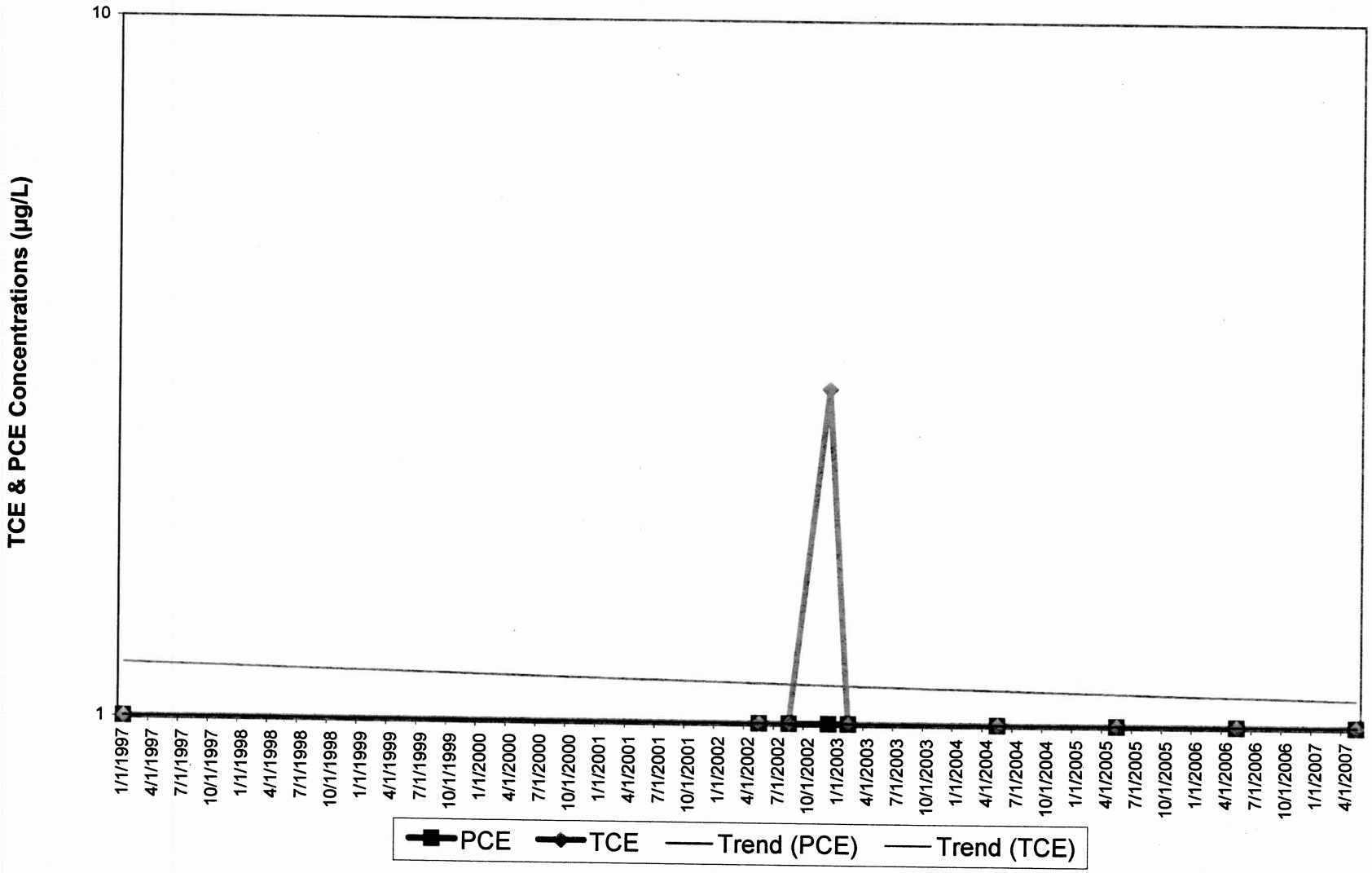


FIGURE 10

CHEMICAL CONCENTRATIONS VERSUS TIME (MW-10I)

Rodale Manufacturing Site
Emmaus, Pennsylvania

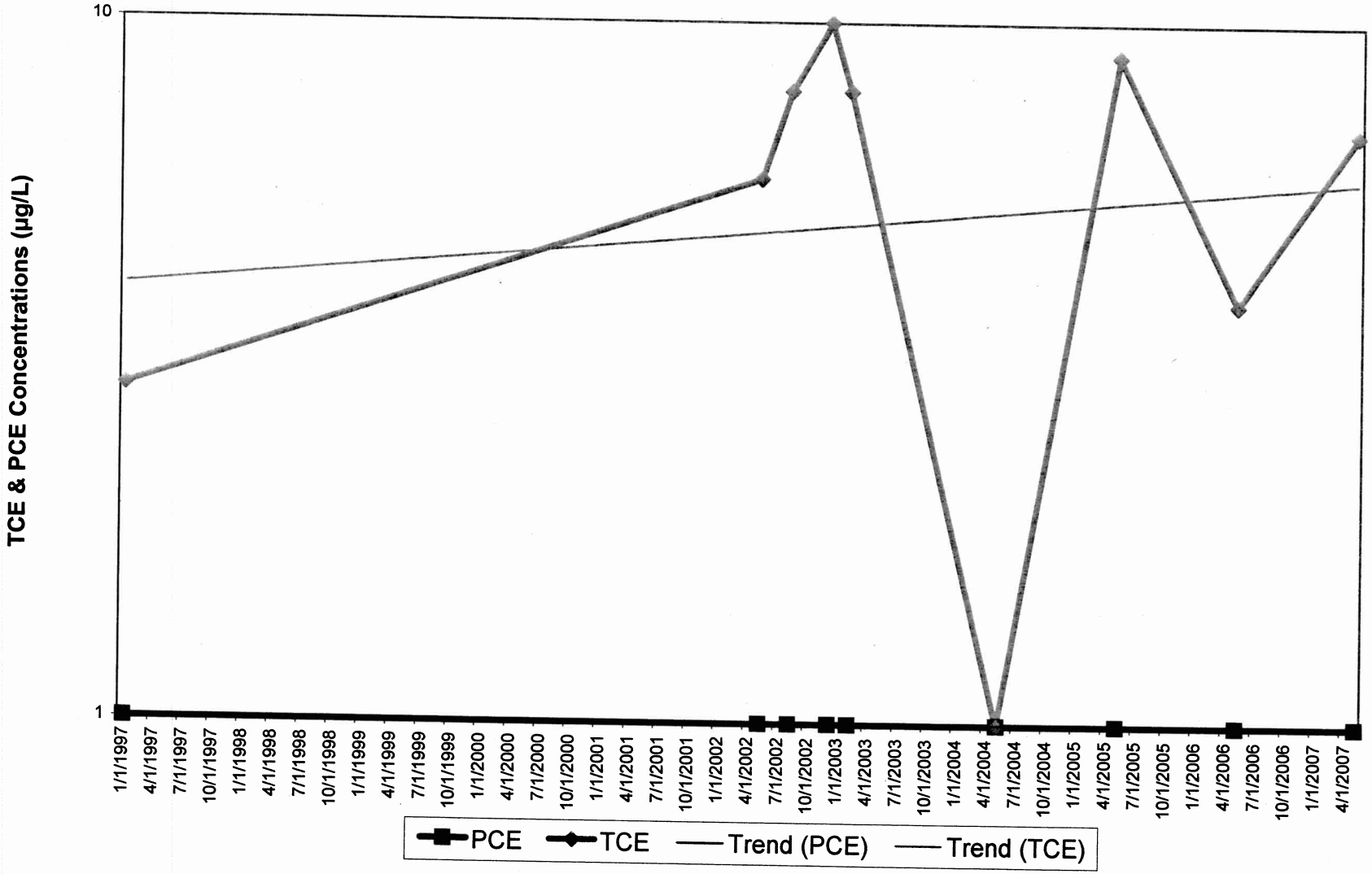


FIGURE 11

CHEMICAL CONCENTRATIONS VERSUS TIME (MW-10S)

