REMEDIAL INVESTIGATION REPORT
DELPHI FACILITY
1000 LEXINGTON AVENUE
ROCHESTER, NEW YORK
Registry Site No. 8-28-064
EPA ID No. NYD002215234

Volume 1 - Text

by

Haley & Aldrich of New York
Rochester, New York

for

Delphi Corporation
Troy, Michigan

File No. 70014-057
7 November 2005

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7 November 2005
File No. 70014-057

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Troy, MI 48098

Attention: Kyle M. H. Jones, Esq.

Subject: Remedial Investigation
Delphi Corporation Facility
1000 Lexington Avenue
Rochester, Monroe County, New York
Registry Site #828064
EPA ID No. NYD002215234

Gentlemen:

Haley & Aldrich is pleased to provide the attached report for the Remedial Investigation (RI) of the Delphi Corporation Facility located at 1000 Lexington Avenue in the City of Rochester, New York.

The site is listed as Site #8-28-064 in the Registry of Inactive Hazardous Waste Disposal Sites in New York State. This Remedial Investigation was performed in accordance with the terms of an Order on Consent agreed to by Delphi and the New York State Department of Environmental Conservation in December 2001 for a Remedial Investigation and Feasibility Study (RI/FS) for the site.

Sincerely yours,
HALEY & ALDRICH OF NEW YORK

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CERTIFICATION

This report describes the results of a Remedial Investigation (RI) performed at the Delphi Corporation site located at 1000 Lexington Avenue in Rochester, New York. The site is listed as Site #8-28-064 in the Registry of Inactive Hazardous Waste Disposal Sites in New York State. The RI was performed pursuant to an Order on Consent, Index # B8-0531-98-06, between GM and NYSDEC (December 2001).

It is hereby certified by Haley & Aldrich of New York that the activities that comprised the RI were performed in full accordance with the RI/FS Work Plan for the site and Work Plan Amendments Nos. 1 through 4.

Signature: Jeffrey E Loney

Name: Jeffrey E. Loney

Position: Vice President

Date: 7 November 2005

EXECUTIVE SUMMARY

This report describes the results of a Remedial Investigation (RI) performed at the Delphi Corporation site located at 1000 Lexington Avenue in the city of Rochester, Monroe County, New York. The site is listed as Site #8-28-064 in the Registry of Inactive Hazardous Waste Disposal Sites in New York State. The RI was performed pursuant to an Order on Consent, Index # B8-0531-98-06, agreed to in December 2001 by Delphi and the New York State Department of Environmental Conservation (NYSDEC).

The 2001 Order on Consent specified the development and implementation of an RI and a Feasibility Study (FS) to address the areas of environmental contamination or potential contamination that had been identified at the site. The RI was performed to determine the nature and extent of contamination in those areas.

Delphi has performed environmental investigations and contaminant-remediation activities at the site since 1981. Much of the work of the RI was devoted to addressing gaps in the data collected prior to 2001. The areas where additional data were needed included potential on-site sources of contamination that had not been previously investigated and off-site areas to the north and east of the site that were potentially downgradient of the previously-identified areas of on-site groundwater contamination.

The RI was performed in accordance with a work plan specified by the RI/FS consent order. Investigations associated with the RI were performed during the period of November 2001 through July 2005. The RI involved the following investigation activities:

- sampling of soil vapor beneath the facility manufacturing building floor at 140 locations for the purposes of delineating the extent of volatile solvent and test fuel releases, with vapor sample analysis performed by Haley &Aldrich;
- drilling of soil and bedrock test borings at 107 locations on the site and at 8 off-site locations;
- soil sampling for chemical analysis at 85 of the on-site borings;
- installation of new groundwater-monitoring wells at 40 of the new boring locations;
- installation of temporary groundwater-sampling points at 16 of the new boring locations;
- one round of groundwater sampling for chemical analysis at each of the new temporary sampling points;
- periodic sampling from January 2003 through April 2005 of groundwater and, where present, light or dense non-aqueous phase liquids (LNAPL and DNAPL) at the 40 new monitoring wells and 113 monitoring wells that had been installed at the site before the RI;
- monitoring of groundwater elevations and NAPL occurrences in on- and off-site wells;
- sampling of stormwater and sanitary wastewater discharges in underground sewer lines at 10 locations on site;
- sampling of combined wastewater in two underground municipal sewers at an upstream, on-site, and downstream location in each tunnel;
- chemical analysis by accredited laboratories of soil, groundwater, NAPL, and wastewater samples collected during the RI; and

- sub-slab soil vapor sampling at 6 locations with simultaneous indoor- and outdoor-air sampling for the purposes of evaluating the potential for soil-vapor intrusion at the site, with sample analysis performed by an accredited laboratory.

The evaluation of the results of the investigations included the following:

- validation of the results of the sampling, analysis, and monitoring activities;
- preparation of a database that includes:
  - results of the sampling and monitoring activities and laboratory analyses performed during the RI,
  - chemical analysis data from 269 soil samples collected during previous site investigations, and
  - groundwater elevation data collected at the site during previous site investigations (includes 4900 records from 1989 through 1999);
- preparation of data summary tables and figures; and
- interpretation of the data.

The principal findings of the RI concerning environmental contamination and conditions at the site are summarized as follows:

- Site groundwater is contaminated with chlorinated volatile organic compounds (chlorinated VOCs). A chlorinated VOC contaminant plume originates from 6 source areas inside the manufacturing building where releases of chlorinated solvents occurred at locations of former solvent degreasers.

  To a variable extent, portions of the groundwater contaminant plume contain non-chlorinated VOCs that are related to releases of petroleum products used in product testing and engineering operations.

  The vertical extent of groundwater contamination is limited by geologic conditions to the overburden and top 25 feet of underlying bedrock. Laterally, the VOC plume extends downgradient to the northern boundary and to 400 feet beyond the eastern boundary.

- A groundwater migration-control system is in place along the northern edge of the site to limit northward lateral migration of groundwater contaminants. The system is one of four interim remedial measures (IRMs) operated at the site by Delphi. The migration-control system has been in operation since 1992, and in the area along the northern site boundary it has effectively reversed the gradient of groundwater flow in the horizons affected by the contaminant plume. Off-site migration of contamination to the north is prevented by the migration-control system.

- The RI results confirmed that natural attenuation of chlorinated VOCs is occurring in the subsurface at the site and that site conditions are conducive to natural attenuation of the VOC contaminants. Natural attenuation involves the degradation of the chlorinated VOCs in groundwater by naturally-occurring bacteria.

- Where it extends off-site beyond the eastern boundary, the groundwater contamination is at relatively low concentrations and is found in what is referred to as the intermediate-bedrock zone. It is not found offsite in shallow groundwater or in deep groundwater.

Groundwater flow in the intermediate-bedrock zone at the east site boundary in the area of the east parking lot is generally to the northeast. This area of the site may be outside the capture zone of the existing groundwater migration-control system, although water levels at offsite wells indicate flow directions in the intermediate zone further east and north may turn to the west (towards the migration-control trench). Regardless of whether or not the capture zone includes the off-site area of contamination in intermediate-bedrock groundwater along the east site boundary, the off-site extent of contamination to the north and east of the east site boundary appears to be limited. Both natural attenuation (described below) and the hydraulic influence of the migration-control system may serve to limit the off-site extent of contamination in this area. Additional study of the feasibility of potential remedies for conditions in the intermediate-bedrock zone at and beyond the eastern site boundary is planned.

- Between the east site boundary and the east side of the manufacturing building, the intermediate-bedrock zone is also contaminated with light non-aqueous phase liquid (LNAPL) petroleum products. The LNAPL occurs at depth although LNAPL is generally absent at the water table. The LNAPL in the intermediate-bedrock in this area appears to originate from under the southeast corner of the manufacturing building. Its occurrence extends under the east parking lot of the facility to and slightly beyond the eastern site boundary. The LNAPL consists of a light-weight test-fuel fraction and a heavier-weight lubricating-oil fraction, and it contains chlorinated VOCs.

  PCBs are present in the east parking lot LNAPL at locations adjacent to and downgradient of the off-site electrical transformer substation located south of the east parking lot. The substation is suspected of being the source of the PCBs. Where the Lexington Avenue municipal sewer tunnel, which is at a depth that corresponds to the intermediate-bedrock zone, passes along the substation property, PCBs have been detected in oil seeping into the south (substation) side of the tunnel.

- Occurrences of LNAPL in shallow groundwater are present in several areas within the interior of the site. As with the LNAPL in the east parking lot area, the shallow LNAPL occurrences consist of lubricating oils released from metal-machining operations inside the facility and/or lighter-weight test-fluid products (petroleum distillates used as calibration fluids and test fuel) released from engineering and product-testing operations inside the facility.

  In some areas, the shallow LNAPL areas overlap the impacts of former degreasers, and LNAPL at the site often contains chlorinated VOCs. A former degreaser area in the southeast part of the facility is presumed to be the source of the chlorinated VOCs found in the LNAPL that occurs in the intermediate bedrock zone in the east parking lot area.

  Poly-chlorinated biphenyl (PCB) compounds, apparently desorbed by the LNAPL from soil in minor source areas that the RI could not identify, are present in the shallow LNAPL at a few locations where the LNAPL has a significant test-fluid component. The primary occurrence of PCBs in shallow LNAPL is at Building 22, where the LNAPL consists of lighter weight Stoddard solvent used as test fluid in carburetor testing. It is unlikely that the test fluid contained PCBs when it was released. No other known sources for the PCBs have been identified, and so it is presumed that there may be an unidentified source of contamination in the fill in the vicinity of Building 22 from which the Stoddard Solvent LNAPL has scavenged the PCBs. One such possibility is that PCB-contaminated oils may have been used for dust control on the gravel-surfaced roadways that were present in this area during the period before the area was filled for construction of Building 22.

Although the groundwater-migration-control system was not specifically designed to address the LNAPL occurrences, the primary shallow LNAPL occurrences are upgradient of and within the groundwater capture zone of the migration-control system. A shallow LNAPL occurrence in the north parking lot is north of the groundwater-recovery trench for the migration-control system, but it is located close to the trench and within its groundwater capture zone.

In two of the LNAPL areas located south of the migration-control trench, IRMs are operating to recover LNAPL by pumping LNAPL and groundwater from recovery wells. These are the Tank Farm Area, located on the east side of the facility at the downgradient end of an LNAPL plume that extends north from Plant 1, and the area of a test-fluid LNAPL occurrence beneath and surrounding Building 22.

The Tank Farm Area LNAPL recovery system IRM, which has been in operation since 1989, was recovering approximately 95 gallons of oily LNAPL per week when the recovery rate was measured in a 5-week trial during the RI. The Building 22 IRM was installed in 1995 and expanded in 1999. Since 1999, 2000 gallons of LNAPL has been recovered as the rate of recovery has steadily declined. The extent of LNAPL in the Building 22 area has diminished significantly during the RI, and over the last year the LNAPL recovery rate has declined to approximately one gallon per month.

- At the former degreaser locations inside the manufacturing building, soil contamination by chlorinated VOCs is present, and in these areas chlorinated VOCs are present in soil vapor beneath the floor slab. In areas of test fluid releases, volatile petroleum compounds are present in the sub-slab soil vapor. Impacts on indoor air quality from intrusion of sub-slab VOC vapors into indoor air appear to range from negligible or none to very minor.

  Delphi implemented a soil-vapor extraction (SVE) system in 1996 to address contamination by chlorinated VOCs in soil and soil vapor beneath the floor of the building in the area of the largest concentration of former degreaser locations. The Study Area 5 SVE system is the fourth IRM in operation at the site. Concentrations of solvent compounds in the extracted vapor have diminished steadily since 1996 to a stable low level.

- Soil contamination by metals including chromium, copper and zinc is present beneath the manufacturing building in three areas where metal plating operations were formerly conducted. On-site soil contamination by these metals is also present in subsurface soils along the path of a former wastewater drainage ditch in an area north of Building 14 at the north end of the facility. In these areas, as indicated above, the impacts to downgradient groundwater quality appear to be negligible.

- The RI data indicate that infiltration of site contaminants into on-site or off-site sewers does not have a significant adverse impact on wastewater conditions. The RI data also indicate that the sewers are not significant pathways for the off-site migration of contaminants.

Observations concerning current site conditions and associated risks include the following:

- Groundwater at the site and in the surrounding area is not known to be used as a source of water for drinking or other domestic, commercial, industrial, or agricultural purposes, and site groundwater does not discharge to surface water bodies. Groundwater use in the area is prohibited by a City of Rochester ordinance.
- Buildings and pavements cover approximately 95% of the site. The building floor slabs and outdoor pavements currently provide an effective barrier that prevents exposure of site workers and the public to contaminants present in soil at the site.
- Continued management and control of public access to the site and enhancements to the existing groundwater migration-control system that give it hydraulic control in the shallow and intermediate-bedrock zone on the east side of the site are two of the options for mitigating potential risks to human health and the environment that will be evaluated fully in the next phases of the RI/FS.

The findings of the RI will form the basis for an assessment of human-health and ecological risks related to the contamination present at the site. A risk assessment report is being prepared and will be submitted under separate cover. The findings of the RI and the risk assessment will then be used together to form the basis for the feasibility study and the selection of a feasible remedial alternative for the site.

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LIST OF ACRONYMS AND ABBREVIATIONS

AOC – Area of Concern
ASP – Analytical Services Protocols (New York State Department of Health)
BTEX – Benzene, Toluene, Ethyl benzene, and Xylene
CLP – U.S. EPA Contract Laboratory Program
DCA - dichloroethane
DCE – dichloroethene (also known as dichloroethylene)
DNAPL – Dense Non-Aqueous Phase Liquid
DO – Dissolved oxygen
DRO - Diesel-Range Organics
EPA – U.S. Environmental Protection Agency
FS – Feasibility Study
GC – Gas Chromatograph
GC/MS – Gas Chromatograph/Mass Spectrometer
GM – General Motors Corporation
IHWDS – Inactive Hazardous Waste Disposal Site
IRM – Interim Remedial Measure
LNAPL – Light Non-Aqueous Phase Liquid
MEK - Methyl Ethyl Ketone (also known as 2-butanone)
MIBK – Methyl Isobutyl Ketone (also known as 4-methyl-2-pentanone)
MNA – Monitored Natural Attenuation
NA – Not Analyzed
ND – Not Detected
NGVD – National Geodetic Vertical Datum
NYSDEC – New York State Department of Environmental Conservation
NYSDOH – New York State Department of Health
ORP – Oxidation-Reduction Potential
PAH – Poly-nuclear Aromatic Hydrocarbon
PCB – Poly-Chlorinated Biphenyl
PERC (or PCE) - perchloroethylene (also tetrachloroethene or tetrachloroethylene)
ppb – parts per billion
PPL – U.S. EPA's Priority Pollutant List
ppm – parts per million
QA/QC – Quality Assurance / Quality Control
RCRA – Resource Conservation and Recovery Act
RCD – Rochester City Datum
RI/FS – Remedial Investigation / Feasibility Study
SVOC – Semi-Volatile Organic Compound
SW-846 – EPA publication SW-846, "Test Methods of Evaluating Solid Waste, Physical/Chemical Methods," 3rd edition, Update III.
SWMU - Solid Waste Management Unit
TAGM – NYSDEC Technical and Administrative Guidance Memorandum
TCA - trichloroethane
TCE - trichloroethene (also known as trichloroethylene)
TCL - U.S. EPA's Target Compound List
TOGS - NYSDEC Technical and Operational Guidance Series Memorandum
TPH – Total Petroleum Hydrocarbons
USGS – U.S. Geological Survey
VOC – Volatile Organic Compound
WWTP – Wastewater Pre-Treatment Plant

1. INTRODUCTION

This report describes the results of a Remedial Investigation (RI) performed at the Delphi Corporation facility located at 1000 Lexington Avenue in the City of Rochester, Monroe County, New York.

The Delphi site is listed as Site # 8-28-064 on the New York State Registry of Inactive Hazardous Waste Disposal Sites, and it is identified under state and federal programs regulating management of hazardous waste by its U.S. Environmental Protection Agency (EPA) identification number NYD002215234.

1.1 Project Background and Purpose

The RI documented in this report was performed in accordance with the terms of an Order On Consent between the New York State Department of Environmental Conservation (NYSDEC) and Delphi that specified the requirements for a remedial investigation (RI) and feasibility study (FS) of the Delphi site ("RI/FS Order," Index # B8-0531-98-06). The Order On Consent addressed requirements of New York State's Inactive Hazardous Waste Disposal Site Program, the NYSDEC Industrial Hazardous Waste Management Corrective Action Program (the state RCRA program), and New York State's Petroleum Spills Assessment Program.

Delphi had conducted investigations of environmental contamination at the site since 1981 and had begun interim remedial actions in 1989. Areas of potential environmental impact at the site, which had been identified on the basis of the results of the previous remedial investigations and a documented review of the site history, were described in the October 2001 RI/FS Work Plan that was attached to the RI/FS Order.

The objective of the RI was to define the nature and extent of site-related contamination. The RI addressed known and potential on-site sources of contamination and the extent of migration of contaminants away from source areas, including the extent of off-site migration of contaminants. The nature and extent of contamination in some areas of the site had been defined by the previous investigations; therefore, much of the work of the RI was designed to address gaps in the data compiled during the previous remedial investigations and complete the process of defining the nature and extent of the contamination at the site.