Rodale Manufacturing Site
Emmaus, Pennsylvania

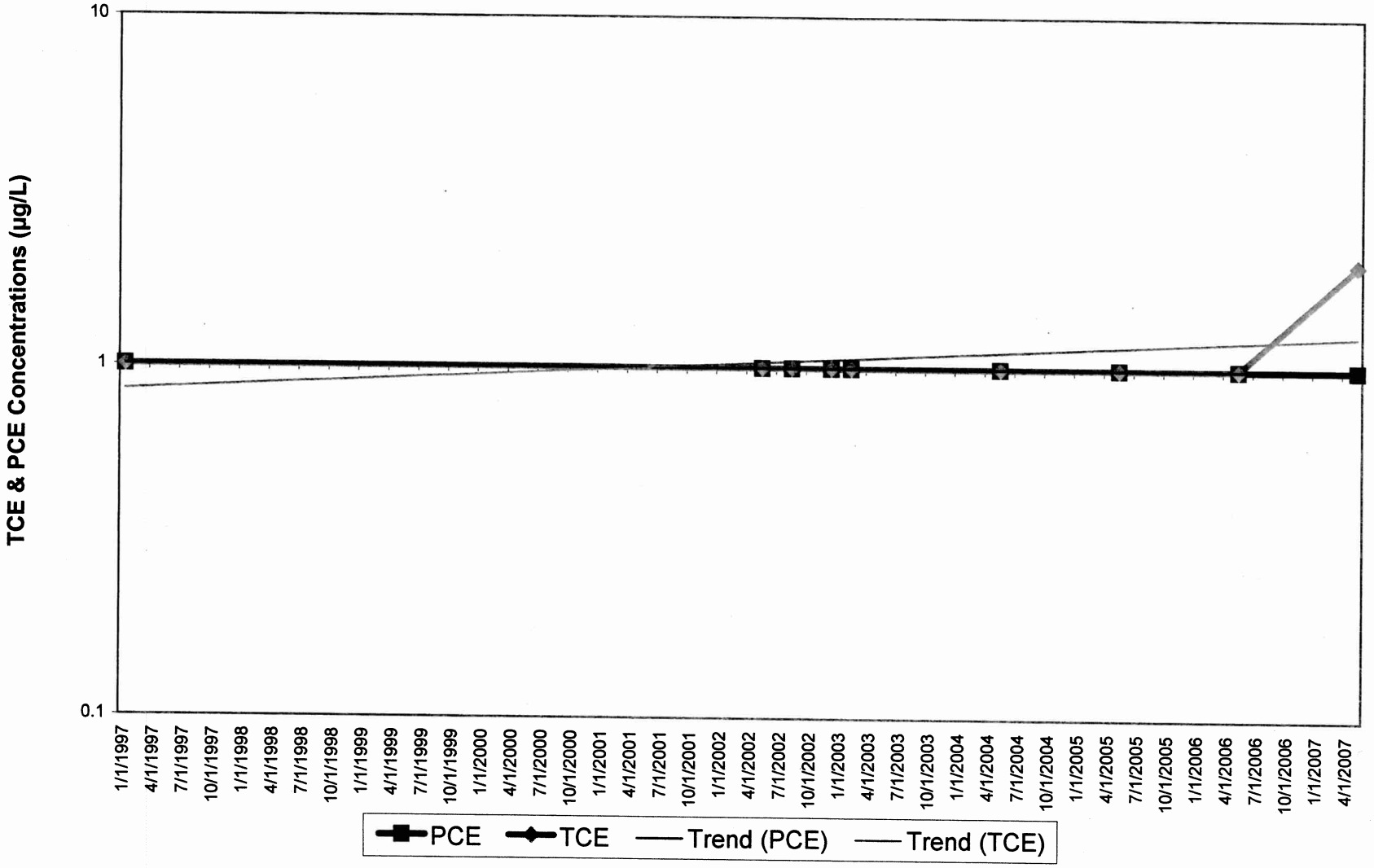


FIGURE 12
CHEMICAL CONCENTRATIONS VERSUS TIME (MW-13D)