By defining the nature and extent of site-related contamination, the RI provides the basis for an assessment of human-health and ecological risks related to the contamination present at the site. The findings of the RI and the risk assessment will in turn form the basis for the FS and the selection of a feasible remedial alternative for the site. The risk assessment and FS portions of the RI/FS project are not covered in this report.

1.2 Implementation of the RI

The RI was implemented as specified in the October 2001 RI/FS Work Plan and four Work Plan Amendments. Work Plan Amendments No. 1 to No. 4 were submitted to NYSDEC for its approval during implementation of the RI.

Haley & Aldrich of New York (Haley & Aldrich) performed the site investigation activities of the RI and conducted chemical analyses of volatile compounds in soil vapor samples. Field work for the RI was begun in November 2001 and was completed on 11 July 2005. Drilling services for the RI were provided by Nothnagle Drilling of Scottsville, New York.

Services for laboratory analysis of RI soil, groundwater, and light and dense non-aqueous phase liquid (LNAPL and DNAPL) oil samples were provided by Free-Col Laboratories of Meadville, Pennsylvania and Ecology & Environment (E&E) of Lancaster, New York. Columbia Analytical Services, Inc. (CAS) of Simi Valley, California performed laboratory analyses of vapor and air samples collected for assessment of potential vapor intrusion. Specialty PCB congener analysis of two LNAPL samples was performed by Severn-Trent Laboratories of Knoxville, Tennessee. Each of the laboratories was appropriately licensed, certified or accredited for the analyses it performed.

As specified in the RI/FS Work Plan, the RI report incorporates relevant data and findings of the various environmental investigations and remedial actions conducted at the site prior to the RI. Data from previous investigations and remedial actions that remains relevant to current site conditions is included in the database used to evaluate the results of the RI. The previous data that is included in the RI database includes geologic data on soil and bedrock at the site and chemical data from laboratory analysis of previous soil samples. Field analysis data for previous soil vapor samples has also been used in the RI for estimating the extent of volatile contaminants in soil and soil-vapor beneath the manufacturing building at the site.

Twelve progress reports have been issued since the RI was begun in November 2001. Each progress report described investigative activities completed during the previous quarter and presented validated results of laboratory analyses of RI samples as the results were received. The twelve progress reports are listed as references at the end of this report.

1.3 Report Contents and Organization

This volume (Volume 1) presents the text of the RI Report. Section 2 of the text presents a description of the site and its setting. Section 3 describes the Areas of Concern (AOCs) investigated during the RI. Section 4 describes the field sampling and monitoring activities, laboratory analysis activities, and validation of project data that were performed during the RI. Section 5 describes the results of the RI. Section 6 presents conclusions about the findings of the RI. References are listed at the end of Volume 1.

Volume 2 of the RI Report contains tables presenting comprehensive compilations of RI field and laboratory-analysis data and maps showing groundwater elevation data and soil-vapor survey results. Volume 3 contains site maps with sample-data summaries for specific areas or features of the site. Volume 4 contains the following appendices:

- Appendix A - logs of borings and monitoring wells installed during the RI.
- Appendix B - groundwater monitoring and sampling records.
- Appendix C - supplemental laboratory analysis data for oil samples.

- Appendix D - a list showing the analyzing laboratory and analysis type and methods for each sample included in the RI database.

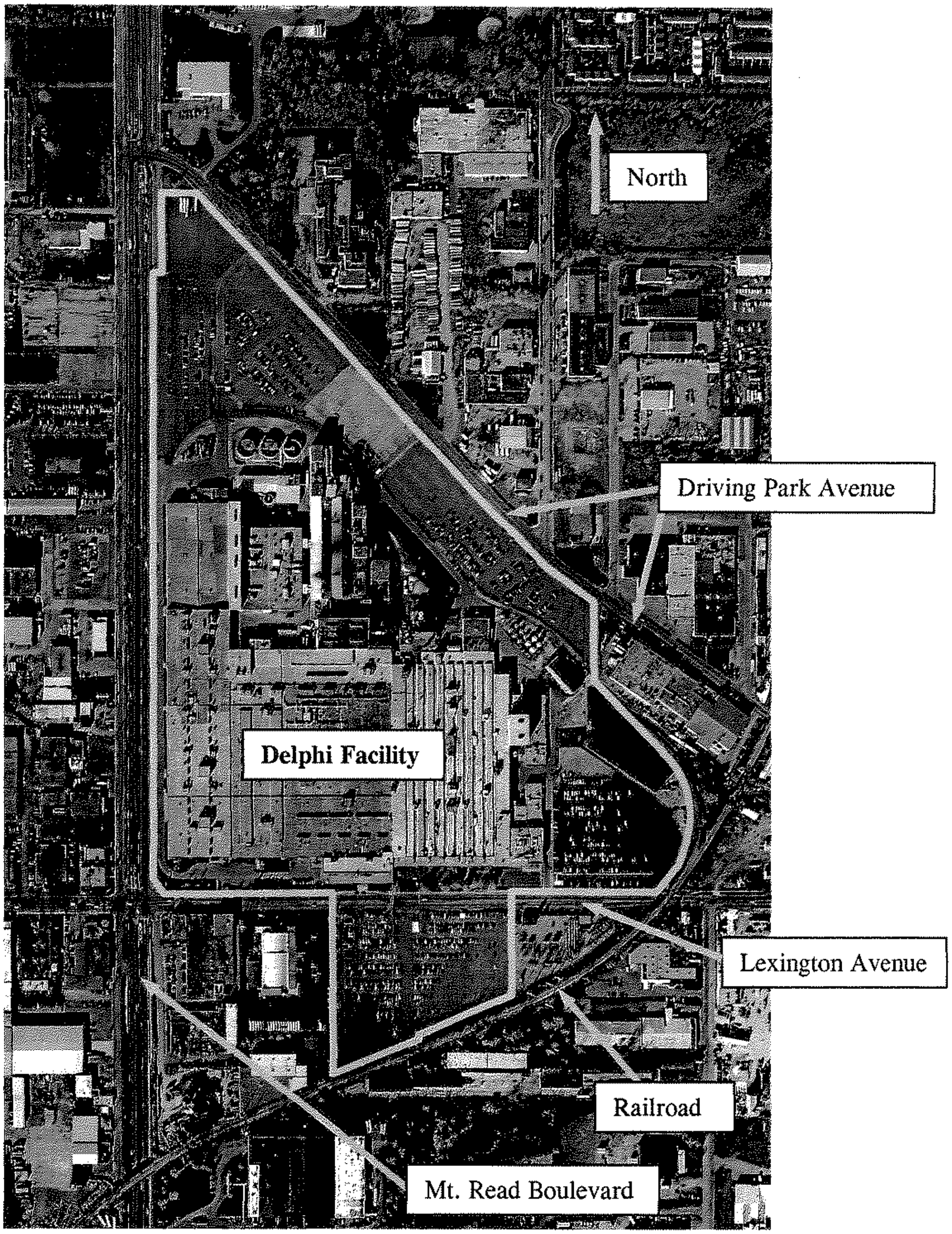
Copies of laboratory analysis reports for RI samples are not included in the report. A complete set of RI laboratory analysis reports will be provided to NYSDEC under separate cover.

2. SITE DESCRIPTION

2.1 Site Location, Description, and Land Use

The Delphi property consists of approximately 90 acres of land located north and south of Lexington Avenue in the City of Rochester, New York. The location and boundaries of the site are shown below.

Aerial Photograph (from Pictometry® Visual Intelligence)
Scale: 1 inch = 650 feet



A topographic map of the area of the site and a site plan showing physical features such as driveways, fences, and buildings are presented on Figures 1 and 2 of this report. Figures 1 and 2 are presented in Volume 3.

The facility is a manufacturing plant where Delphi produces automotive components. The 2-million square foot manufacturing building also houses administrative and engineering offices that are related to the manufacturing operations. The smaller buildings and sheds on the site are used for storage, utility, industrial-wastewater pretreatment and security activities that are related to the manufacturing operations. Most of the remainder of the site is occupied by paved roadways, service and shipping courtyards, and vehicle parking lots. Outdoor areas that are not paved occupy roughly 5 percent of the site area, and are either maintained as mowed lawns or covered with stone cobbles.

The site is bounded on the west by Mt. Read Boulevard, on the north by Driving Park Avenue, and on the east by a railroad embankment. The portion of the site which contains the manufacturing plant is bounded on the south by Lexington Avenue; however, the Delphi site also includes an employee parking lot located on the south side of Lexington Avenue.

2.2 Summary of Site History and Facility Operations

A detailed review of the history of the site was reported in the February 1999 "Site History Document". The history of the site and its manufacturing operations is outlined below.

General Motors Corporation (GM) built the original manufacturing building and began manufacturing operations at the site in 1938. Various GM divisions operated the facility until ownership of the site and its operation were transferred to Delphi in 1999. The facility has been used for producing a wide variety of automotive parts. Automotive fuel systems have been the primary product line since 1945.

Manufacturing processes have included machining and forming of metal parts, metal tube manufacturing, metal plating, heat treating, die casting, solvent degreasing, injection molding of plastic parts, and the assembly of finished automotive parts and fuel systems. Fuel-systems flow-testing and calibration, engine output testing, and related product engineering and testing operations have also been conducted, as have wastewater pre-treatment and steam generation for plant heating.

2.3 Previous Remedial Investigation Activities

Delphi and its predecessor GM divisions had conducted subsurface investigations at the site since 1981. A comprehensive summary of previous remedial investigation findings was presented in the September 1998 "Data Summary Report" (1), and data from a subsequent groundwater sampling event were presented in the February 1999 "East Parking Lot Area Well Installations and January 1999 Groundwater Sampling Events" report.

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[1] References are listed at the end of the report text.

Prior to the start of the RI in November 2001, investigations performed by Delphi had included:

- testing of approximately 590 soil-vapor sample points for volatile organic compounds (VOCs) related to degreasing solvents and petroleum distillates,
- collection and analysis of a total of 278 soil samples,
- installation of 113 groundwater monitoring wells, and
- periodic hydrogeologic testing and groundwater sampling and analysis.

Delphi had also installed and continues to operate four interim remedial measures (IRMs) to address soil and groundwater contamination at the site. The four IRMs are described below. Detailed information on the design, operation, and monitoring of each of the IRMs will be presented in the Feasibility Study report.

2.3.1 Tank Farm Area LNAPL-Recovery System

A light non-aqueous phase liquid (LNAPL) recovery system has been in operation since 1989 in the tank farm area located at the northeast corner of the manufacturing building. LNAPL recovery was implemented in this area of the site to collect a floating oil layer that is present at the water table in the overburden. The LNAPL layer consists of a mixture of Stoddard solvent (a petroleum distillate used at the facility as a calibration fluid in fuel-system product testing), other gasoline-like test fuels, and machining oils.

The LNAPL-recovery system includes three large-diameter recovery wells (RW-101, RW-2, and RW-3) installed along a 400-foot-long gravel-backfilled trench. The locations of the recovery wells and trench are shown on Figure 2.

Initial LNAPL-recovery operations consisted of passive skimming of product from the water table at the three recovery wells. In November 1994, the passive skimmers were replaced with a total-fluids pumping system installed in RW-2, the well located in the middle of the LNAPL-recovery trench. Recovered LNAPL and groundwater are piped to the wastewater treatment building. Oil is removed and groundwater is treated prior to discharge with facility wastewater to the municipal sewer. The municipal sewer flows to the Publicly Owned Treatment Works (POTW) for Monroe County.

During the RI, Delphi conducted a trial of an oil-water separator for the RW-2 discharge. Approximately 475 gallons of oil was recovered during the 5-week trial period.

2.3.2 Groundwater Migration-control, Collection and Treatment System

A migration-control, collection, and treatment system designed to capture contaminated groundwater moving north from source areas in the manufacturing plant was constructed and put in operation in the spring of 1992. The system mitigates off-site flow of contaminated groundwater along the downgradient, northern site boundary. It consists of a 1200-foot-long migration-control trench that is located beneath Delphi's north parking lot. The migration-control trench was created using engineered-blasting techniques to enhance bedrock aquifer permeability. Two wells (GR-1 and GR-2) installed in the 50-foot-deep blasted zone are used to pump groundwater. Treatment of the recovered groundwater is accomplished using an ultra-violet (UV) oxidation system, and the treated groundwater is discharged to the municipal sewer.

The average rate of groundwater extraction by the migration-control system during the RI was 22 gallons per minute (approximately one million gallons per month).

2.3.3 Building 22 Area LNAPL-Recovery System

An LNAPL-recovery system was installed and has been operating inside Building 22 since 1995. The system was installed to address an LNAPL layer that consists of Stoddard solvent contaminated with PCBs. Stoddard solvent had been used in Building 22 as a calibration fluid for carburetor testing operations, and it had been released from underground piping. The source of the PCBs has not been identified, but it is suspected that the LNAPL may have leached PCBs from contaminated soil or fill present in the subsurface in the area of Building 22.

The LNAPL-recovery system originally consisted of a passive LNAPL skimmer and pump installed in Well RW-4 inside Building 22. In 1999, vacuum-enhanced total-fluids pumping of LNAPL and groundwater was implemented at RW-4, and total-fluids pumping was added at Well Z, which is located east of Building 22. Collection of LNAPL and groundwater from the foundation-drain system for the Additional Waste Treatment Area (AWTA) building (Building 14) located north of Building 22 was also added at that time. The LNAPL and groundwater collected from these three points is routed through a coalescing filter oil-water separator inside the AWTA building. Collected LNAPL is placed in drums and shipped off-site for disposal, and the separated groundwater water from the Building 22 system is co-mingled with groundwater collected in the migration-control system recovery wells and then treated in the migration-control system oxidation unit.

Between the implementation of upgrades to the system in 1999 and the end of 2000, approximately 2000 gallons of LNAPL were recovered by the Building 22 Area system. Since the beginning of 2001, 500 gallons of product have been recovered, and the recovery rate has declined further in the last year. Less than 15 gallons was recovered during the 10 months from September 2004 and July 2005. During the RI, LNAPL has been absent from or only present intermittently in the Building 22 Area wells in which LNAPL was present at the start of the RI.

2.3.4 Degreaser Study Area 5 SVE System

Delphi implemented a soil-vapor extraction (SVE) system in Degreaser Investigation Study Area 5 in June 1996. Its purpose is to address contamination by chlorinated degreasing solvent present in soil beneath the floor of the manufacturing building in this area. The Study Area 5 SVE system uses 16 overburden wells to extract soil vapor. Until 1999, the vapor stream was treated through activated-carbon canisters to remove solvent vapors. The concentrations of solvent compounds in the extracted vapor diminished with time as the system removed contaminants, and at the end of 1999 NYSDEC approved direct discharge of the vapors without carbon filtration. Since then, weekly monitoring of the extracted soil vapor has demonstrated further decline of contaminants to a relatively steady low level.

2.4 Geologic Setting

The site is underlain by variable unconsolidated fill materials and overburden soils. The fill and native overburden deposits vary from 5 to approximately 25 feet in total thickness. The overburden is thickest in the area at the north end of the plant and thinnest on the south near Lexington Avenue. The presence or absence of specific soil deposits or fill components is variable across the site.

Bedrock beneath the overburden is the Upper Silurian-aged Rochester Shale, a dolomitic mudstone, which dips gently to the south at approximately 40 feet per mile. Deep bedrock wells on the north side of the site penetrate the Rochester shale and intersect the underlying Irondequoit Limestone.

The soil and bedrock types observed at the site are listed on the following page.

Overburden Deposits

Type	Description
Fill	Silt, sand, gravel, and miscellaneous materials including construction and demolition debris, riprap, asphalt, coal ash and cinders, and railroad ties.
Swamp deposits	Soft, dark brown to black clayey silt to loose sandy silt with organic matter and shell fragments. The swamp sediments are present north of the manufacturing building within the footprint of a former canal wide-waters basin.
Lacustrine sediments	Soft gray to brown silty clay to loose to medium dense silty sand, little gravel, bedded.
Glacio-lacustrine sediments	Same as lacustrine, except often red-brown, often underlying glacial till.
Glacial till	Medium dense brown to red-brown silty sand, with trace to little gravel, trace clay.
Residual soil	Loose to medium dense brown sandy silt to silty sand with organics and root fibers (formed from weathered shale bedrock material).
Completely-weathered bedrock	Medium dense to very dense gray-brown silt, little to some fine sand, with the fabric of the parent bedrock material still visible.

Bedrock Units

Formation	Description
Rochester Shale	Moderately hard, fresh, fine grained, gray to brown-gray dolomitic mudstone, with horizontal closely-spaced bedding, occasional pits and vugs, occasional fossils, and secondary gypsum mineralization in fractures, vugs, joint openings, and as fossil replacement.
Irondequoit Limestone	Hard, fresh, gray to green-gray, fine to medium grained fossiliferous limestone, with horizontal moderately-spaced bedding and occasional vugs.