Rodale Manufacturing Site
Emmaus, Pennsylvania

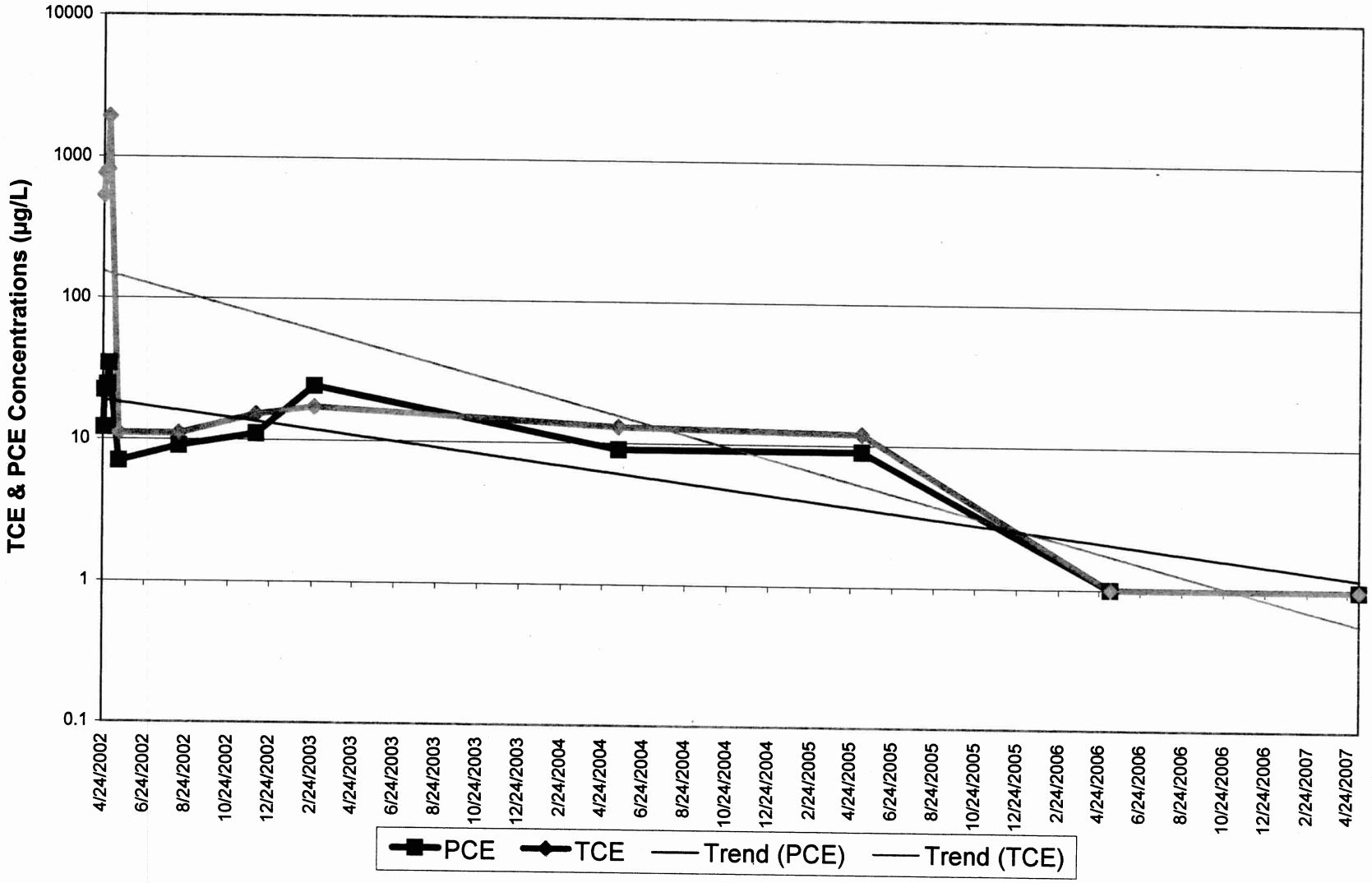


FIGURE 13

CHEMICAL CONCENTRATIONS VERSUS TIME (MW-13I)

Rodale Manufacturing Site
Emmaus, Pennsylvania

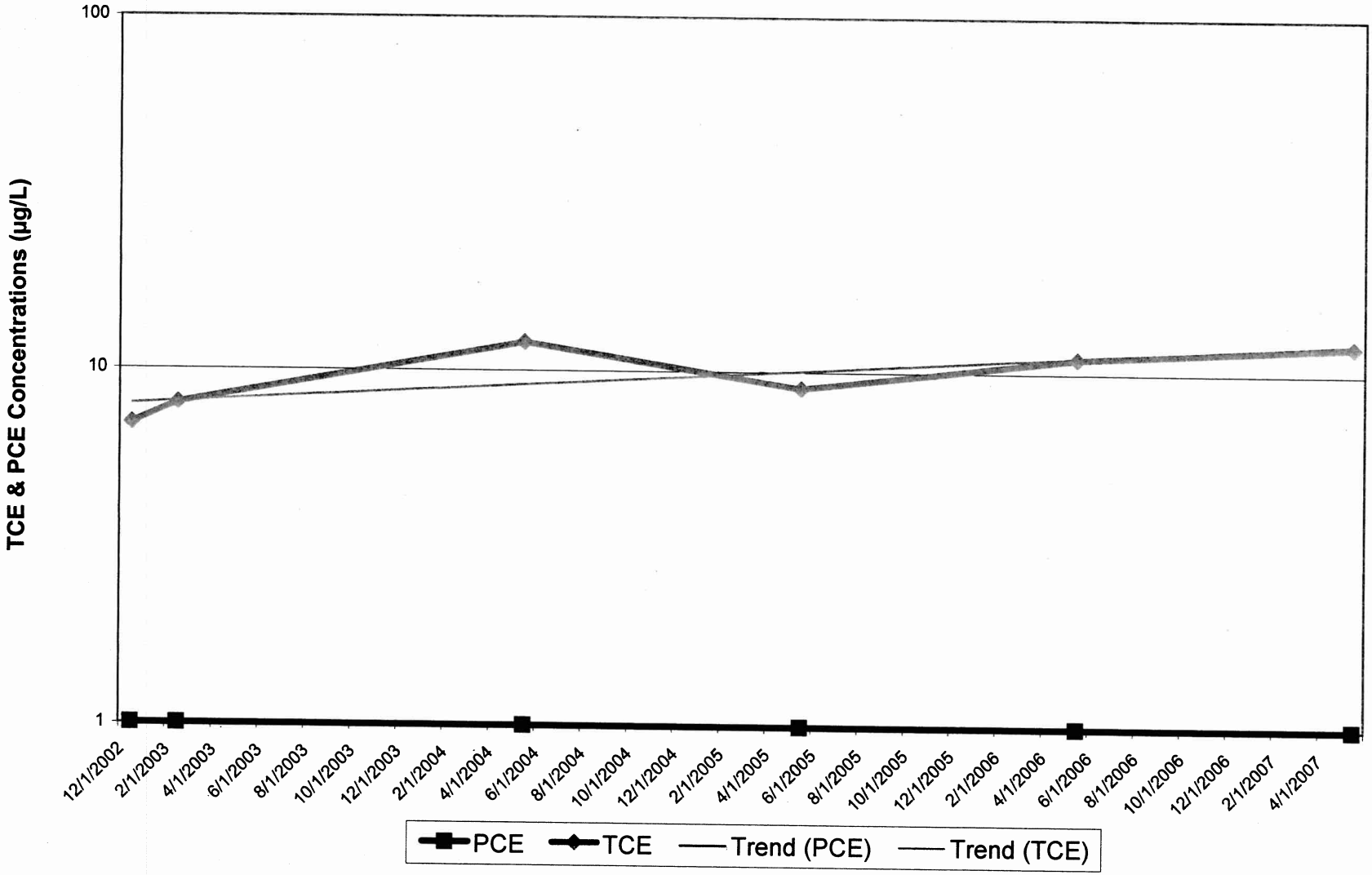


FIGURE 14

CHEMICAL CONCENTRATIONS VERSUS TIME (MW-13S)