2.5 Hydrogeologic Setting

Four hydrogeologic units are recognized at the site, and the on-site and off-site wells have been installed to monitor hydrogeologic conditions in these units:

- Overburden Unit - saturated overburden deposits. Wells labeled with the OW prefix monitor this unit, as do wells PZ-1, PZ-111 through 114, -116 through 128, and -132, Tank Farm Area LNAPL recovery wells RW-101, RW-2, and RW-3, and Degreaser Investigation vapor-monitoring wells VM-209 through -232.

- Shallow-Bedrock Unit - the overburden-bedrock interface and underlying upper 7 feet of bedrock. Wells labeled with the SR prefix monitor this unit, as do wells PZ-115, -129, -130, -133 through 144, and Building 22 LNAPL recovery well RW-4.

  (Well Z, which was an unscreened well installed as a water-supply well but never used for that purpose, was modified for monitoring purposes by plugging the bottom section of the original well interval. The Well Z monitoring interval currently spans the shallow-bedrock and underlying intermediate-bedrock units. It has exhibited static water levels consistent with those in surrounding shallow-bedrock wells.)

- Intermediate-Bedrock Unit - from 10 feet to approximately 25 feet below the top of bedrock. Wells labeled with the R prefix monitor this unit.

- Deep-Bedrock Unit - from 30 feet to 65 feet below the top of rock. Wells labeled with the DR prefix monitor the deep-bedrock horizon from approximately 50 to approximately 65 feet below the top of rock.

The extent of groundwater contamination at the Delphi site has been found to be restricted to the overburden and the upper 25 feet of bedrock. The limitation on the vertical extent of VOC contamination is interpreted to be the result of the decrease in permeability and an absence of transmissive fractures in deep bedrock. Permeability in the shallow- and intermediate-bedrock units is variable and ranges from $3x10^{-1}$ centimeters per second (cm/sec) to less than 1×10^{-6} cm/sec. Permeability in the deep-bedrock unit is generally very low, ranging from 2×10^{-6} cm/sec to less than $1x10^{-8}$ cm/sec at six of the seven deep bedrock wells. At the seventh well, new well DR-132, the permeability of the deep zone was found to be higher (6.2×10^{-4} cm/sec).

The groundwater migration-control system blasted-bedrock zone and recovery wells span the shallow- and intermediate-bedrock units. The permeability of the shallow- and intermediate-bedrock units was enhanced continuously along the migration-control trench by the engineered blasting performed during trench construction in 1992.

2.5.1 Direction and Gradients of Groundwater Flow

The groundwater elevation data on which the following observations are based are summarized on groundwater elevation plans presented in Volume 2.

Prior to the start-up of the migration-control system in 1992, groundwater flow at the site generally tended to exhibit a downward vertical component from the overburden to the shallow-bedrock zone and from the shallow zone to the intermediate-bedrock unit. Lateral flow in the overburden, shallow-bedrock, and intermediate-bedrock units tended to be to the north or northeast.

Since the start-up of groundwater migration-control pumping, lateral flow in the shallow- and intermediate-bedrock units in the area north of the migration-control trench has reversed, and groundwater in these units in the area along Driving Park Avenue now flows from Driving Park Avenue south towards the trench. An elongated depression of the water table and the potentiometric surface in the shallow-bedrock zone occurs along the migration-control trench; a somewhat broader depression of the potentiometric surface in the intermediate-bedrock zone, relative to the 'static' conditions that prevailed prior to 1992, extends south (upgradient) from the trench into the middle of the Delphi site.

2.5.1.1 Migration-Control Capture Zone

There are two areas of the site where the edge of the groundwater contaminant plume appears to be beyond the capture zone of the migration-control trench. (Additional discussion of the conditions in these two areas is presented in Section 5.4 of the report.) One is along the west site boundary in the immediate vicinity of shallow-bedrock well SR-301, where traces of VOC contaminants are present in the shallow-bedrock horizon and groundwater flow in the shallow bedrock appears to be off-site to the west.

The second area where the contaminant plume may be beyond the capture zone of the migration-control trench is in the east parking lot area of the site. In this area, LNAPL contamination is present in the intermediate-bedrock zone up to and, at well R-305, beyond the site boundary. In the off-site area beyond the east parking lot, dissolved-phase contamination by VOC compounds at concentrations to 0.05 ppm extends in the intermediate zone to wells R-401 and R-306; these wells are located 400 feet northeast and 200 feet east, respectively, from the site boundary.

2.5.1.2 Deep-bedrock Zone

Groundwater flow gradients in the deep-bedrock zone cannot be definitively judged from the RI groundwater elevation data. Groundwater levels in most of the deep wells respond very slowly if at all to withdrawals, which indicates that water level measurements made during the RI may not be representative of actual lateral gradients between the deep wells or vertical gradients between the intermediate and deep zones.

At most locations, however, water level measurements and chemical analysis data appear to indicate that there is little or no hydraulic connection between the intermediate-bedrock and deep-bedrock zone. For example, after installation and development of new deep monitoring well DR-315, which is located in the center of the site, the water level in the well rose slowly throughout the RI, eventually reaching a level 20 feet above the water level in nearby intermediate-bedrock well R-131. Groundwater contaminants from the site were not detected in DR-315 samples although it is close to Degreaser Study Areas located within Building 2 and is within the footprint of the chlorinated VOC contaminant plume that affects the shallower units. These data indicate that the deep zone at DR-315 is not affected by migration-control pumping (which has a strong effect on the overlying intermediate zone in this area) or by contamination in the shallower zones, and indicates that there is, at least in this part of the site, an upward gradient from the deep to the intermediate zone.

The one location where there is some indication of possible connection of the deep zone with the overlying intermediate zone is at new deep well DR-132, located on the east side of the facility, where, as indicated above, the permeability of the deep zone is somewhat higher than observed at other deep-bedrock well locations. Water levels at DR-132 were found to be within a few feet of the levels recorded at its intermediate zone partner R-132, and DR-132 levels rose and fell roughly in concert with the levels at R-132. Site contaminants were not detected in the samples from DR-132. Relatively low (trace) concentrations of VOC contaminants have consistently been observed in samples from R-132 (relative to other intermediate zone wells on the downgradient side of the plant). These data may be indications that if there is a connection between the deep and intermediate zones at this location, groundwater is discharging up from the deep to the intermediate zone.

2.5.2 Discharge of Groundwater to Municipal Sewer Tunnels

There is a large-diameter municipal sewer line that runs to the east beneath Lexington Avenue on the south side of the Delphi facility, and a second large-diameter sewer that runs to the southeast beneath Delphi's north parking lot and then along the northeastern property line north of the east parking lot. The second line parallels Driving Park Avenue, and is referred to as the Driving Park leg of the sewer. Both sewers are concrete lined and 7 feet wide by 10 feet tall. The Driving Park leg intersects the Lexington Avenue sewer approximately 1000 feet east of the site. The location of the sewers is shown on Figure 2.

The Lexington Avenue sewer and the section of Driving Park sewer southeast of Delphi's north parking lot (the section southeast of monitoring well PZ-139, which is located near the southeast end of the migration-control trench) are constructed in tunnels through bedrock in the intermediate-bedrock horizon. The upstream segment of the Driving Park sewer (from PZ-139 northwest beneath Delphi's north parking lot to Mt. Read Boulevard) was constructed in an open cut excavated through overburden soils and into the top of bedrock. The position of the sewers in the geologic section is shown on hydrogeologic profiles presented at the end of Volume 3 (Figures 34 and 35).

Minor seeps of water into the upstream segment of the Driving Park sewer tunnel located beneath the north parking lot were noted when that section of the tunnel was inspected in 1991 prior to the construction of the adjacent and parallel migration-control trench. A sample collected from one seep was found to contain chlorinated VOCs at concentrations that were typical of the chlorinated VOCs in groundwater from monitoring wells in the north parking lot. At present, however, the potential for infiltration of site contaminants into the sewer and migration of groundwater in the bedding around the outside of this segment of the sewer may be reduced or eliminated by operation of the migration-control system. Groundwater pumping at the migration control wells apparently depresses the water table in the area of the north parking lot to below the level of the sewer.

Southeast of the north parking lot, the downstream bedrock-tunnel segment of the Driving Park sewer is below the water table. The sewer has not been inspected in this area. Groundwater elevation data do not appear to indicate that there are distinct groundwater discharge features into this segment of the sewer from any of the hydrogeologic units.

In the southeast corner of the site, a depression in the overburden/shallow-bedrock water table above the Lexington Avenue sewer line is apparent in the area south of the Delphi facility's east parking lot. The depressed water table in this area indicates discharge of groundwater from the shallow-bedrock unit to the tunnel (or to a zone of increased permeability which may surround the tunnel lining). The discharge feature that is apparent from the groundwater-level monitoring data may be the result of infiltration that has been observed in the walls of a sewer manhole located between the southeast corner of the Delphi facility and the RG&E substation on the opposite side of Lexington Avenue. The manhole was built with holes in its walls that permit groundwater to drain in from the surrounding ground.

The RI included sampling of wastewater flows in the municipal sewers to determine whether infiltration of contaminated site groundwater is currently occurring at the site. Information on the results of the sampling is presented in Section 5.6 of the report.

2.5.3 Petroleum Hydrocarbons in Deep-bedrock Groundwater

A summary of deep-bedrock groundwater quality conditions observed at the site during the RI is presented on Figure 3. As shown on Figure 3, benzene, toluene, and xylene have been detected in groundwater at each of the seven locations on site where deep-bedrock groundwater monitoring has been performed.

The presence of these constituents at the concentrations detected in deep-bedrock groundwater at the site appears to be a natural condition that results from the petroliferous nature of bedrock units in which the deep wells are installed. The bituminous, shaley sections of the Rochester Formation are the apparent source for the petroleum hydrocarbons that occur in this unit at the site. The natural occurrence of petroleum hydrocarbons in groundwater in the Rochester Shale has been documented elsewhere in western New York and southern Ontario, Canada. West of Rochester, the Rochester and overlying dolostones are commercial sources of petroleum hydrocarbons, and natural gas is present in the Rochester in the Rochester area.

2.5.4 Contamination of Groundwater at the Upgradient Site Boundary

2.5.4.1 South Parking Lot

As indicated above, groundwater flow at the site is generally towards the north. Groundwater at the upgradient south site boundary is contaminated by chlorinated volatile organic compounds (VOCs), and concentrations of some metals, particularly chromium, are above expected background concentrations. The contamination is apparently unrelated to Delphi operations and is presumed to be from an off-site source or sources.

Results of the RI sampling at upgradient wells were consistent with results that had been observed during previous investigations. The following table lists contaminants detected in groundwater at upgradient wells located in the south parking lot. The data summarized are maximum concentrations detected in Pre-RI and RI groundwater samples. Well locations are shown on Figure 2.

Maximum Concentrations of Contaminants at Upgradient Wells

Concentrations in parts per million (ppm) NA = not analyzed ND = not detected

Chemical Analysis Parameter	**Well SR-11**		**Well R-11**		**Well SR-233**	
	Pre-RI	RI	Pre-RI	RI	Pre-RI	RI
Chlorinated VOCs						
1,1,1-Trichloroethane (TCA)	1.6	0.007	0.011	ND	ND	ND
1,1-Dichloroethane (DCA)	0.15	0.01	0.025	0.006	ND	ND
1,1-Dichloroethene (DCE)	0.086	ND	ND	ND	ND	ND
Trichloroethene (TCE)	0.41	0.024	0.009	ND	0.040	0.010
cis- or trans-1,2-DCE	ND	ND	0.007	0.001	0.033	0.020
Vinyl Chloride	ND	ND	ND	0.003	0.011	ND
Metals						
Arsenic	0.022	ND	ND	0.007	NA	ND
Chromium	8.2	10.7	0.002	0.012	0.004	0.05
Copper	0.05	0.16	ND	0.040	ND	ND
Lead	0.19	0.001	0.005	0.049	0.003	0.011
Mercury	0.01	ND	ND	ND	ND	ND
Nickel	0.22	0.591	ND	0.05	ND	0.060
Zinc	0.81	0.073	0.04	0.127	0.022	0.035

2.5.4.2 Lexington Avenue

Anomalously high concentrations of chromium (21 ppm), copper (0.7 ppm), and nickel (5.4 ppm) have also been detected in Pre-RI and RI samples of groundwater from off-site shallow- and intermediate-bedrock wells SR-234, SR-245, and R-242. These wells are located along the site boundary on Lexington Avenue at the southeast corner of the site, and hydraulic gradients evident in this area indicate that the high metals concentrations in these groundwater samples may reflect upgradient, off-site conditions. A second possible explanation for the high metals concentrations in these wells, which are not known to be related to any on-site conditions, releases, or operations, is that road salt may be causing corrosion of the stainless steel from which the well casings are constructed.

2.5.4.3 RG&E Substation

An electrical transformer substation is located adjacent to the southeast corner of the site. This substation is a potential source for polychlorinated biphenyls (PCBs) which had been detected during previous investigations in oily seeps in the south side of the Lexington Avenue sewer tunnel where it passes along the substation. PCBs had also been detected during previous investigations in a floating, oily LNAPL layer found in bedrock monitoring wells located northeast of the substation, and were detected in RI samples of LNAPL from Lexington Avenue well R-243 at concentrations (43 to 92 ppm) similar to those previously detected. These concentrations are similar to those found at monitoring well R-2, which is located in Delphi's east parking lot 200 feet downgradient of R-243.

2.6 Groundwater Use

Groundwater at the site and in the surrounding area is not known to be extracted or used for drinking or domestic water supply or for industrial purposes. Future potable, domestic and industrial uses of groundwater at the site and in the surrounding area are not expected. Water supply for the Delphi plant and for other properties in area of the site is provided by municipal water systems, and use of wells as a source of water supply in the area is prohibited by a City of Rochester ordinance.

2.7 Surface Water

There are no surface water features (streams, rivers, canals, ponds, or lakes) on the site or on surrounding properties. Surface water runoff from the site and surrounding properties collects in stormwater drains that connect to the municipal sewer system.

2.8 Surrounding Land Use

Land uses on the properties surrounding the site are industrial and commercial. Adjacent properties are developed with one exception: a narrow wooded area is located north of the railroad spur that runs along the northeast edge of the East Parking Lot area. The wooded area is on the south side of the adjacent American Packaging manufacturing plant property.

3. AREAS OF CONCERN

In accordance with the requirements of the RCRA Corrective Action program, areas of potential environmental impact at the site were identified as part of the preparations for the RI. The areas of potential environmental impact at the site include those identified during previous remedial investigations and others identified by the 1999 review of site history. The areas of potential environmental impact were described in detail in the October 2001 RI/FS Work Plan.

A list of the areas of potential environmental impact at the site is presented below. The list includes references to the section of this report in which the RI findings for each area are described.

Site Groundwater Conditions

- Deep Bedrock Groundwater Conditions (Section 5.3)
- Downgradient Conditions (Section 5.4)
- On-site Conditions Downgradient of Source Areas (Section 5.5)
- Conditions along Municipal Sewers (Section 5.6)

Manufacturing Process Areas

- Former Solvent Degreasers (Section 5.7)
- Former Plating Areas (Section 5.8)
- Former Heat-treating Areas (discussed below)
- Former Machining Areas (Section 5.10)
- Former Tubing Mills Area (Section 5.12)
- Former Stoddard Flow-testing Areas (Section 5.14)
- Former Product Engineering Areas (Section 5.14)
- Former Maintenance Painting Booths (discussed below)
- Former Die Casting Area (discussed below)
- Current Plating Area (Section 5.8)
- Current Heat Treating Area (discussed below)
- Current Machining Areas (Section 5.10)
- Current Maintenance Paint Booth (discussed below)
- Current Die Casting Building (discussed below)

Other Plant Features

- Basement Sumps (Section 5.11)
- Stoddard-Solvent Storage Tank Farm (discussed below)
- Plant 2 Elevator (Section 5.13)
- Former Trichloroethene (TCE) Underground Storage Tank (UST) (Section 5.15)
- Former UST Areas A through F (Section 5.15)
- Former Coal Pile at the Power House (Section 5.17)
- Former PCB-containing Equipment (discussed below)
- Scrap-metal Handling in Building 11 (Section 5.17)

RCRA Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs)

- Former USTs 26 and 26A (Section 5.15)
- Oil House and the Adjacent Center Dock (Section 5.16)
- CWTA (Central Waste Treatment Area, Section 5.19)
- Former Incinerator (Section 5.19)
- Waste Oil Storage Areas (Section 5.19)
- AWTA (Additional Waste Treatment Area, Section 5.21)
- Former Wastewater Drainage Ditch (Section 5.21)
- Underground Sewers (Section 5.22)
- Storage Areas Covered by the facility's former RCRA Permit:
    - the Degreasing Sludge Storage Area, located in the Oil House (Section 5.16).
    - the Cyanide Drum Wash Area (Section 5.9).
    - the Non-Cyanide Drum Wash Area (Section 5.9).
    - the Cyanide Storage Area (discussed below).
    - the Wastewater Treatment Sludge Area in Plant 2 south of the CWTA (Section 5.19).
    - Tanks 4 and 8, USTs formerly used for storage of waste gasoline and Stoddard solvent, were located outside of Plant 1 in UST Areas A and D, respectively (Section 5.15).
- Trash Compactors and Solid Waste Roll-off Boxes (discussed below)
- Former Easement A Disposal Area (Section 5.18)
- Old Canal-Lands Fill Area (located in the North Parking Lot, Section 5.23)

With a few exceptions, each of the areas listed above was targeted by direct investigation during the RI. (The few exceptions are described below.) The RI/FS Work Plan specified the investigations that were needed to determine the nature and extent of contamination in these areas. The nature and extent of contamination in these areas, which are referred to collectively as AOCs in the remainder of this report, was determined by the investigations performed. Results of the remedial investigations in each of the AOCs are described in Section 5 of this report.