Rodale Manufacturing Site
Emmaus, Pennsylvania

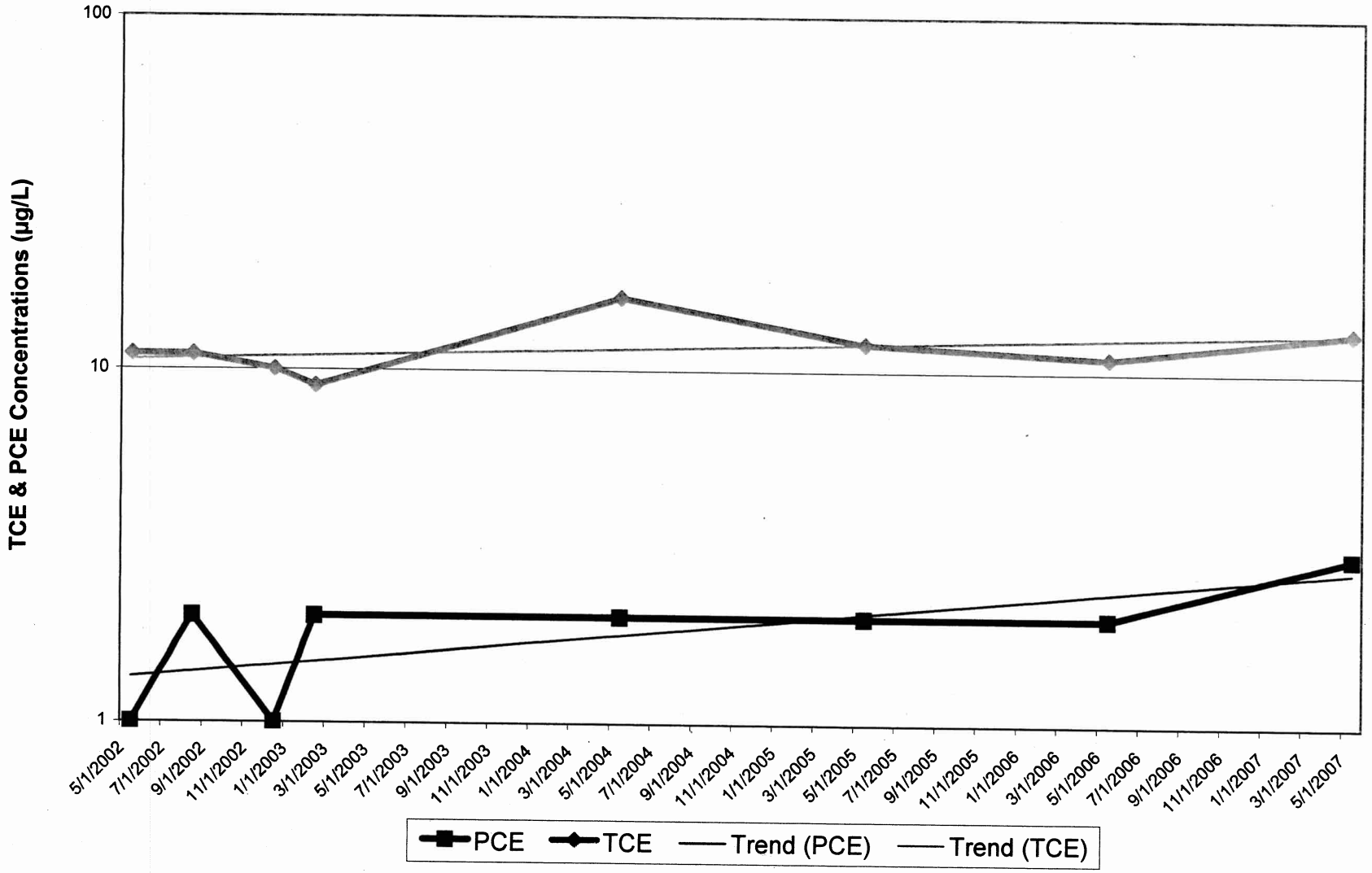


FIGURE 15
CHEMICAL CONCENTRATIONS VERSUS TIME (RW-3)

Rodale Manufacturing Site
Emmaus, Pennsylvania

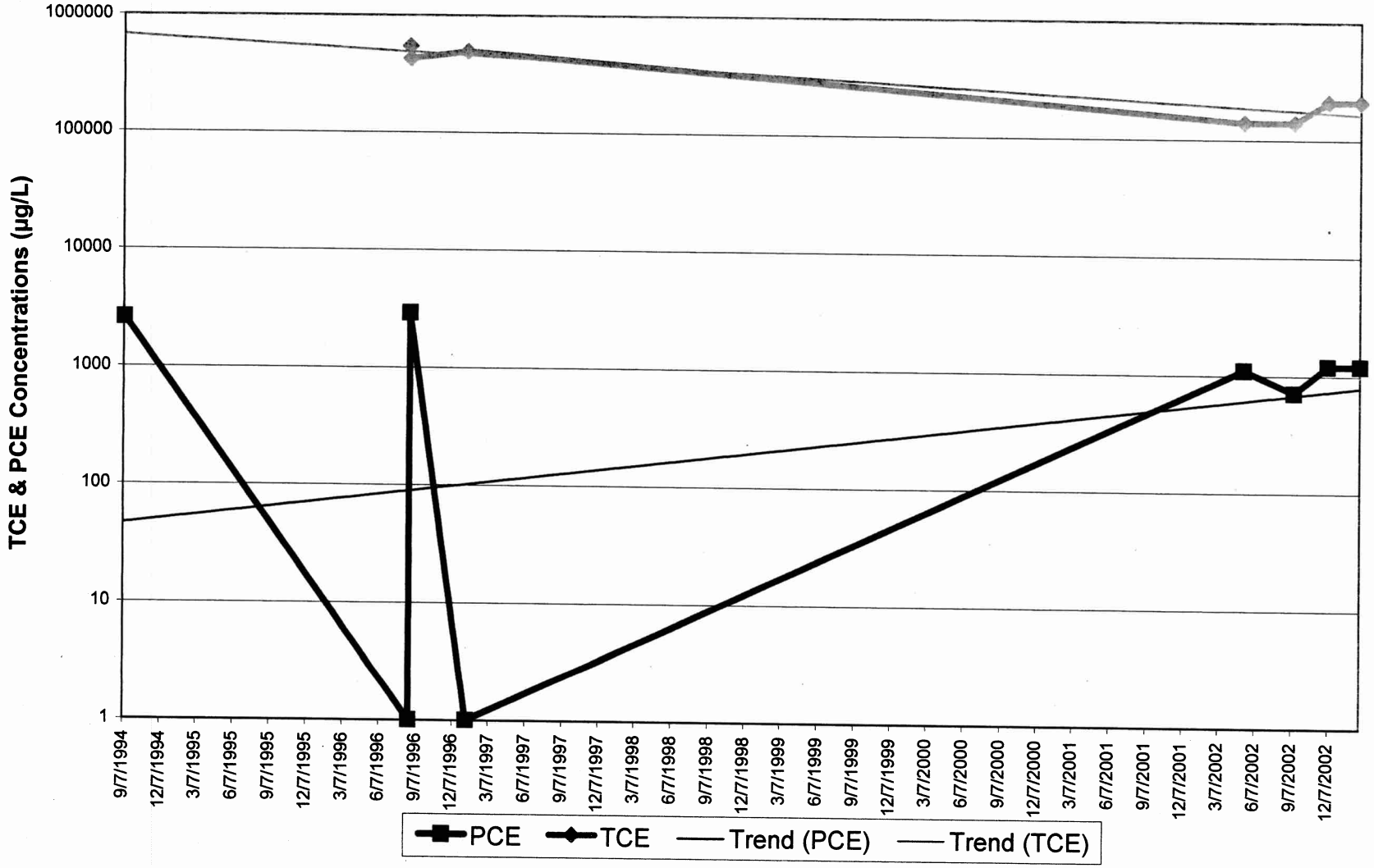


FIGURE 16
CHEMICAL CONCENTRATIONS VERSUS TIME (RW-3R)