As described in the Work Plan, subsurface investigation during the RI was not warranted in a few areas where potential environmental contaminants may have been used but where the potential for release of the contaminants was minimal. These areas included the following:

- the current heat-treating area in Building 1,
- the cyanide-salt storage area adjacent to the heat-treating area (a SWMU),
- the wastewater treatment sludge area in the CWTA (also a SWMU),
- maintenance painting booths,
- die-casting areas, and
- roll-off box and trash-compactor locations.

The current heat-treating area in Building 1 is representative of the areas that were not investigated. In the heat-treating area, salt compounds containing cyanide (the potential environmental contaminant of concern) were heated and used as a molten salt bath for hardening of steel parts. Visual inspection of the area of the heat-treating operation, operational practices, knowledge of the employees who have worked in and managed the operation, and the physical and chemical characteristics of the salts all indicated that the potential for releases of the salts to the environment was minimal. Therefore, direct subsurface investigation in the heat-treating area was seen as unnecessary and was not included in the RI. The potential for releases was indirectly investigated during the RI, however, with the monitoring of groundwater at downgradient locations for the presence of cyanide.

Other areas, including some of the former solvent degreaser areas, the former cyanide drum-wash area, and the former canal-lands fill area, had been investigated previously, and the nature and extent of contamination in these areas had been identified prior to the RI. The RI did, however, include monitoring of groundwater conditions in these areas.

The Stoddard-Solvent Storage Tank Farm is an above-ground storage tank farm that is still in use for storage of petroleum products. As specified in the RI/FS Work Plan, investigation of soil conditions in the tank farm is being deferred until the tanks are removed. RI findings concerning groundwater conditions in the area that surrounds the tank farm are described in Section 5.15.

No releases from former PCB-containing equipment are known to have occurred at the site, and there were no test borings or wells installed during the RI that specifically targeted PCB equipment. However, PCBs from unknown sources had been detected in previous site samples. Therefore, as specified in the RI/FS Work Plan, PCB analysis was performed on samples from each on-site test-boring and well location for the purposes of characterizing any PCB releases that may have occurred. Results of the PCB analyses are described throughout Section 5 with the findings for each AOC.

4. INVESTIGATION ACTIVITIES

The RI included investigation of general site conditions, soil, soil-vapor and groundwater conditions in AOCs, and groundwater conditions in adjacent off-site areas. The subsurface investigation activities performed during the RI included the following:

- sampling of site soils in AOCs;
- soil-vapor sampling to delineate the extent of solvent and test-fuel releases in AOCs;
- additional soil-vapor sampling and simultaneous indoor- and outdoor-air sampling to assess the potential for intrusion of volatile contaminants into facility buildings;
- installation of groundwater monitoring wells at on-site locations in and downgradient of AOCs and at off-site locations downgradient of the site;
- groundwater-level monitoring at new and existing on- and off-site wells;
- groundwater sampling at new and existing wells; and
- wastewater sampling to assess potential infiltration of contaminated groundwater into site and municipal sewers.

Investigation activities and methods are described in the following sections.

4.1 Soil Vapor Sampling

Approximately 140 soil vapor samples were collected from nine AOCs during the first half of 2002. In the areas where soil vapor surveying was performed, samples were collected on approximately 40- to 50-foot centers. Sampling proceeded outward from potential sources of subsurface contamination until levels of less than 100 ppm in soil vapor were encountered or soil vapor contamination was found to extend into other previously-delineated areas of known petroleum or VOC soil-vapor contamination.

In the southern portion of the Building 3 investigation area, where petroleum test fluids had been used in product engineering operations, chlorinated VOCs were detected in the soil vapor. Chlorinated VOCs in this area had not been the subject of previous investigations, and therefore the soil vapor investigation was expanded to the south and the chlorinated VOC vapor plume was delineated.

Soil vapor samples were collected using a steel rod to advance a hole for a hollow probe approximately 2.5 feet below ground surface. The hole in the floor slab was sealed around the probe using bentonite. Soil vapor was extracted from the subsurface through the probe into a sample bag using an evacuation-canister system. The soil vapor sample was collected in a Tedlar™ bag after an initial sample-bag-volume of soil vapor (approximately 0.5 to 1 liters) was purged to assure a representative vapor sample. The sample collected was analyzed the same day by Haley & Aldrich on a Hewlett Packard 5890 Series II gas chromatograph. All samples were analyzed for Stoddard solvent, chlorinated VOC compounds, individual BTEX compounds (benzene, toluene, ethyl benzene, and xylene) and related VOC compounds.

A summary of soil vapor survey results is presented in Table 2. Survey locations and total concentrations of VOCs detected at each location are shown on maps of each survey area that are presented in Volume 2. The larger-scale site plans (figures) presented in Volume 3 show soil vapor sampling locations and outlines of areas where total concentrations of VOCs detected in soil vapor exceeded 100 ppm. Figure 26, which shows the results of the soil-vapor intrusion (SVI) assessment described in the next section of the report, presents a comparison of RI soil vapor results, previous soil vapor results, and SVI assessment results at the six locations where SVI sampling was performed.

4.2 Soil Vapor Intrusion Assessment

In accordance with Work Plan Amendment No. 4, soil-vapor intrusion assessment sampling was performed in May 2005. Sub-slab soil vapor and indoor air sample pairs were collected at six locations in the manufacturing building in areas where soil, soil vapor, and/or groundwater impacts from contamination by chlorinated VOCs and/or petroleum test fluids is present. The locations were selected with guidance from NYSDEC and NYSDOH project personnel. The locations sampled are described in the following table:

Location	General Description of Area	Comments
Opposite column YE-13 (Previous SV point B3-6)	Building 3 Training Room, approx. 6'S and 12'E of training room entrance door.	At edge of product engineering test fluid "hot-spot"; within enclosed working area. Previous SV point was used for sub-slab sample.
13 feet north and 7 feet west of column T-27 (T-27, 13'N 7'W)	Inside Grind Room, in front of equipment and shelving along north wall of room.	Within enclosed working area, within Study Area 2, potentially within or near edge of LNAPL plume.
E-19, 14'N 2'W (Previous SV point E-19 14'N 2'W)	Stamping area, E-aisle just east of the Plant 1 West Product Testing Room's east wall.	Within VOCs "hot spot" in product testing area and Degreaser Study Area 3, near edge of LNAPL plume. Previous SV point used for sub-slab sample.
FF-37, 3'S 8'E	Break Room in open corner adjacent W of vending machines.	Enclosed area downgradient of Study Area 4, potentially within or near edge of LNAPL plume.
C-13, 4'N 2'W (Previous SV point C-13, 4'N 2'W)	South and outside of Plant 1 West Product Testing Room.	On the edge of the test-fluid plume, in active working area. Previous SV point used for sub-slab sample.
DD-33, 20'S 2'W	In open work area where new manned packaging stations are set up just N of Study Area 4 and S of wells OW-/SR-316.	Open area just downgradient of Study Area 4, within footprint of LNAPL plume.

Two outdoor ambient air samples were also collected, one each on the east and west sides of the facility (on the prevailing downwind and upwind sides of the building, respectively).

The general scope of work for each sub-slab sample consisted of advancing a soil vapor probe to approximately 2.0 feet below the floor slab. Probes were hollow stainless steel tubes sealed at the end and containing open slots on the sides. After installation of the probe, the small-diameter borehole was grouted at the surface with a mixture of clay and hydrated bentonite to create a vapor-tight seal between the concrete floor surface and the probe.

Sub-slab vapor samples were collected using calibrated 8-hour flow controllers and 6.0-liter passivated stainless steel canisters. Prior to sampling, approximately one to two tubing dead volumes were purged. During the purging process helium (a tracer compound) was released into a containerized area surrounding the probe at the ground surface and samples collected and analyzed for He from the installed probe to assess potential short-circuiting and ensure that the surface seal was intact. The helium analysis indicated that in all cases the bentonite seal around the probe at the floor surface was intact and non-leaking.

The use of 8-hour flow controllers yielded sample flow rates of approximately 0.01 liters/minute, within the range recommended in NYSDOH's written guidance (maximum flow rate recommendation of 0.2 liters/minute). Concurrent with the collection of the six sub-slab soil gas samples, six indoor air samples were also collected. The indoor air samples were collected in direct proximity to the locations of the sub-slab samples to establish the approximate building-specific attenuation factor for the COCs detected at that location.

Sampling canisters and flow controllers were provided by Columbia Analytical Services (CAS) of Simi Valley, California, and the soil vapor samples were submitted to CAS for EPA Method TO-15 analysis of chlorinated VOCs (including cis-1,2-dichloroethene, tetrachloroethene, 1,1,1-trichloroethane, trichloroethene, and vinyl chloride) and aromatic (BTEX) and aliphatic hydrocarbons that are components of Stoddard solvent and other petroleum test fluids.

4.3 Test Borings and Soil Sampling

Installation of a soil test boring was performed at each of the site features specified in the RI/FS Work Plan. Soil sampling was performed at a total of 85 borings, including test borings drilled solely for soil sampling and others completed with monitoring well installations. Soil test boring locations are shown on Figure 2.

Soil test borings were installed in accordance with the Work Plan, and the overall number of borings, general sampling procedures, and the general locations of borings were as specified in the Work Plan and Work Plan Amendments. Soil sampling was performed at each soil test boring location and, with the following exceptions, at each location of a single monitoring well or well cluster. Soil sampling was not conducted at the on-site SR-/R-308 wells because impacts from site operations were not anticipated to affect the overburden soils at this location. Soil sampling was not conducted at the on-site well SR-326, which was installed in Plant 1 to delineate the extent of LNAPL, because soil sampling had been performed in nearby test borings. Soil sampling was also not conducted at off-site wells R-401 and SR-/R-402; these three wells were installed to delineate the downgradient extent of groundwater contamination detected in off-site well R-305.

Soil test borings were installed using either direct-push methods or conventional hollow-stem auger methods. The drilling methods employed depended on accessibility, subsurface conditions, drilling depths, and whether well installation was performed at that location. Wells were installed using conventional drilling/auger boring techniques, with the exception of well OW-328 which was installed in soil boring STB-39 using a direct-push rig.

During soil sampling, continuous split-spoon or direct-push sampling of soil was performed to refusal on bedrock (or other obstruction). Soils were logged in accordance with the Unified Soil Classification System (USCS). Representative soil samples from each sample interval were collected for submittal to one of the two project laboratories for analysis, in accordance with the Work Plan. Additional representative sample material from each sample interval was collected in a separate jar for headspace field-screening of VOCs in the sample for purposes of sample selection for laboratory analysis.

Soil samples were collected, screened, and assessed in the field according to the protocols specified in the Work Plan. Samples were targeted based on pre-selected depth intervals, the presence of staining, odors or elevated headspace VOCs screening levels, and any other indicators of presence of contamination. Selected samples were then prepared for submittal to the project laboratory with sample handling as specified in the Work Plan (storage on ice, standard chain-of-custody tracking, adherence to sample holding times, etc.).

Test boring logs describing the soil types and conditions encountered are presented in Appendix A. Headspace screening results for soil samples are presented in Appendix B.

4.3.1 Soil-sample Analysis Parameters and Methods

Analytical parameters were selected for each soil sample submitted in accordance with the RI/FS Work Plan. With a few exceptions, all soil samples were submitted for analysis of the volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and polychlorinated biphenyls (PCBs) listed on the most recent U.S. EPA Target Compound List (TCL) and EPA's Priority Pollutant List (PPL) metals or the "site" metals. (The site metals list includes cadmium, chromium, copper, lead, mercury, nickel and zinc, as defined in the Work Plan.) Samples analyzed for the PPL metals were in most cases also analyzed for total cyanide and pH.

Approximately 190 soil samples were submitted for approximately 670 individual analyses. Approximately 44% of the samples were submitted for analysis by methods specified in the New York State Department of Health's Analytical Services Protocols (ASP). Ecology & Environment (E&E) of Lancaster, New York performed the analyses done using the ASP specifications (hereinafter referred to as ASP methods). Approximately 106 samples (56%) were submitted to Free-Col Laboratories (Free-Col) of Meadville, Pennsylvania for analysis by methods specified in the U. S. EPA's SW-846 guidance. Both labs were pre-approved for the project work and were appropriately certified for the analyses performed.

Soil samples collected from DGRB-2, SMHB-1, and PB-15 were not submitted to a laboratory due to an oversight. Test borings were re-drilled at these locations at a later time and associated samples submitted for analysis.

The RI activities also included follow-up analysis of previously submitted samples for additional metals including copper (Cu) and lead (Pb). These additional analyses were performed within acceptable sample holding times to allow for delineation of elevated concentrations of these constituents that had been detected in other samples.

4.4 Bedrock Core Sampling

As specified in the RI/FS Work Plan, continuous bedrock coring was performed at each location of a single bedrock monitoring well or bedrock well pair, with the following exceptions. Coring was not performed at well locations SR-325 or SR-326 because information sufficient for purposes of characterization of bedrock conditions had already been obtained. Bedrock core samples were collected and assessed in the field according to the protocols specified in the Work Plan. Core Boring Reports are presented in Appendix A.

4.5 Well Installations

The new wells installed during the RI include:

- Downgradient off-site wells: R-302, SR-303, R-303, SR-304, and R-304.
- Northwest corner of the site: SR-301 and R-301.
- East Parking Lot off-site areas to the east/northeast: R-305, R-306, R-307, R-401, SR-402, and R-402.
- South side of the Plant: SR-308 and R-308.
- Deep-bedrock wells: DR-132 and DR-315.
- Degreaser Study Area #1: SR-310.
- Degreaser Study Area #2: SR-311.
- Degreaser Study Area #3: SR-312 and SR-313.
- Degreaser Study Area #4: OW-316 and SR-316.
- Oil Pit #20/Machining Areas: R-309, OW-317, SR-317, SR-318, SR-319, and SR-320.
- Plant 2 Elevator: SR-321.
- Former UST Areas A through F: OW-323, OW-314, SR-314, and R-314.
- Scrap Building 11: OW-322.
- Oil House Dock: OW-324.
- Product Testing and Engineering Areas - Soil Vapor Survey follow-up: OW-327 and OW-328.
- Supplemental LNAPL delineation: SR-325 and SR-326 (in the CWTA courtyard and Plant 1, respectively).

Well installations were performed in accordance with the RI/FS Work Plan. The well locations and depth of the monitoring intervals of the wells were generally as specified in the Work Plan. A few wells were installed at locations a short distance from the proposed locations identified in the Work Plan either because underground utilities were present at or adjacent to the proposed locations or active facility operations necessitated relocation.

Four wells not specified in the work plan were added to the RI program to delineate or characterize apparent contamination encountered in the planned investigations. These included the supplemental LNAPL delineation wells SR-325 and SR-326 and UST area wells OW-323 and OW-324. OW-323 and -324 were installed to monitor elevated contaminant concentrations observed in groundwater grab samples from temporary wells installed in UST test borings.

All well locations are shown on the site plan presented in Figure 2. A summary of the relevant elevation and monitoring interval information for each new well and the wells installed at the site prior to the RI is presented on Table 1. Well installation reports are presented in Appendix A.

Well development was performed at each new well, as specified in the Work Plan, until a volume of water equal to that lost in the monitoring interval during coring was purged, until a minimum of three well volumes was purged, until the well was purged dry, or up to a maximum of one hour per well, whichever occurred first. Wherever possible, if drilling water was lost to the formation within the monitoring interval during drilling, development continued until at least an equal volume was recovered. Where possible, development continued until a turbidity of less than 50 NTU was achieved, but development of some wells did not reach this target level. Development consisted of purging using a combination of one or more of the following methods: steel bailer with bottom-loaded check valve, disposable bailer, submersible pump, drill-rig-mounted pump, or surge block/piston.

Drilling and development water was contained in tubs or 55-gallon drums, then decanted and treated through the on-site groundwater treatment system located in the wastewater treatment building.

4.6 Permeability Testing

Hydraulic-conductivity testing was performed to assess the permeability of the water-bearing units monitored in each new monitoring well that did not contain LNAPL. Four overburden, eight shallow-bedrock, ten intermediate-bedrock, and two deep-bedrock wells were tested using slug tests in accordance with the procedures specified in the Work Plan.

The calculated hydraulic conductivity for each well tested is presented in Table 3. Slug test data and calculations are presented in Appendix B.

4.7 Groundwater and LNAPL Sampling and Water Level Measurements

On 30 January 2003, initial groundwater samples were collected from the 8 new downgradient off-site wells installed during the RI (R-302, SR-303, R-303, SR-304, R-304, R-305, R-306 and R-307). Groundwater samples were submitted for analysis of TCL VOCs, SVOCs, PCBs, and PPL metals, as specified in the Work Plan. Each groundwater sample was also analyzed for total cyanide. All sample analyses were performed using ASP-specified methods. Well R-305, which contained a 1-foot thick layer of floating oil, was also sampled for LNAPL. The R-305 LNAPL was analyzed for VOCs, SVOCs, PCBs, physical parameters, and GC fingerprinting using SW-846 Methods.

During a sampling event conducted from 21 to 29 April 2003, initial samples were collected from each of the 29 remaining new wells that had been installed to that point. (Off-site wells R-401 and SR-/R-402 were not installed until November 2004). Groundwater and LNAPL sample analysis parameters and methods were as described in the previous paragraph except that ASP methods were used for both groundwater and LNAPL.

The April 2003 sampling event was also the initial site wide "annual" groundwater sampling event. Sampling was performed at each of the 101 other accessible on-site wells and the eight previously-sampled new off-site wells. As specified in the Work Plan, ASP methods were used for analysis of groundwater and LNAPL from 25 selected pre-RI wells. In accordance with the Work Plan, analyses of samples from the remaining wells were performed using SW-846 Methods.

Nine of the soil-vapor extraction system "VM" series wells, located in Degreaser Study Area 5 in Plant 2, and North Parking Lot wells OW-7, SR-8, DR-108, and SR-9 were dry (or had insufficient water for sampling) and were not sampled. This was generally the case for subsequent events as well, although OW-7 and SR-9 had sufficient water for sampling in April 2004.

Subsequent groundwater and LNAPL sampling events were performed on a quarterly basis for two years in accordance with the Work Plan. Analyses of samples of both groundwater and LNAPL samples from these events were performed using SW-846 Methods. These subsequent events included the following:

- Sampling of the eight new off-site wells was performed each quarter.
- Two events focused on the reduced "semi-annual" list of wells were performed in October of 2003 and 2004.
- The second site-wide "annual" event was performed in April 2004.

In all, four "quarterly" off-site events, two "semi-annual" events, and two "annual" events were conducted from January 2003 through October 2004.

Two additional sampling events were then performed at the end of the RI. New off-site wells R-401, SR-402, and R-402, which had been installed in November 2004, were sampled in January and April 2005. Groundwater samples were analyzed for VOCs, SVOCs, PCBs, and the "site" metals minus mercury in January and for VOCs and the "site" metals in April. New RI off-site well R-307 was also sampled and analyzed for VOCs in the April 2005 event after its monitoring interval was lengthened 7 feet to deepen the well to the level of the invert of the adjacent section of the Lexington Avenue municipal sewer tunnel.

Free-Col Laboratories of Meadville, Pennsylvania performed most of the groundwater sampling activities. Haley & Aldrich personnel performed incidental sampling activities including the installation of PDBs in deep wells prior to sampling events and a few instances of off-schedule sampling of individual wells.

Groundwater and LNAPL levels were measured in all accessible on-site and off-site wells on the first two to three days of each groundwater sampling event. In general, wells were then purged prior to sampling using disposable bailers, a centrifugal or peristaltic pump, or the dedicated bladder pumps that have been in place in several R-series wells since the 1990s. A minimum of three well volumes of groundwater was removed or the well was bailed or pumped until dry, whichever occurred first.

Wells were purged in accordance with the procedures specified in the RI/FS Work and subsequent correspondence with the NYSDEC project manager. Upon completion of purging, groundwater samples were collected in the following order: first VOCs, then SVOCs, PCBs, and inorganic parameters (metals, cyanide, pH) last. In instances where insufficient volume of groundwater was available after purging for all analysis parameters, a later attempt at sample collection was made on the same or the next day, as time permitted, to complete the sample collection process.

Groundwater sampling records, including water levels, purging records, low-flow procedure records and field-parameter analysis results, are presented in Appendix B. Groundwater and LNAPL level measurements are also presented in Appendix B. Groundwater elevation plans showing groundwater elevation contours, apparent directions of groundwater flow, and LNAPL distribution and thickness during each of the sampling events are presented in Volume 2.

As with soil samples, laboratory analyses of groundwater by ASP methods was performed by E&E. Non-ASP analysis of groundwater and LNAPL samples was performed by Free-Col.

4.7.1 Groundwater Sampling Variances

Starting in October 2003, analysis of SVOCs was dropped for well R-304, and starting in January 2004 SVOCs were dropped from all new off-site wells except R-306. At these locations SVOC contaminants had been detected, but the number of compounds was small, the detected compounds of interest were typical laboratory contaminants, and the concentrations observed were only slightly above each compound's practical quantitation limit. This change was as approved by NYSDEC on 13 January 2003.

For deep-bedrock monitoring wells DR-103, DR-105, DR-109, DR-11, DR-132, and DR-315, the groundwater sampling procedure described in the RI/FS Work Plan was modified, in accordance with Delphi's 8 April 2003 letter to and with prior approval from NYSDEC, to include low-flow groundwater sampling techniques. During low-flow sampling, a compressed-gas-driven submersible bladder pump was used to purge groundwater at a slow continuous rate. In-line flow-through monitoring equipment was used to analyze field parameters. Parameters analyzed in the field to assess aquifer stabilization during purging included temperature, pH, conductivity, oxidation-reduction potential (ORP), dissolved oxygen and turbidity.

At the suggestion of NYSDEC, and in accordance with its 9 October 2003 approval letter, deep-bedrock wells DR-132 and DR-315 were sampled using passive diffusion bags (PDBs) for VOCs analysis for the first time in October 2003. Sampling and analysis of VOCs in all on-site deep-bedrock wells in October 2004 was performed using PDBs.

In April 2004, off-site well R-305, which had an LNAPL layer approximately 7.5 feet thick, was sampled for groundwater instead of LNAPL by using tubing to pass sampling equipment through the LNAPL layer. VOCs analysis was performed on the groundwater sample.

4.8 Basement Sump Sampling

In accordance with Section 5.5.E of the Work Plan, sampling of LNAPL was performed at the two basement sumps on site which had been found to contain LNAPL. The Utility Room and Power House sump samples were collected by Free-Col on 15 April 2004 and submitted to E&E for ASP-method analysis of VOCs, SVOCs, PCBs and petroleum fingerprinting identification, and analysis of various physical parameters by standard methods.

4.9 Test Pit TP-301

Test pit TP-301 was excavated near monitoring well PZ-115 at the site boundary east of the plant. The planned purposes of the test pit were to attempt to investigate groundwater conditions adjacent to a facility sewer and evaluate the potential for off-site migration of contaminated groundwater in the bedding material for the sewer line. A high water table and coarse rock fill encountered in the test pit prevented completing the test pit as planned, and the excavation was backfilled.

Samples of water and LNAPL were, however, collected from the test pit prior to backfilling. Sampling and analysis results are discussed in Section 5 of the report. The test pit location is shown on Figure 2. A test pit report and photographs of the test pit are presented in Appendix A.

4.10 On-site Sewer Sampling

In accordance with Section 5.6.D of the Work Plan, wastewater in on-site Plant sewers was sampled on 22-24 October 2003 at nine locations - three from the sanitary sewer and six from the storm sewer, as shown on Figure 2. Samples were collected at sewer manholes or cleanouts using disposable bailers. Sewer wastewater samples were analyzed for PCBs and VOCs, the parameters best suited as indicators of groundwater or LNAPL infiltration.

Follow-up sampling to assess and monitor detections of VOCs and PCBs in the sanitary sewer wastewater at the east, downstream side of the facility was performed monthly from November 2003 until July 2004.

4.11 Municipal Sewer Tunnel Assessment

In accordance with Work Plan Amendment No. 3 (presented in Appendix C of Quarterly Progress Report No. 10), dry-weather sampling of wastewater flows was performed in the Driving Park Avenue (DP) and Lexington Avenue (LA) municipal sewer tunnels. The locations sampled, which are shown on Figure 2, included:

- Location #1 in the DP sewer at Mt. Read Boulevard near the northwest corner of the site, upstream of Delphi facility wastewater discharges to the tunnel and cross-gradient or upgradient of the site with respect to groundwater flow.
- Location # 2 at the DP sewer manhole near migration-control well GR-2 in Delphi's north parking lot. This location is downstream of the Delphi combined stormwater and pretreated process-wastewater discharge to the tunnel (located near PZ-140), upstream of the Delphi sanitary sewer discharge to the DP tunnel (located northeast of monitoring well R-241), and on the downgradient side of the site in terms of groundwater flow.
- Location #3, in the LA sewer at Lexington and Mt. Read Blvd. at the southwest corner of the site. This location is upstream of stormwater discharges from the parking lots and roadways on the south side of the site and upgradient of site groundwater. Location #3 was sampled instead of proposed location #4 because location #4 was not accessible. Location #3 is upstream of location #4.
- Location #5 in the LA sewer at the manhole at the southeast corner of the Delphi facility (near well R-235), in an area of possible discharge of shallow groundwater to the tunnel (as indicated by groundwater elevation data).
- Location #9 at the confluence of the DP and LA sewers off-site to the southeast of the Delphi facility. Two sample points were sampled at this location, one in each of the sewer tunnels immediately upstream of the confluence. This location is cross-gradient or upgradient of site groundwater.

Sewer sampling was performed on 16 February and 5 April 2005. Sampling in February included all of the above sample locations with the exception of #3. Initially the first choice as an upstream sample on Lexington Avenue had been location #4. Location #4 was not sampled in February due to accessibility issues (#4 is located in the middle of the intersection of Lexington Ave. and Mt. Read Blvd.). In the months that followed, the Monroe County Division of Pure Waters (MCPW) assessed location #4 and the associated entry and safety issues inherent in setting up to sample at this location, and MCPW determined that location #4 could not practically be sampled from either the surface or from within the tunnel. Location #3 was chosen as an alternate upstream wastewater sample location. Location #3 was sampled on 5 April, and a second sampling at location #5 was performed to provide a same-day comparison of wastewater conditions at these two locations on the Lexington Avenue sewer tunnel.

Samples were collected by Haley & Aldrich with the assistance of the MCPW. With the exception of location #9, all samples were collected from the surface using a disposable plastic bailer on a rope and/or an extendable Teflon sample cup. Wastewater samples at location #9 were collected by entering the sewer tunnel, and samples were collected directly in sample containers.

Wastewater samples at each of the locations were analyzed by Free-Col Laboratories for TCL VOCs using SW-846 method 8260B.

Sampling and analysis results are discussed in Section 5 of the report.

4.12 MNA Sampling Event

In accordance with the RI/FS work Plan, on-site and off-site wells were chosen for a monitoring event to evaluate groundwater conditions across the site that would be indicative of and/or influence the processes of intrinsic or natural degradation of VOCs that can lead to natural attenuation of groundwater contamination.

(Natural attenuation can under some circumstances be a remedy for groundwater contamination, and the parameters that are typically evaluated when monitoring natural attenuation conditions and efficacy are commonly referred to as Monitored Natural Attenuation (MNA) parameters.)

Well selection for the MNA event was based on factors such as location relative to contaminant plumes, geologic horizon (depth), and absence of LNAPL in the well. The following upgradient, source-area, mid-plume, and downgradient wells from the shallow- (SR) and intermediate- (R) bedrock horizons were selected: SR-231, SR-101, R-101, R-308, R-11, R-131, SR-131, R-132, SR-132, R-103, SR-301, R-108, R-307, R-306, R-303, and SR-303.

Sampling was performed during the period of 10 to 16 November 2004. Low-flow purging and sampling methods and field-parameter monitoring methods that are standard practice for MNA evaluations were used. The field and laboratory analysis parameters for the MNA samples included alkalinity, pH, sulfate, sulfide, nitrate, nitrite, chloride, Total Kjeldahl Nitrogen (TKN), dissolved oxygen (DO), nitrogen, ammonia, phosphorus, total iron, total and dissolved manganese, TCL VOCs, methane, ethane, ethene, dissolved organic carbon (DOC), carbon dioxide, conductivity, temperature, and oxidation-reduction potential (ORP).

Sampling and analysis results are discussed in Section 5 of the report.

4.13 Laboratory Analysis

In general, soil, groundwater, and LNAPL sample analyses were performed in accordance with Table IV of the RI/FS Work Plan and with Amendments 1 through 4, with the exceptions noted in sections above. Ecology & Environment (E&E) of Lancaster, New York and Free-Col laboratories of Meadville, Pennsylvania were the primary project laboratories. Severn-Trent Laboratories (STL) of Amherst, New York performed several verification analyses in support of E&E. STL of Knoxville, Tennessee performed high-resolution analysis of PCBs congeners in two LNAPL samples during the RI. Columbia Analytical Services of Simi Valley, California performed low-detection limit analysis of soil-vapor and indoor and outdoor air samples collected for the soil-vapor intrusion assessment.

Laboratory analysis of the following was performed during the RI:

- 190 soil samples, 289 groundwater samples and 67 LNAPL samples from monitoring wells, 1 groundwater sample and 1 LNAPL sample from a test pit, 2 basement sump LNAPL samples, 11 Delphi sanitary sewer wastewater samples, 6 Delphi storm sewer wastewater samples, 7 municipal combined sewer wastewater samples, and;
- various field and laboratory Quality Assurance/Quality Control (QA/QC) samples including: 30 field duplicate samples, 39 trip blanks, 26 equipment blanks, and 48 matrix spike/spike duplicate pairs collected during field work, and numerous lab/method blanks and control samples.

A table presented in Appendix D lists the analyzing laboratory, parameters analyzed and analytical methods used for sample analyses completed during the RI. Laboratory analyses were completed in accordance with the procedures specified in the RI/FS Work Plan. However, some laboratory analysis methods used were different than those specified in the RI/FS Work Plan. The changes were made, with prior approval from NYSDEC, to update analysis methods for soil samples and initial groundwater samples from new wells to the Department's current Analytical Services Protocol (ASP) of June 2000.

4.14 Data Validation

Analytical results for environmental samples collected at the site from 2002 through 2005 were reviewed to determine the data usability. Each laboratory data package was reviewed with guidance provided by the United States Environmental Protection Agency (USEPA) National Functional Guidelines for Organic Data Review (EPA 540/R-99/008), and/or National Functional Guidelines for Inorganic Data Review (EPA 540-R-01-008), and the NYSDEC "Guidance for the Development of Quality Assurance Plans and Data Usability Summary Reports (DUSR)", September 1997. Laboratory method-specific criteria as prescribed by "Test Methods for Evaluating Solid Waste", SW846, Update III, 1996 were used, where applicable, if the analytical anomaly identified was not addressed by the guidelines referenced above.

During the data validation process, the following quality control/quality assurance (QA/QC) criteria were reviewed where applicable:

- Preservation and Holding Time Compliance
- GC/MS Instrument Performance Check
- Initial Calibration and Continuing Calibration Procedures
- Blank Sample Analysis
- System Monitoring/Surrogate Compound Recoveries
- Laboratory Control Samples, Matrix Spike/Matrix Spike Duplicate Recoveries
- Internal Standard Recoveries

- Duplicate Sample Analysis
- ICP Interference Check Sample Performance
- ICP Serial Dilution Replicate Percent Difference
- Use of Laboratory Data Qualifiers
- Sample Data Reporting Format

Each section below provides a brief description of the procedure used in the evaluation and an example corrective action implemented as a result of the assessment. The intent of this summary is to assist the data user with an understanding of the data qualification procedures implemented during the reduction of the investigation results and their use in the evaluation of the current site conditions.

4.14.1 Preservation and Holding Time Compliance

Maximum allowable holding times for each parameter were measured from the time of sample collection to the time of sample preparation or analysis for each project sample. All project samples were found to be properly preserved or analyzed within the USEPA recommended maximum holding time without exception.

4.14.2 GC/MS Instrument Performance Check

GC/MS instrument performance checks were evaluated to ensure proper tuning of the instrument for mass resolution, compound identification, and sensitivity. Validation was performed to determine whether analysis of the instrument performance solutions was performed at the beginning of each 12-hour period during which samples or standards were analyzed

The mass assignment and ion abundance criteria were met for all project samples. No qualification of the data was required.

4.14.3 Initial Calibration and Continuing Calibration Procedures

Instrument calibration procedures for the analysis of project samples were evaluated based on the requirements of the National Functional Guidelines and/or prescribed by the laboratory standard operating procedures (SOPs) when not directly addressed by the guidelines.

Initial calibration procedures were verified to confirm that the instrument was capable of acceptable performance in the beginning of an analytical run and of producing a linear calibration curve. If the Percent Relative Standard Deviation (%RSD) of a target compound was greater than 30% during the initial instrument calibration, positive results for that compound were qualified as estimated (J) and non-detects for that compound were qualified as having an estimated quantitation limit (UJ). If the initial calibration standard Relative Response Factor (RRF) for a target compound was less than 0.05, positive results for that compound were qualified as estimated (J) and non-detects for that compound were qualified as unusable (R for Rejected).