Rodale Manufacturing Site
Emmaus, Pennsylvania

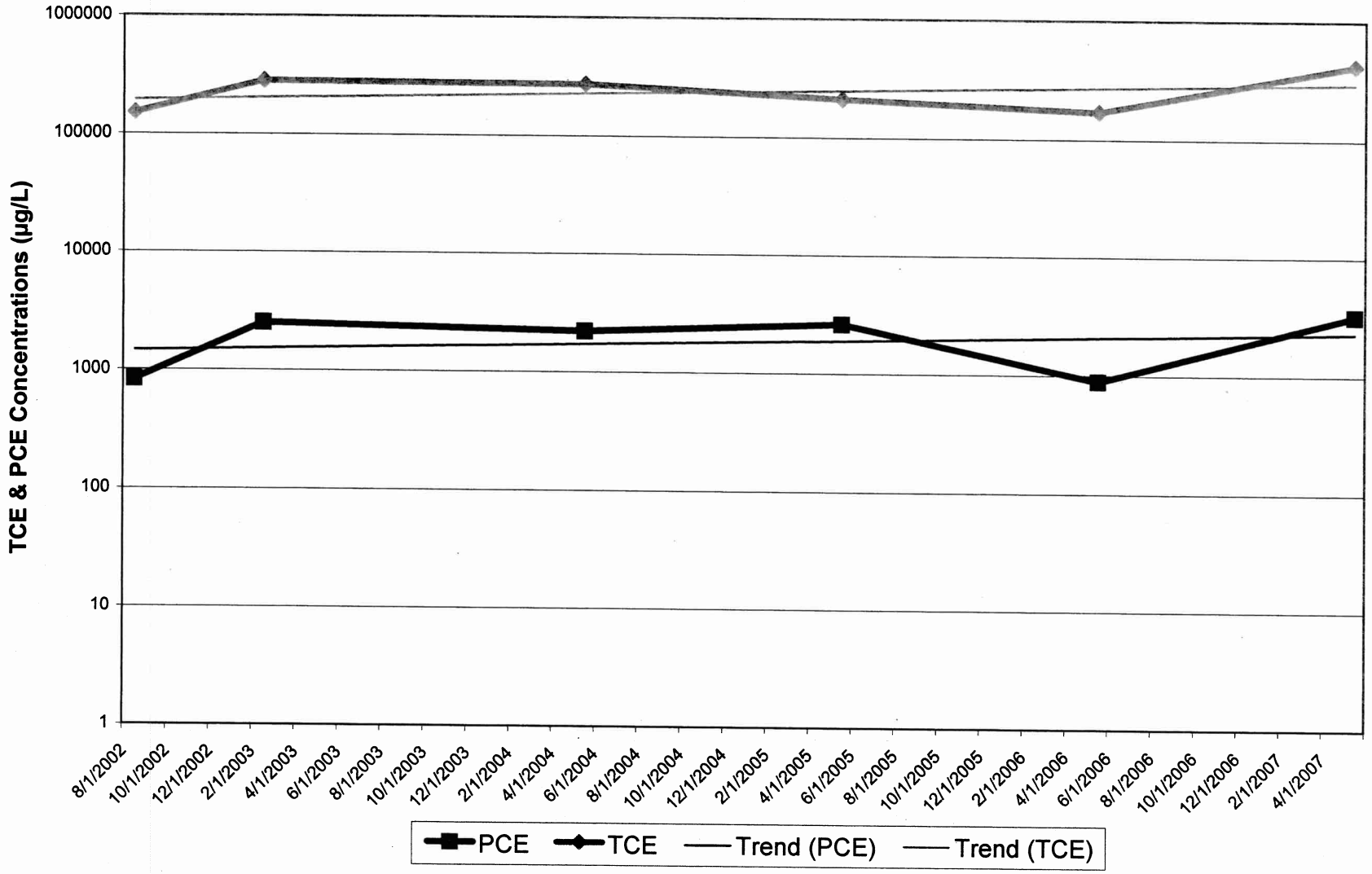


FIGURE 17

CHEMICAL CONCENTRATIONS VERSUS TIME (RW-4)