Continuing calibration procedures were verified to ensure that the instrument was capable of producing acceptable qualitative and quantitative data. Continuing calibration establishes the 12-hour relative response factors on which the quantitations are based and checks the satisfactory performance of the instrument on a day-to-day basis. If the Percent Difference (%D), of a target compound, between the averaged initial calibration RRF and the continuing calibration RRF was greater than 25%, positive results for that compound were qualified as estimated (J) and non-detects for that compound were qualified as having an estimated quantitation limit (UJ). If the continuing calibration standard Relative Response Factor (RRF) for a target compound was less than 0.05, positive results for that compound were qualified as estimated (J) and non-detects for that compound were qualified as unusable (R).

4.14.4 Blank Sample Analyses

The presence of target compounds in associated trip, field, equipment, preparation and/or method blank samples prepared and analyzed concurrently with the project samples was determined as part of each laboratory sample data package. If target compounds were reported in blank at a concentration above the method detection limit (MDL) for organic parameter analyses or the instrument detection limit (IDL) for inorganic parameter analyses, the associated sample results were qualified as described below.

In the case of organic method blank sample analyses, if the target compound detected was identified as a "common laboratory contaminant" by the USEPA Functional Guidelines, an action level of 10 times (10X Rule) the blank contamination level was calculated. For all other organic parameters that are not defined as common lab contaminants, an action level of 5 times (5X Rule) the blank contamination level was calculated. In the case of inorganic parameter blank sample analyses, an action level of 10 times (10X Rule) the blank contamination level was calculated.

Then, in accordance with EPA guidance, if the detection of the blank contaminant in the associated project samples was reported at a concentration between the MDL or IDL and the action level, the result was qualified as non-detect (U). This data qualification indicates that the detection of the parameter was due to sampling and/or analysis contamination and is not representative of the site conditions.

4.14.4.1 Common Lab Contaminants

Common lab contaminants that were detected in project blank samples include the VOCs acetone, 2-butanone (also known as methyl ethyl ketone, MEK) and methylene chloride and several phthalate compounds that are SVOCs. Some of the acetone, MEK, and methylene chloride detections in site samples were qualified as U based on detections in associated blanks. Other detections were not associated with blank contamination and were not qualified in the data validation process, but they may nevertheless be due to laboratory contamination. Acetone and MEK detections in deep bedrock groundwater samples do appear to reflect actual groundwater conditions (rather than lab contamination), but methylene chloride and phthalate compound detections, while not qualified as U or excluded from consideration in the RI, are thought to be related to contamination from laboratory solvents or plasticizers in lab equipment or sample containers.

4.14.4.2 Caprolactam Detections in Groundwater Samples

Sample analysis for the April 2003 groundwater sampling event detected the semi-volatile organic compound caprolactam in groundwater samples from a number of wells at the site. Caprolactam was detected in samples from 30 wells at concentrations ranging from 0.01 to 8.9 ppm. Caprolactam is not a known site contaminant and was therefore suspected of being related to contamination from sampling or analysis equipment; however, it was not present in project blank samples or other lab quality-control samples.

At the suggestion of NYSDEC, a bench test was performed by Free-Col Laboratories in which segments of nylon rope of the type used by Free-Col in RI sampling events were placed in samples of lab-grade water. Analysis of the water after 24 hours detected caprolactam at concentrations of 1 to 4 ppm. The detections of caprolactam in site samples are therefore believed to be attributable to leaching of caprolactam from the rope during well purging and sampling.

4.14.5 System Monitoring/Surrogate Compound Recoveries

System monitoring/surrogate compounds were added to each sample prior to analysis of organic parameters by EPA Methods 8260B, 8270C and 8082 to confirm the efficiency of the sample preparation procedures. The calculated recovery for each surrogate compound was evaluated to confirm the accuracy of the reported results. If the calculated recovery of these compounds was greater than the laboratory specific upper acceptance limit (UL), associated detected target compounds were qualified as estimated (J) and non-detects were not qualified. If the calculated recovery of these compounds was less than the laboratory specific lower acceptance limit (LL), associated detected target compounds were qualified as estimated (J) and non-detects were qualified as having an estimated quantitation limit (UJ). If the surrogate percent recovery is less than 10%, associated target analyte positive results were qualified "J" and non-detects were qualified "R".

For example, the calculated recovery of the four surrogate compounds (S01 through S04) for analysis of project samples by EPA method 8260B resulted in the following qualifications:

Project Sample	Matrix	S01 %R	S02 %R	S03 %R	S04 %R	Positive Results	Non Detect (ND)
PZ-129	Groundwater			132		J	U
R-240	Groundwater	98		93	0	J	R
East Roadway San	Wastewater	30	12			J	UJ
Intermediate San	Wastewater	24	11			J	UJ
M.H. #BB23 San	Wastewater	31	14			J	UJ

4.14.6 Laboratory Control Samples, Matrix Spike/Matrix Spike Duplicate Recoveries

Analytical precision and accuracy were evaluated based on the laboratory control (LCS) and matrix spike (MS) sample analyses performed concurrently with the project samples. For LCS analyses, after the addition of a known amount of each target analyte into a sample of laboratory reagent water, the sample was analyzed to confirm the ability of the analytical system to accurately quantify the compounds. For matrix spike samples, after the addition of a known amount of each target analyte to a site sample designated for MS analysis, the sample was analyzed to confirm the ability of the analytical system to identify these compounds within the sample matrix.

The percent recovery calculated for each target analyte fell within method specific criteria for each project sample analytical batch with the following exceptions.

Project Sample MS	Target Analyte(s)	%R Criteria	%R	Affected Samples
R-306 MS/MSD	Pyrene	80 - 120	140	SR-11, R-11, R-308, SR-308, OW-323, R-307, SR-303, R-108, R-302, and R-306
	Indeno(1,2,3-cd)pyrene	80 - 120	152	
	Dibenz(a,h)anthracene	80 - 120	160	
	Benzo(g,h,i)perylene	80 - 120	178	
	Hexachlorobutadiene	80 - 120	138	
	4-Bromophenyl phenyl ether	80 - 120	128	

4.14.7 Internal Standard (IS) Compound Recoveries

Internal Standard (IS) compounds were added to each sample prior to the analysis of organic parameters by EPA Methods 8260B and 8270C to quantify the amount of the target compounds detected within the sample matrix. All IS recoveries were acceptable during the analysis of the project samples without exception.

4.14.8 Duplicate Sample Analysis

During the analysis of metals, duplicate sample analyses were evaluated to demonstrate acceptable method precision at the time of analysis by using a control limit of 20% for the relative percent difference (RPD) between the original and duplicate sample with concentrations greater than five times (5x) the Contract Required Quantitation Limit.

4.14.9 ICP Interference Check Sample Performance

The results of the ICP Interference Check Samples analyzed concurrently with the project samples were evaluated versus an acceptance criteria +/- 20% of true value as prescribed by USEPA guidance.

4.14.10 ICP Serial Dilution Replicate Percent Difference (RPD)

The results of the ICP Serial Dilution samples analyzed concurrently with the project samples were evaluated for compliance with the USEPA protocol criteria of less than 10% replicate percent difference (RPD) between the diluted and undiluted sample. All ICP serial dilution sample results met criteria, and no qualification of the data was required.

4.14.11 Use of Laboratory Data Qualifiers

Sample data was qualified by the laboratory in accordance with laboratory specific SOPs. Data qualification included the reporting of estimated concentrations of target compounds/analytes quantified either a) below the project reporting limit (RL) but above the method or instrument detection limit, or b) at concentrations greater than the instrument calibration. The presence of target compounds in corresponding method blank samples, and non-compliant results of associated QA/QC sample analyses (i.e. MS/MSD) were also qualified by the laboratory.

In accordance with the project specific QAPP, the laboratory-specific qualifiers were amended during the data validation process to be consistent with the guidance provided by the USEPA National Functional Guidelines recommendations. For example, the laboratory assigned "B" qualifiers, assigned by the lab for all inorganic parameters detected below the reporting limit but above the instrument detection limit, were converted during validation to a "J" as prescribed by the EPA guidelines to indicate that the reported value was estimated.

4.14.12 Sample Data Reporting Procedures

The reporting format for the project sample data included full NYSDEC Category B Analytical Services Protocol (ASP) equivalent deliverables format with Forms I though IX, and applicable instrument raw data including GC/MS instrument tuning and calibration logs, standard and sample chromatograms, and ICP instrument printouts for approximately 50% of the project soil samples, and the initial round of groundwater samples collected for analysis from each new well and other selected wells sampled during the RI. All subsequent groundwater sample data was presented in a standard laboratory report format with site-specific QA/QC sample reporting. The data reporting format was evaluated within each SDG and found to be compliant with the project data quality objectives (DQOs).

5. FINDINGS

This section of the report describes the sample analysis results and other RI findings for each area of the site investigated during the RI.

5.1 Sample Analysis Dataset

The findings presented in this report are based on an evaluation of a dataset that includes analysis results for the following samples:

- soil, groundwater, LNAPL, DNAPL, wastewater, soil-vapor, indoor-air, and ambient outdoor-air samples collected during the RI (from November 2001 through April 2005),
- previous-investigation soil and soil-vapor samples collected prior to the RI (from 1989 to 1999), and
- groundwater and LNAPL samples collected in January 1999 during the last pre-RI groundwater sampling event.

5.2 Figures and Tables Summarizing Sample Analysis Results

Figures referenced in this section of the report present summaries of the sample analysis results for each area of the site. Some figures present results for a single AOC, while others present results for more than one AOC or for areas that are not related to specific AOCs. The referenced figures are presented in Volume 3 of the report.

The majority of the figures presented in Volume 3 show summaries of results for locations where contaminant compounds were detected in soil or groundwater samples at concentrations that exceeded specific criteria. For soil samples, the criteria used to screen the analysis data and select the results that are shown on the figures are NYSDEC's generic soil cleanup objectives for inactive hazardous waste disposal sites. The screening criteria used for groundwater analysis data were NYSDEC's standards for protection of groundwater resources that may be used as sources of drinking water. The screening criteria used are listed in Volume 2 on Table 4.

On a few of the figures, all compounds detected in the soil and groundwater samples summarized are listed in the data summaries, even if the concentrations detected did not exceed the screening criteria. In most figures, however, the data summaries do not show soil and groundwater analysis results for compounds that were either a) not detected, or b) were detected at concentrations below screening criteria. Most figures, in other words, only present data summaries for the samples in which screening criteria were exceeded, and therefore anywhere from a few to many of the samples collected in an AOC are not shown on the figures. For all sample analysis results that are relevant to each area, including results for compounds not detected and compounds detected at concentrations below screening criteria, the reader should refer to the tables presented in Volume 2 of the report. The tables in Volume 2 present a complete listing of analysis results for all samples that are relevant to each AOC.

The Volume 3 figures also present summaries of sample analysis results for LNAPL, DNAPL, and wastewater samples collected in each AOC. LNAPL, DNAPL and wastewater results were not screened against comparison criteria to determine which results would be shown on the figures. All compounds detected in LNAPL, DNAPL, and wastewater samples are shown in the data summaries on the figures. The figures do not show results for NAPL or wastewater samples in which contaminant compounds were not detected. For summaries of all LNAPL, DNAPL, and wastewater analysis results, including results for compounds not detected, the reader should refer to the tables presented in Volume 2.

5.3 Deep-bedrock Groundwater

Two additional deep-bedrock wells were installed during the RI to supplement the data from 5 deep wells that had been installed during previous investigations. The purposes of installing additional deep-bedrock wells were:

- to evaluate the deep-bedrock groundwater quality downgradient of former degreaser areas but in closer proximity to the former degreasers than existing deep wells,
- to assess whether dense non-aqueous phase liquid (DNAPL) may be present in deep-bedrock at the site, and
- to evaluate further the gradients of groundwater flow in the deep-bedrock zone at the site.

Hydrogeologic and groundwater quality conditions in the deep-bedrock zone were described above in Section 2.4 of this report, and a summary of deep-bedrock groundwater quality conditions observed during the RI is presented on Figure 3. A summary of deep-bedrock groundwater sample analysis results is presented on Table 5.

As shown on Figure 3, benzene, toluene, and xylene have been detected in groundwater samples at concentrations exceeding NYSDEC groundwater standards for sources of drinking water at each of the seven locations on site where deep-bedrock groundwater monitoring has been performed. As described in Section 2.4, this condition is a result of the natural presence of petroleum compounds in the Rochester Formation bedrock unit that underlies the site.

Chlorinated solvent compounds were not detected in deep-bedrock groundwater. The RI results indicate that DNAPL is not present in the deep zone and that the dissolved groundwater contaminant plume does not extend below the intermediate-bedrock zone.

5.4 Downgradient Conditions

New shallow- and/or intermediate-bedrock wells were installed at 9 locations near the site boundary in areas that are downgradient of the site. The areas include the following:

- the area along the western site boundary at the northwest corner of the site.
- the off-site area north of the site along the north side of Driving Park Avenue (the area that, prior to the implementation of groundwater pumping at the migration-control trench, was downgradient of the site and the chlorinated VOC plume).

- the areas northeast and east of the East Parking Lot (the area along the eastern site boundary where LNAPL has been identified in the intermediate-bedrock horizon).

Groundwater quality conditions at downgradient off-site locations and other wells located around the site perimeter are summarized on Figure 4. Tables 6 through 10 present sample analysis results for the wells along the site perimeter (specific table numbers for each section of the perimeter are noted below).

5.4.1 Northwest Corner of the Site

As shown on Figure 4, traces of the chlorinated VOC contaminants TCE and DCE were detected in the shallow-bedrock zone at monitoring well SR-301, located on the west site boundary near the north end of the site. Groundwater elevation data indicates that the direction of groundwater flow at SR-301 is off-site to the west, and therefore there may be low levels of contamination in shallow groundwater off-site to the west of SR-301. Flow in the intermediate zone at this location, however, as indicated by elevation data for companion well R-301, is eastward towards the west end of the migration-control trench. Intermediate-bedrock groundwater, as indicated by results of analyses of samples from R-301, is not contaminated at this location.

The apparent potential for off-site migration of contaminated groundwater in the shallow bedrock horizon at SR-301 appears to be a localized condition that may be caused by discharge of shallow groundwater to an underground sewer, stormwater drain, or other underground feature along Mt. Read Boulevard. The vertical gradient at this location is upward from the intermediate to the shallow-bedrock, a condition that is not typical of the site.

The depressed water levels and traces of contamination in the shallow horizon at SR-301 apparently do not extend to the north. As documented in the Data Summary Report, water levels observed at former shallow-bedrock well SR-1, located in the northwest corner of the site from 1985 until the well was abandoned in 1997, were 3 to 4 feet above the levels observed at SR-301 during the RI, and VOCs were never detected at SR-1.

TCE, which is also present in similar proportions to DCE at shallow wells OW-6 and PZ-144, located to the southeast of SR-301, is typically not found as a significant contaminant this far north on the site. The residual presence of TCE at SR-301 appears to be a function of aerobic groundwater conditions and a related decrease in or absence of biodegradation of chlorinated VOCs. Groundwater from SR-301 had the highest Oxidation/Reduction Potential (ORP) of any well tested during the MNA sampling event, and was one of only two wells to demonstrate a positive ORP. The absence of vinyl chloride and ethene and ethane in SR-301 groundwater is consistent with an absence of intrinsic anaerobic biological dechlorination activity.

Sample analysis results for SR-301 and R-301 are listed in Table 6 with results for other wells and borings located along the down-gradient, northern site boundary. Additional discussion of the results of the MNA sampling performed during the RI is presented in Section 5.24.

5.4.2 Area North of the Site along Driving Park Avenue

As shown on Figure 4, the results of the RI indicate that significant adverse impacts to groundwater quality are not present in off-site groundwater north of the site, although very low levels of chlorinated VOCs were detected sporadically. These data and the southward hydraulic gradients evident in the shallow- and intermediate-bedrock zones along the northern boundary (gradients that are produced by the operation of the migration-control system) indicate that off-site migration of the site plume to the north is not occurring.

Sample analysis results for the off-site wells located north of the site along Driving Park Avenue are listed in Table 7.

5.4.3 Area East of the Site

As shown on Figure 4, in the area east of the site, where LNAPL contamination is present in the intermediate-bedrock zone in the area of Delphi's east parking lot, LNAPL containing VOC contaminants extends off-site 200 feet to the location of R-305. Low levels (to 0.03 ppm) of dissolved phase contamination by VOC compounds in the intermediate zone extend off-site 400 feet northeast and 200 east from the edge of the east parking lot to the locations of off-site wells R-401 and R-306.

PCBs are present in the east parking lot LNAPL at off-site locations adjacent to the off-site electrical transformer substation located south of the east parking lot, and PCBs are also present at on-site well R-2, which is downgradient of the substation. The substation is suspected of being the source of the PCBs. PCBs have in the past been detected in oil seeping into the south side of the Lexington Avenue municipal sewer tunnel (the side that faces the substation) where the tunnel passes by the substation and at a depth that corresponds to the intermediate-bedrock zone.

Traces of PCBs and a few semi-volatile poly-nuclear aromatic hydrocarbons (PAHs) that are possibly components of the east parking lot LNAPL were detected at R-306 in 3 of the 8 sampling events in which PCBs and SVOCs were analyzed.

The hydraulic influence of the migration-control trench does not create a gradient of flow at the east site boundary from off-site to on-site and towards the trench. These conditions appear to indicate that the east parking lot and adjacent off-site areas may be beyond the capture zone of the trench, although groundwater level data for the newest off-site wells (wells R-401 and R-402) appear to indicate that there may be a gradient in the intermediate zone back towards the site and the trench from these wells located furthest east and north of the east parking lot. Additional evaluation of the directions and gradients of flow in the intermediate-bedrock zone in this area will be included in the Feasibility Study.

Sample analysis results for the wells located along the site boundary around the north and east sides of the east parking lot are presented in Table 8. East parking lot samples are presented in Table 9. Sample analysis results for the wells located along Lexington Avenue on the south side of the east parking lot are presented in Table 10.

5.5 On-site Conditions Downgradient of Source Areas

New monitoring wells were installed during the RI in areas of the site that were:

a) beyond the immediate vicinity of known or potential source areas,
b) were potentially downgradient of the source areas, and
c) had not been previously investigated.

These wells included the following:

- deep wells DR-315 and DR-132, located on the north side of Buildings 1 and 2 north of former chlorinated-solvent degreaser areas,
- well pair SR- and R-308, located on the south side of Building 1, and
- well trio OW-, SR, and R-314, located on the north side of Building 1.

RI results for DR-315 and DR-132 were described above in Section 5.3. Results for the 308 and 314 locations are described below.

5.5.1 South Side of Plant 1

Along the Lexington Avenue municipal sewer tunnel southeast of Plant 1, LNAPL contamination is present in the intermediate-bedrock zone, and there is a shallow-bedrock groundwater discharge feature that may be related to the sewer manhole located in Lexington Avenue south of the southeast corner of the building. A new shallow- and intermediate-bedrock well pair (SR/R-308) was installed on the south side of the manufacturing building between the building and Lexington Avenue to provide information on hydraulic gradients, groundwater quality, and the extent of LNAPL along the section of the Lexington Avenue tunnel that is upstream (west) of the southeast corner of the building.

Groundwater elevation data from the RI indicates that there is not a strong southward gradient towards the sewer tunnel from the Delphi plant in either the shallow or the intermediate-bedrock zone at the SR-308/R-308 location. And, as shown on Figure 5, no LNAPL was present in either zone. However, although dissolved-phase contamination by chlorinated VOCs is absent in the shallow zone, cis-1,2-DCE (to 3 ppm), vinyl chloride (to 6 ppm), and traces of other chlorinated solvent breakdown products are present in the intermediate-bedrock zone.

The RI data indicate that the section of the tunnel upstream of the east parking lot is not a significant groundwater discharge feature or contaminant migration pathway in the shallow zone. Whether the conditions at R-308 could be the result of intermediate-bedrock groundwater discharge to the tunnel is not clearly evident from the RI groundwater monitoring data or the wastewater sampling data described below. The presence of chlorinated VOCs in the intermediate zone at R-308 appears to indicate that there is either southward groundwater flow and/or contaminant dispersion from former Plant 1 degreaser areas or that there is southeastward flow or dispersion from former Plant 2 degreaser areas. Southeastward migration of contaminants from Plant 2 degreaser areas appears to be a more likely possibility given the groundwater flow directions indicated by groundwater-level monitoring data.

Sample analysis results for the wells located along Lexington Avenue on the south side of Building 1 are summarized on Figure 5 and presented in Table 10.

5.5.2 North Side of Plant 1

The installation and sampling of the OW/SR/R-314 well cluster served two purposes. One was to monitor groundwater conditions downgradient of degreaser, machining, plating, and test-fluid AOCs in Building 1. The second purpose was to investigate former UST Area E, and the well cluster was installed within the footprint of former UST Area E. Findings relevant to former UST Area E are described in Section 5.15, and sample analysis results for the OW/SR/R-314 well cluster are summarized on Figure 16 and Table 25 with results for UST Area E.

As shown on Figure 16, the RI results indicate that in the area of the OW/SR/R-314 well cluster the only significant downgradient impact from potential source areas in Building 1 is the presence of vinyl chloride and 1,2-DCE in groundwater in the intermediate-bedrock zone. Other organic contaminants, including LNAPL, are not present at this location. Exceedances of screening criteria for metals were observed in groundwater from shallow wells, but the metals concentrations detected do not indicate significant contamination. The metals concentrations were 2 to 4 times higher in the two April events than in the two October events, and the higher April concentrations may be related to seasonal water-level fluctuations. Groundwater levels were generally higher in the shallow zones during the April events.

5.6 Sewer Tunnel Wastewater Sampling

Results of analyses of samples of dry-weather wastewater flows collected in the two municipal sewer tunnels are presented on Table 11. Wastewater results are also summarized on Figure 5 with data from the groundwater monitoring wells that are located along the sewers.

As shown on Figure 5, traces of the site groundwater contaminants cis-1,2-DCE and vinyl chloride (0.004 to 0.019 ppm) were detected in the wastewater samples from the downstream sample points at the intersection of the tunnels (locations 9 and 9L) and from the location 5 at the Lexington sewer manhole at the southwest corner of the east parking lot. The data indicate that minor infiltration of contaminated site groundwater into the sewer tunnels is occurring in or downstream of the area of Delphi's east parking lot. The previously-noted inflows of groundwater at the Lexington Avenue manhole at sample location 5 may account for the VOCs detected in the Lexington Avenue Tunnel samples from locations #5 and 9L. The concentrations detected in these samples of dry weather flow appear to indicate that the magnitude of the influx of contaminated groundwater to the sewer tunnels is relatively small and that the influx does not adversely impact the wastewater stream to the POTW.

5.7 Former Solvent Degreasers

Six areas of former solvent degreasing operations had been identified and investigated during previous investigations. Each of the Degreaser Study Areas was the subject of further investigation during the RI. Former degreasing equipment locations that had not been previously investigated were also targeted during the RI.

5.7.1 Degreaser Study Areas 1 through 6

Test borings and monitoring well installations were performed in each of the Building 1 Degreaser Study Areas (numbers 1, 2, and 3). These areas had been delineated by previous soil vapor sampling but, unlike Building 2 Study Areas 4, 5 and 6, had not had previous soil or groundwater sampling.

In Study Area 4, additional soil sampling to delineate the impact of the former degreaser operations was performed at test borings that also targeted adjacent former plater locations, and two new wells were installed to delineate the downgradient extent of LNAPL and VOC contamination previously identified in Study Area 4.

In general, the soil sample analysis results for the degreaser areas indicated moderate to high concentrations (10 to 900 ppm) of VOCs including trichloroethene (TCE) and related chlorinated compounds in shallow soil in the areas which had been delineated by previous soil-vapor survey work as having had soil-vapor concentrations above 100 parts per million. Sample analysis results for test borings located outside the 100 ppm soil-vapor line generally indicated relatively low concentrations of VOCs. Poly-nuclear aromatic hydrocarbons (PAHs) were detected occasionally in oily soil samples from the degreaser areas.

Groundwater sampling was performed during the RI at all six degreaser study areas. LNAPL containing chlorinated VOCs was encountered at each of the new shallow-bedrock wells in Study Areas 1 through 3 and in both the overburden and shallow-bedrock wells (OW- and SR-316) installed downgradient of Study Area 4. Study Area 6 is the only one of the six former degreaser areas in which LNAPL is not present. In each former degreaser area where LNAPL is present, high concentrations of chlorinated VOCs and usually lower concentrations of trimethylbenzene and butylbenzene are present in the LNAPL. In Study Area 1, the LNAPL does not have the methyl-, butyl-, or propyl-benzene constituents. (The various methyl-, butyl-, and propyl-benzene compounds that are typical of petroleum test-fluid releases at the site are referred to collectively below as substituted benzenes.)

In groundwater samples from non-LNAPL wells in Study Areas 5, chlorinated VOCs were detected at concentrations of up to 180 ppm. Cis-1,2-DCE is the compound that was usually the most abundant, and non-chlorinated VOCs were not detected. Chlorinated VOCs were detected in overburden and shallow-bedrock groundwater samples from Study Area 6 at concentrations of up to 8 ppm.

Summaries of analysis results for previous soil samples and RI soil, groundwater, and LNAPL samples for the three Degreaser Study Areas located in Building 1 (Study Areas 1, 2, and 3) are presented on Figure 6; Tables 12 through 14 present the data for each area individually. The data for each of the three study areas (4, 5, and 6) in Building 2 are presented individually on Figures 7, 8 and 9 and Tables 15, 16, and 17.

5.7.2 Former Degreaser-36 and Degreaser-39 Locations

Soil vapor sampling at the former locations of these two previously un-investigated degreasers was performed during the RI. The degreaser locations (in the southeast and west sides of Building 2, respectively) and the soil vapor sample points surrounding them are shown on Figure 9. Results indicated no significant sub-slab concentrations of VOCs in soil vapor, and therefore no further investigation was performed. Soil vapor sample analysis results for these and other areas surveyed during the RI are summarized in Table 2.

5.8 Areas of Metal Plating Operations

Soil test borings were installed at 39 former plating equipment locations, and groundwater monitoring was performed at monitoring wells downgradient of the former platers. Results are summarized on Figure 10. A detailed plan with results for the Former Plating Area in Building 2 is presented on Figure 11. Soil sample analysis results for plater borings are presented on Table 18. Results of monitoring of groundwater for metals and cyanide in and downgradient of plating areas are presented on Table 19. (Results of monitoring for organic contaminants in groundwater at these wells, which are located in and around Buildings 1 and 2, are presented in other tables.)

Three of the plating features investigated during the RI showed indications of contamination by plating chemicals. Those three areas are described below. Indications of contamination by plating chemicals, including contamination by metals or cyanide or strongly alkaline or acidic soil, were not detected at the other plater test borings drilled during the RI.

5.8.1 Former Building 2 Plating Area

Plater test borings PB-31 and -34 were installed in the footprint of former Ionic #II plating line in Building 2. Concentrations of 50 to 13,000 ppm of chromium, copper, nickel, and zinc were detected at both locations. As shown on Figure 11, the former plating line was located adjacent to the west side of the former Ionic #III plating line that had been investigated in 1995 and at which soil contamination by chromium, nickel and zinc had been detected. Slightly elevated levels of alkalinity (from 9 to 11) were detected in shallow soil at other borings in the former Building 2 plating area (PB-19, -21, and 30), but, as shown on Figure 11, metals concentrations indicative of a significant release were not detected. As shown on Figure 11, the 1995 test boring data and the RI results indicate that soil contamination in the Former Building 2 Plating Area is limited to shallow sub-slab soil (to 2 ft below grade) in the Ionic #III PA sample area and at the Ionic #II PB-31 and -34 locations. The approximate extent of the area in which contamination has been detected is approximately 80 feet square.

As shown on Figure 10, Degreaser Study Area 5 overburden well VM-210 is located 100 feet downgradient of the soil contamination in the former Building 2 plating area, and it exhibited variable concentrations of zinc that may represent groundwater contamination. Variable concentrations of metals were also detected in samples from the other overburden VM wells located to the west of VM-210 and south of plater boring PB-30. Shallow-bedrock monitoring wells SR-230 and SR-216 may also be located downgradient of the soil contamination in former Building 2 plating area, but both are LNAPL wells and were therefore not sampled for analysis of metals in groundwater during the RI. Previous (1995 and 1999) sampling of groundwater at SR-216 and SR-230 had not detected significant metals contamination. Groundwater sample analysis results for wells OW- and SR-317, which are located approximately 400 feet east-northeast of the former Building 2 plating area, showed variable but declining metals concentrations that do not indicate the presence of significant contamination by metals.

5.8.2 Former Copper Plate Line at PB-17

The second area of apparent contamination by metals related to a former plater is at the former 'Copper plate' line in Building 2 where PB-17 was installed. As shown on Figure 10, copper was detected in soil at concentrations of 219 ppm (4 to 6 ft.) and 1926 ppm (12 to 16 ft.). Copper contamination was not detected at test borings located 20 to 30 feet east and west of PB-17, indicating that soil contamination is not extensive. Copper contamination in groundwater was not detected at downgradient overburden and shallow-bedrock wells OW- and SR-317 which are located 120 feet to the north-northwest.

5.8.3 Former Dichromate Sump at PB-10

The third indication of a possible release of plating chemicals was detected in soil at test boring PB-10, located (as shown on Figure 10) in Building 1 in the area south of Degreaser study Area 3. Zinc was detected at a concentration of 607 ppm at a depth of 6 feet at this location. Contamination was not detected in samples of underlying soil. The PB-10 boring was drilled adjacent to the former location a dichromate-process wastewater sump installed in 1964. The results indicate that if the zinc concentrations detected resulted from a release of wastewater from the sump, the adverse impacts of the release were negligible.

Shallow-bedrock monitoring wells in Degreaser Study Area 3 may be located downgradient of the PB-10 location, but both are LNAPL wells and were therefore not sampled for analysis of metals in groundwater.

5.8.4 High Concentrations of Lead in Soil at PB-33 and SR-313

As shown on Figure 10, an elevated lead concentration was detected in soil at plater boring PB-33. PB-33 was located in a former plating area that coincides with former Degreaser Study Area 4. The high lead concentration (8550 ppm) was detected at a depth of 6 to 8 feet. Other metals were not present at elevated concentrations in PB-33 soil samples, and lead concentrations were not elevated in over- or underlying soil at PB-33 or at adjacent follow-up boring PB-35. Lead was not detected at elevated levels in groundwater from Study Area 4 well SR-208 (0.004 ppm in a January 1999 sample). The impact of the high concentration of lead at PB-33 appears to be negligible.

A similar occurrence of high lead concentrations in soil was detected at Degreaser Study Area 3 well boring SR-313. Lead concentrations of 7050 and 8620 ppm were detected in soil at

5.10 Machining Areas

New overburden and shallow bedrock wells were installed in the north ends of Buildings 1 and 2. These wells and the plater borings and Degreaser area wells were used to evaluate the impacts from metal machining operations at the facility. In addition to these shallow investigations, new intermediate-bedrock well R-309 was installed adjacent to a deep machining-system pit located in the southeast part of Building 1. The floor of pit 20 is constructed approximately 9 feet below the top-of-bedrock.

Soil and groundwater sample analysis results for the Machining area wells and borings in each building are summarized on Figure 12 and Table 20 (Building 1) and Figure 13 and Table 21 (Building 2). As shown on the figures, the principal impact from machining operations that is evident from the RI is the presence of LNAPL. In soil and where LNAPL is absent from the water table, significant soil and groundwater impacts that are unrelated to degreasers are not apparent, although the occasional detection of low concentrations of PAHs in soils from LNAPL areas did correlate with oily staining observed in the samples. In both buildings, the LNAPL at wells located downgradient of the degreaser Study Areas contains chlorinated VOCs and substituted benzene isomers.

LNAPL containing chlorinated VOCs and substituted benzenes is present in the intermediate-bedrock zone at R-309. A downward vertical gradient of 13 to 15 feet was observed between the shallow- and intermediate-bedrock zones in this area during the RI. While that gradient is not atypical of conditions at the site, it may have caused the outside of Pit 20 to be a conduit by which LNAPL has gotten from the shallow-bedrock zone down to below the water table and into the intermediate–bedrock zone in the southeast part of the site.

5.11 Basement Sumps

Basements and basement sumps were evaluated to determine whether groundwater or LNAPL infiltration is occurring, and samples of LNAPL were collected from the basement sumps in the Power House and the Building 1 Utility Room. VOCs and PCBs were not detected in either sample.

The Building 1 Utility Room is located at the south end of the Building 1 machining area, and LNAPL sample analysis results for that location are summarized on Figure 12 and Table 20. The Power House is located north of the Oil House on the north side of Building 1, and Power House sump LNAPL sample analysis results are summarized with results for other locations in the Oil house area on Figure 16 and Table 26.

5.12 Former Tubing Mills Area

Three test borings (TM-1 and -2 and PB-17) were installed in the footprint of the former tubing mills area, which is located at the north end of the Building 2 machining area, to assess whether mercury releases had occurred, and monitoring wells installed downgradient of the former tubing mills area during the RI were sampled for analysis of mercury in groundwater. Results are summarized on Figure 13 and presented in Table 22. Evidence of mercury releases was not indicated by the results of the RI.

5.13 Plant 2 Elevator

A shallow-bedrock monitoring well (SR-321) was installed just north of the elevator shaft in the northwest corner of Plant (Building) 2 to evaluate the possible presence of hydraulic fluid in the subsurface. LNAPL is present at the well. The LNAPL does not contain VOC or PCB contaminants. Analysis results are summarized on Figure 13 and on Table 21 with results from Building 2 machining areas.

5.14 Fuel System Test Areas and Product Engineering Areas

A carburetor and fuel-system product testing area in Building 22 and the Building 22 Addition was investigated beginning in 1993, and Delphi currently operates an IRM in this area of the site to recover an LNAPL comprised of Stoddard solvent. The conditions in the Buidling 22 area are described separately in Section 5.20.

Other locations of current and former operations where Stoddard solvent or other test fluids have been used to test carburetors and other fuel system components or perform product engineering tests include the following areas:

- columns VW-27 to VU-33 near the far west wall of the facility in Building 2B,
- columns A21 to C35 along the west wall of Building 1,
- columns W25 and Y35 along the east wall of Building 1,
- Building 4, and
- the north end of Building 3.