Rodale Manufacturing Site
Emmaus, Pennsylvania

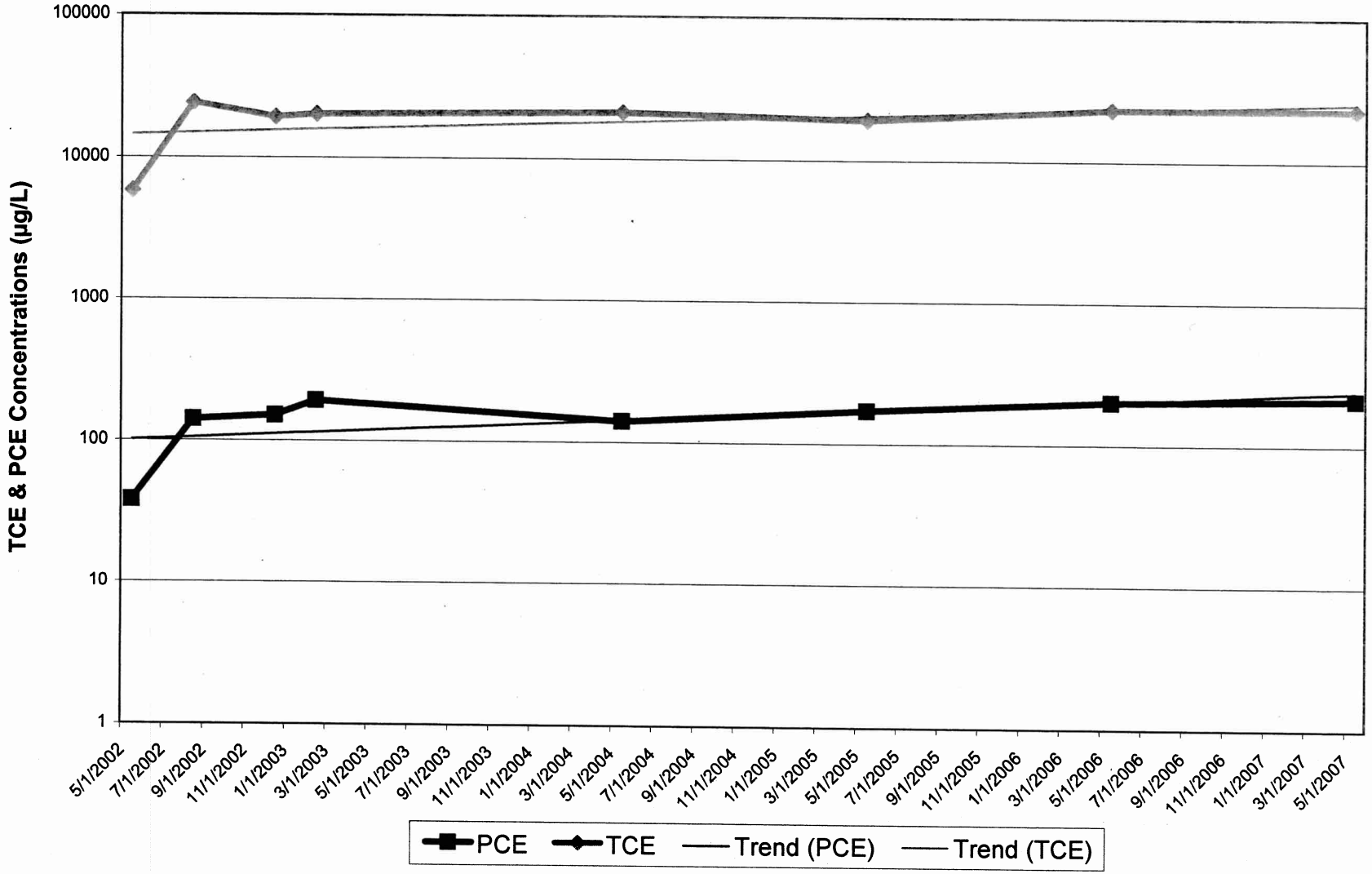


FIGURE 18

CHEMICAL CONCENTRATIONS VERSUS TIME (Well 3)

Rodale Manufacturing Site
Emmaus, Pennsylvania

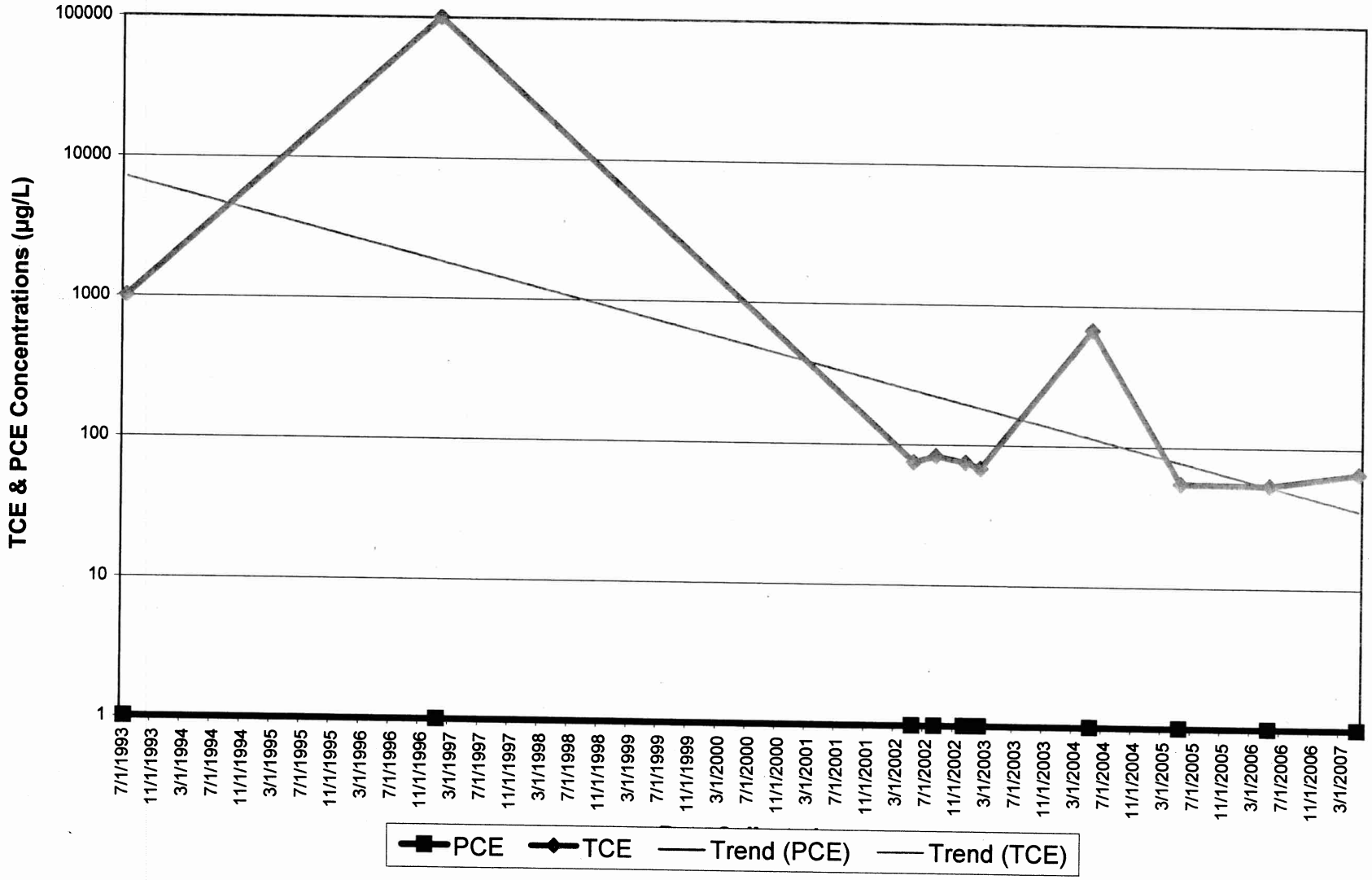
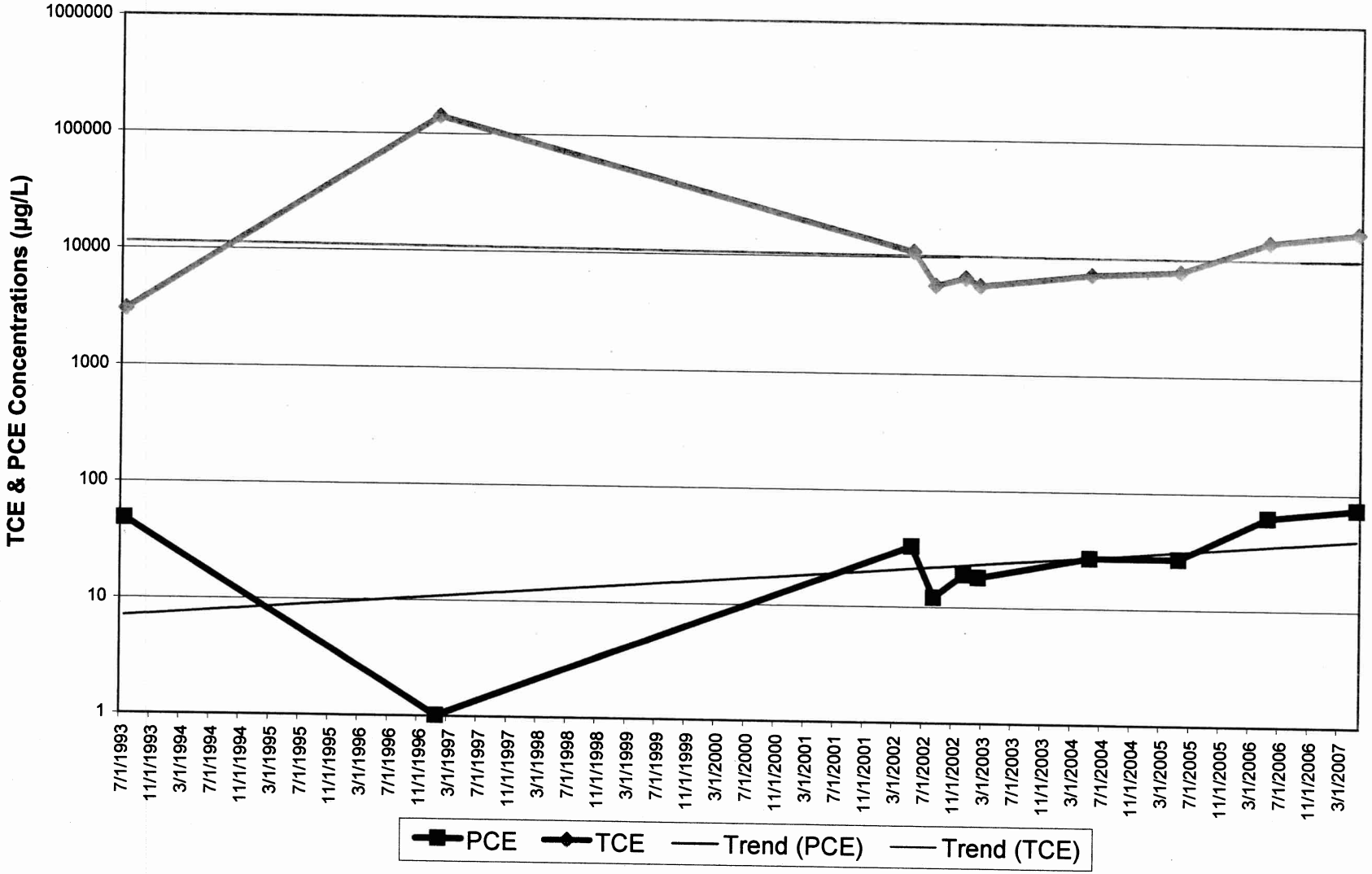
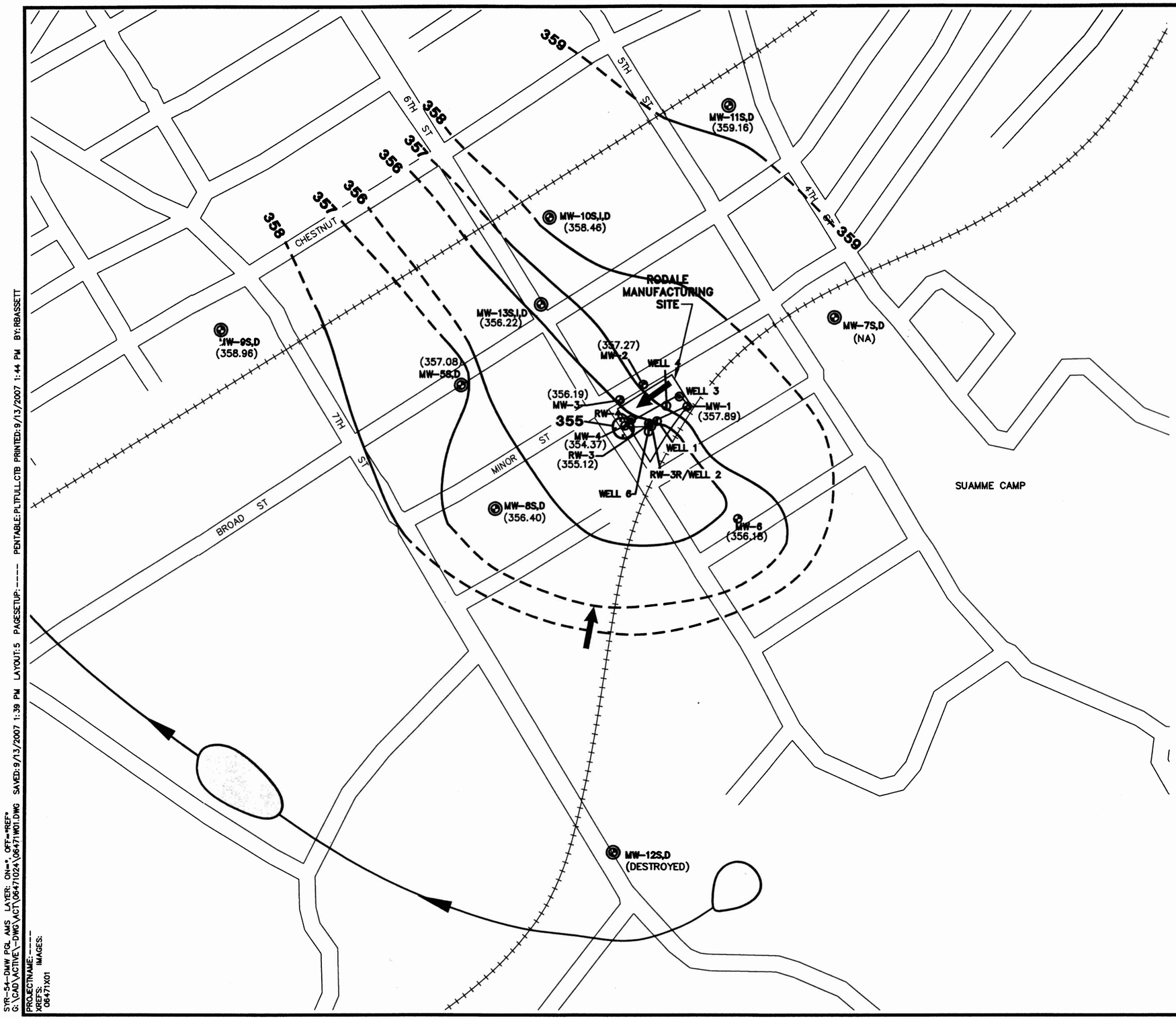


FIGURE 19

CHEMICAL CONCENTRATIONS VERSUS TIME (Well 4)

Rodale Manufacturing Site
Emmaus, Pennsylvania





LEGEND

- MONITORING WELL CLUSTER
- SHALLOW MONITORING WELL
- FORMER PRODUCTION/DISPOSAL WELL
- RECOVERY WELL
- LIMITS OF PROBABLE DNAPL ZONE (SEE NOTE 3)
- 362 GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- (363.20) GROUNDWATER ELEVATION
- GROUNDWATER FLOW DIRECTION

NOTES:

1. BASE MAP MODIFIED FROM GEO-ENVIRONMENTAL CONSULTANTS, INC. DRAWING ENTITLED "GROUNDWATER ELEVATION CONTOUR MAP SEPTEMBER 1993", FILE NUMBER EMM-REG.DWG, DATED 12/9/93.
2. MONITORING WELLS COMPLETED IN CONNECTION WITH THE REMEDIAL INVESTIGATION AND THE RD/RA HAVE BEEN SURVEYED. ALL OTHER LOCATIONS ARE APPROXIMATE.
3. LIMITS OF PROBABLE DNAPL ZONE COPIED FROM FIGURE 9 OF THE "TECHNICAL IMPRACTICABILITY EVALUATION FOR THE RODALE MANUFACTURING SITE EMMAUS, PENNSYLVANIA" REPORT BY BBL, DATED SEPTEMBER 1999.

0 400' 800'
GRAPHIC SCALE

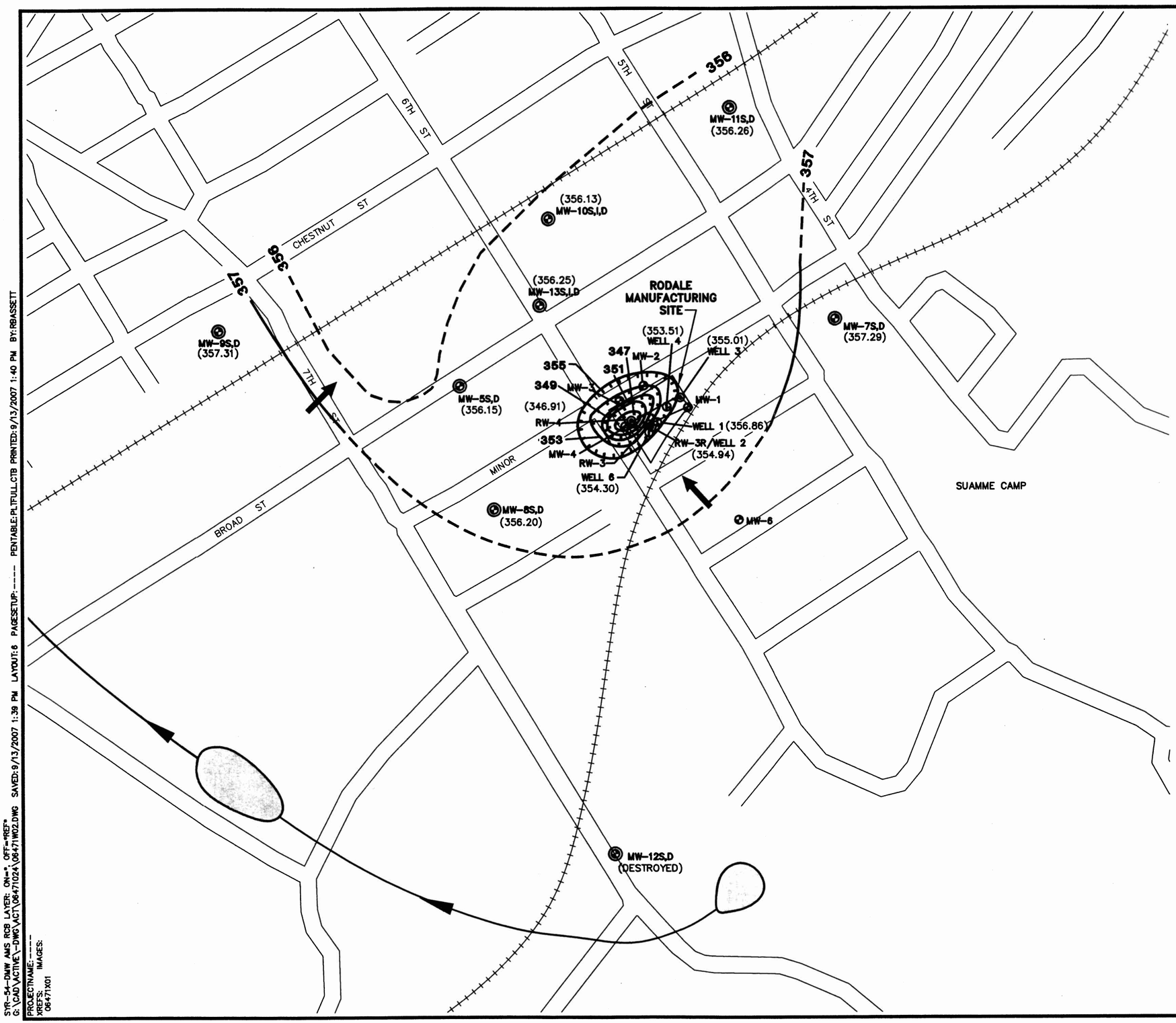
RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA
ANNUAL MONITORING REPORT

POTENTIOMETRIC SURFACE SHALLOW WELLS (~135 FEET DEPTH)
MAY 8, 2007

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE
20

SYR-54-DWW PGL AMS LAYER: ON=*, OFF=*REF*
G:\CAD\ACTIVE\-DWG\ACT\06471024\06471W01.DWG SAVED:9/13/2007 1:39 PM LAYOUT:5 PAGESETUP:---- PENTABLE:PLTFULL.CTB PRINTED:9/13/2007 1:44 PM BY:RBASSETT
PROJECTNAME:----
XREFS: 06471X01 IMAGES:



LEGEND

- MONITORING WELL CLUSTER
- SHALLOW MONITORING WELL
- FORMER PRODUCTION/DISPOSAL WELL
- RECOVERY WELL
- LIMITS OF PROBABLE DNAPL ZONE (SEE NOTE 3)
- 356 — GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- (353.99) GROUNDWATER ELEVATION
- GROUNDWATER FLOW DIRECTION

NOTES:

1. BASE MAP MODIFIED FROM GEO-ENVIRONMENTAL CONSULTANTS, INC. DRAWING ENTITLED "GROUNDWATER ELEVATION CONTOUR MAP SEPTEMBER 1993", FILE NUMBER EMM-REG.DWG, DATED 12/9/93.
2. MONITORING WELLS COMPLETED IN CONNECTION WITH THE REMEDIAL INVESTIGATION AND THE RD/RA HAVE BEEN SURVEYED. ALL OTHER LOCATIONS ARE APPROXIMATE.
3. LIMITS OF PROBABLE DNAPL ZONE COPIED FROM FIGURE 9 OF THE "TECHNICAL IMPRACTICABILITY EVALUATION FOR THE RODALE MANUFACTURING SITE EMMAUS, PENNSYLVANIA" REPORT BY BBL, DATED SEPTEMBER 1999.

0 400' 800'

GRAPHIC SCALE

RODALE MANUFACTURING SITE
EMMAUS, PENNSYLVANIA
ANNUAL MONITORING REPORT

POTENTIOMETRIC SURFACE DEEP WELLS (~300 FEET DEPTH)
MAY 8, 2007

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE
21

SYR-54-DMW AMS RCB LAYER: ON=*, OFF=*REF*
G:\CAD\ACTIVE\-DWG\ACT\06471024\06471W02.DWG SAVED:9/13/2007 1:39 PM LAYOUT:6 PAGESETUP:---- PENTABLE:PLTFULL.CTB PRINTED:9/13/2007 1:40 PM BY:RBASSETT
PROJECTNAME:----
XREFS: IMAGES:
06471X01