(Buildings 3 and 4 are both located at the east side of Building 1.)

Soil-vapor testing was performed to delineate petroleum vapors in each of these areas. Following the soil-vapor sampling, five soil borings (STB-37 to -41) were installed in two large areas of sub-slab petroleum vapors found beneath Building 1, and wells OW- 327 and -328 were constructed at the north end of each of the Building 1 vapor plume areas.

Soil vapor sampling locations and areas of elevated soil-vapor concentrations are shown on Figure 14 with a summary of the results of soil, groundwater, and LNAPL sample analyses for the areas in Plant 1. Soil, groundwater, and LNAPL sample analysis results are presented in Table 23.

As shown on Figure 14, the large extent of the soil-vapor plumes in these areas does not appear to reflect widespread or high levels of contamination of shallow soil by petroleum compounds. Contamination by BTEX and substituted benzenes was detected, however, in deep soil at the water table where LNAPL is present in the overburden at OW-327. The LNAPL at OW-327 contains substituted benzenes and BTEX and lower concentrations of DCE. Variable low levels of groundwater contamination by substituted benzenes, 2-methylnaphthalene, naphthalene and PCB Aroclor 1248 were detected in OW-328 samples from the downgradient end of the Plant 1 West soil-vapor plume.

5.15 Former UST Areas

5.15.1 Areas A, B, C and D

UST Area A is located near the southeast corner of the facility in the courtyard between Building 1 and engineering Building 3. UST Area B is located on the east side of the facility in the east parking lot. UST Areas C and D are located on the Tank Farm area. Sample analysis results for these four areas are summarized on Figure 15. Area A and B data is presented in Table 9 with other east parking lot data. Area C and D data is presented in Table 24 with data from other locations in the Tank Farm area.

UST Area A is the former location of gasoline tanks removed in 1987. Previous investigations in Area A had included the installation of PZ-120 and SR- and R-236. Sampling of groundwater from the three wells was performed during the RI. As shown on Figure 15, results indicate that overburden groundwater at PZ-120 has variable, low concentrations of benzene and that there is an LNAPL layer in the shallow-bedrock that also contains benzene. Unlike the LNAPL that is present in intermediate-bedrock well R-236 and at nearby Degreaser Study Area 1 shallow-bedrock well SR-310, the SR-236 LNAPL does not contain chlorinated VOCs. It also lacks a light-weight hydrocarbon fraction, indicating that it is not related to release of product engineering test fluids. The data suggest that the SR-236 LNAPL may be may be a distinct occurrence related to a former tank used for waste automotive fluids (motor oil, gasoline, etc.) from product engineering activities.

Test borings for soil and groundwater sampling were performed in each of UST Areas B, C, and D (borings USTB-1 through –4). Tanks 26 and 26A, which stored used test fuel, and Tank 30, a 10,000-gallon TCE UST, had been located in Area D. These tanks were targeted by the two UST borings in Area D.

As shown on Figure 15, analysis results for samples of soil from USTB-1 through –4 did not indicate significant contamination. However, overburden well OW-323 was installed at the USTB-1 location in Area B to follow up on detections of BTEX and substituted benzene VOCs in the January 2002 sample of groundwater from the temporary USTB-1 groundwater sampling point. Concentrations of BTEX and substituted benzenes detected in the samples from OW-323 have ranged from 0.6 to 0.02 ppm. The tanks that had been located in Area B were Indolene test-fuel tanks and an unleaded gasoline tank which had been removed in 1977 and 1989. The groundwater analysis results for OW-323 may represent residual contamination from a minor release at the Area B USTs.

5.15.2 Areas E and F

UST areas E and F are in the area north of Plant 1, as shown on Figure 16. Test borings for soil and groundwater sampling were performed in these areas (borings USTB-5 through -8), and the OW/SR/R-314 well cluster was installed in Area E.

Results are presented on Figure 16 and in Table 25. The sample analysis results for the former UST locations do not indicate the presence of significant contamination in the UST areas. The chlorinated VOCs present in intermediate–bedrock groundwater at R-314 are presumed to be from the degreaser areas located upgradient inside Building 1.

5.16 Oil House and Center Dock

At the Oil House and Center Dock, located on the north side of Plant 1, soil test borings OHB-1 and -2 and CDB-1 and -2 were performed to attempt to determine potential impacts in areas where chemical- and waste-management activities were conducted. Overburden well OW-324 was installed to follow up on detections of chlorinated VOCs in soil from the OHB-2 location and groundwater from the temporary OHB-1 groundwater sampling point. Boring and well locations and a summary of sample analysis results are shown on Figure 16. Sample analysis results are presented in Table 26.

The data indicate the presence of a limited area of soil contamination by chlorinated VOCs at the OHB-2 location. Groundwater contamination by chlorinated VOCs is present in the overburden in the area, and it is present at higher concentrations downgradient at the adjacent SR-/R-131 well pair. The VOCs in bedrock groundwater may be from the OHB-2 area or from an upgradient source in Degreaser Study Area 3 or 4.

5.17 Building 11 and Adjacent Coal Pile

Possible past releases of machining oil from the scrap metal handling areas in Building 11 and conditions related to the former coal pile storage area on the south side of Building 11 were evaluated with test borings DR-315, SMHB-1 and -2, and overburden well OW-322. This area and a summary of relevant sample analysis results are shown on Figure 17, and sample analysis results are presented in Table 27.

The principal finding of the RI in this area is the presence of a small area of VOC contamination in the overburden at OW-322. Soil-vapor sampling was used to delineate the extent of the soil contamination after it was detected in the OW-322 soil samples. Groundwater conditions in the overburden at OW-322, which is 200 feet upgradient of the groundwater migration-control trench, are similar to those observed at downgradient shallow-bedrock well SR-103.

5.18 Former Easement A Disposal Area

Four test borings were installed in the former Easement A Disposal Area to determine whether there are environmental impacts related to the fill and to identify the extent of the fill. The borings included Building 11 borings SMHB-2 and OW-322 discussed above and EAB-1 and -2. The locations of the borings are shown on Figure 17 with a summary of sample analysis results, and results are presented in Table 28. No significant contamination was detected in the two EAB borings.

5.19 Former Incinerator, Waste Oil Pit, and Waste Oil Storage Area

Sample analysis results for test borings and wells installed to evaluate waste-handling operations and features in the Central Waste Treatment Area (CWTA) courtyard are presented on Figure 18 and Table 29. Previous soil sampling at the C-100 series of borings, which had been performed to attempt to identify the source of PCBs present in LNAPL in the area of Building 22, located on the north side of the CWTA courtyard, had detected low (less than 10 ppm) concentrations of PCBs in soil at three locations in this area.

Significant soil contamination was not indicated by the soil sampling performed during the RI. LNAPL with varying proportions of chlorinated VOCs and aromatics (BTEX and substituted benzenes) is present at the water table and in shallow-bedrock. PCBs were detected in the April 2003 sample of LNAPL from well PZ-130.

5.20 Building 22 Area

In the Building 22 Area, the LNAPL that was present in two monitoring wells (PZ-129 and PZ-142) and 2 LNAPL recovery wells (RW-4 and Well Z) in 1999 was absent at least periodically from each of these wells during the RI, and other than at PZ-129 it has been absent in these wells since October 2003. Associated groundwater contamination by PCBs and dissolved-phase substituted benzenes and BTEX VOCs also declined significantly or disappeared at the Building 22 wells during the same period. Data summaries for the results of RI groundwater monitoring in the Building 22 Area are presented on Figure 19, and sample analysis results are presented in Table 30.

LNAPL recovery by the Building 22 recovery system (which was described in Section 2.3.3 of this report) dropped to less than 15 gallons during the 10 months from September 2004 and July 2005. The removal of LNAPL by the recovery system has apparently had a beneficial impact on the extent of the test-fluid LNAPL plume that is present in this area. Groundwater pumping for recovery of the Building 22 LNAPL plume contaminants is being continued as an IRM by Delphi at the present time. Results of monitoring of the recovery system will be evaluated during the FS.

5.21 Building 14 AWTA and the Former Drainage Ditch

The Building 22 LNAPL plume extends north to the area around the Additional Waste Treatment Area (AWTA) building (Building 14), where LNAPL infiltrates the foundation drain system for Building 14. LNAPL that collects in the Building 14 foundation drain is removed as part of the Building 22 LNAPL recovery system.

Sample analysis results for test borings and wells located around the AWTA building are presented on Figure 20 and Table 31. Aromatic VOCs and PCBs were detected in soils in this area, and NAPL containing trimethylbenzene, butylbenzene, xylene, and PCBs was encountered in both the top and bottom of the water column in shallow-bedrock well SR-110 during the April 2003 groundwater sampling event. NAPL was not encountered at SR-110 in earlier or subsequent measurement or sampling events, but low concentrations of aromatic VOCs were detected in groundwater from SR-110 in April 2004. These conditions indicate that impacts from the test-fluid LNAPL extend north of Building 14.

A second focus of the borings installed during the RI in this area was to evaluate conditions along the former stormwater and wastewater drainage ditch that ran through the area. The results of the RI indicate that contamination by metals and cyanide is present in soil along the former ditch in the area Building 14, with the highest concentrations in the area north of the building. Results of analyses of metals and cyanide at locations along the former drainage ditch, including the upstream part located south of Building 14, are presented on Figure 21. The data indicates that there is not significant contamination along the upstream section of the former ditch.

5.22 Storm and Sanitary Sewers

Sample analysis results for soil, groundwater, LNAPL and wastewater samples collected adjacent to and in the stormwater and sanitary sewer lines at the site are summarized on Figure 22 and presented in Table 32. As shown on Figure 22, relatively high levels of VOC contamination are present in soil, groundwater and LNAPL along the sewers. However, wastewater sample results indicate that infiltration of contaminants into the sewers does not have a significant impact on wastewater.

Test pit TP-301 was excavated near the site boundary east of the plant. The location of TP-301 is shown on Figure 22. Its intended purpose had been to evaluate the potential off-site migration of contaminated groundwater in the bedding of the sewer.

As described in Section 4.9, conditions encountered in the test pit prevented completing the test pit as planned. Prior to the backfilling of the excavation, groundwater and LNAPL from the excavation were sampled for analysis by U. S. EPA SW-846 methods. Groundwater samples were submitted to Free-Col for analysis of TCL VOCs, TCL SVOCs, PPL Metals, and cyanide; TCL PCBs analysis and a petroleum fingerprint scan were performed on the LNAPL sample.

Neither volatile nor semi-volatile organic contaminants were detected in the TP-301 water sample, and cyanide was not detected. Concentrations of metals including lead and zinc detected were higher than those typically encountered in site groundwater; however, the elevated metals concentrations may have been due to sample turbidity.

The petroleum fingerprint scan for the oil sample indicates that the LNAPL contained the two hydrocarbon fractions previously detected in samples of the Tank Farm Area LNAPL layer. The two components of the LNAPL indicated by the chromatogram, which is presented in Appendix C, are an earlier-eluting fraction resembling Stoddard-solvent and a later-eluting fraction of heavier cutting oil. PCBs were not detected in the TP-301 LNAPL sample.

5.23 Data summaries for the East and North Parking Lots

Data summaries for soil sampling locations and monitoring wells located in the east and north parking lots are presented in Figures 23 and 24, respectively. The data summarized includes previous soil sample analyses and the results of RI groundwater monitoring. East parking lot sample analysis results are presented in full in Table 9, and north parking lot results are presented in Table 33. In both areas, RI results were consistent with conditions observed prior to the RI.

In the east parking lot, the principal finding concerns the presence of LNAPL in the intermediate-bedrock zone which, in the absence of LNAPL at the water table (in the overburden and shallow bedrock), is apparently from a source in the southeast corner of Building 1. PCBs in the LNAPL at well R-2 and in groundwater at off-site well R-306 are suspected of being from an as-yet unidentified release at the RG&E substation located on the south side of Lexington Avenue south of the east parking lot.

In the north parking lot, LNAPL with a significant test-fluids component and substituted benzenes but not chlorinated VOCs was a) intermittently present in the shallow-bedrock zone along the Driving Park leg of the sewer tunnel at monitoring wells PZ-136, PZ-137, and PZ-138, and b) consistently present in the migration-control blasted-bedrock trench at well R-240.

Along the site boundary in the north parking lot, shallow-bedrock well SR-9, which has been dry since the inception of migration-control pumping in 1992, did have water during one RI sampling event and was sampled in April 2004. The April 2004 VOC concentrations indicate a significant decline in contaminant levels since 1992 (from more than 4 ppm of cis-1,2-DCE in 1992 to less than 0.1 ppm in 2004). Concentrations of chlorinated VOCs in intermediate-bedrock groundwater at adjacent well R-109 (0.1 ppm DCE, 0.05 ppm vinyl chloride) were approximately the same in April 2003 and April 2004 as they had been prior to the RI. Concentrations of DCE (to 0.2 ppm) and vinyl chloride (to 0.4 ppm) were down slightly relative to pre-RI levels at R-108, the other property-line intermediate well that has exhibited contamination in the past.

5.24 Non-AOC Areas

Monitoring wells located on the upgradient south and west sides of the facility are summarized on Figure 4 (the figure showing groundwater conditions around the site perimeter). Data for wells located in the south parking lot are presented in Table 34, and data for wells located near the southwest corner of the facility are presented in Table 35.

5.25 MNA Sampling Event

The results of the November 2004 groundwater sampling event that was focused on MNA parameters are summarized on Figure 25 and in the table on the next page.

Summary of Results of November 2004 MNA Sampling Event

Concentrations are milligrams per liter (mg/L = ppm) except for the parameters with units noted in parentheses

WELL	R-11	SR-101	R-101	SR-231	SR-131	R-131	R-103	SR-132	R-132	R-108	SR-303	R-303	SR-301	R-308	R-306	R-307
Non-contaminant parameters																
Field ORP/eH (mv)	-182	-286	-212	-11	-140	-137	-86	-37	-12	-108	-60	-7	149	-342	-278	66
Field DO	0.2	0.4	0.2	0.4	0.6	0.2	0.3	1.2	0.5	0.3	2.1	4.8	1.8	0.3	0.4	0.9
Field Conduct. (us/cm)	2.0	4.4	34.7	4.1	3.1	2.6	3.7	4.7	12.2	6.7	1.2	5.8	4.5	3.7	3.8	3.8
Chloride	344	1110	9880	1030	875	450	875	1100	1800	1030	156	1430	1190	928	1860	803
Sulfate	290	140	4600	130	88	88	40	99	2500	1100	60	800	41	170	39	100
Sulfide, Direct	3.5	0.7	2	0.9	0.6	4	1.3		0.2	3			0.5	8.2	0.9	
Nitrogen, Ammonia	0.96	0.17	8.53	0.62	0.57	1.27	1.1	0.74	3.75	2.73	0.06	1.44	0.12	0.6	0.17	0.07
Tot. Kjeldahl Nitrogen	1.4	0.7	9.7	1	1.3	2	2	1.4	4.5	3.1	0.4	1.9	0.4	0.8	0.4	0.6
Nitrogen, Nitrate			0.13									1.34				0.75
Nitrogen, Nitrite												0.1				
Iron	27.9	0.25	112	0.05	3.17	14.1	6.17	5.9	12.8	12.3	0.16	0.66	0.11	0.65	1.86	0.37
Field Iron	1.2		6		2.2	4.1	1.8	3.3	3.8	4				0.2	1.2	
Manganese	0.52	0.07	4.51	0.02	0.48	0.18	0.07	0.61	0.38	0.24	0.02	0.08	0.09	0.02	0.09	
Manganese, Filtered	0.24	0.06	3.92	0.02	0.47	0.19	0.06	0.63	0.16	0.34	0.01	0.08	0.09	0.02	0.09	
Field pH (no units)	7.6	7.3	7.1	7.2	7.6	7.4	7.2	7.3	7.1	7.3	7.3	7.3	7.2	7.4	7.4	7.1
Field Alkalinity	300	410	220	320	360	500	500	520	500	440	380	220	400	400	430	420
Field CO2	235	175	50	105	230	195	330	145	285	295	230	140	180	237	225	240
Field Turbidity (NTU)	589	35	119	8	37	59	34	47	53	34	22	14	18	1	20	40
Field Temp (deg. C)	12	15	13	25	14	16	12	16	15	12	12	13	14	14	12	13
Diss. Organic Carbon	3	3	2	5	18	16	13	30	2	4	5	2	6	6	4	5
Phosphorus, Total	0.12	0.02		0.01	0.01	0.02		0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.03
Chlorinated VOCs																
TCE						0.003	0.52						0.019	0.002		
cis-1,2-DCE			0.006	1.4	0.062	8	11.5	0.004		0.052		0.003	0.016	2.9	0.015	
trans-1,2-DCE				0.014		0.077	0.053							0.012		
1,1-DCA	0.003			0.008		0.011	0.021							0.011		
1,1-DCE						0.011	0.029							0.006		
Vinyl Chloride			0.003	0.078	0.05	31	6			0.32				5.3	0.009	
End-product gases																
Ethene				0.016	0.006	2.3	0.36			0.34				0.15	0.011	
Ethane	0.066		9.8		0.009	0.26	0.048	0.012	0.013	0.03				0.013	0.023	
Methane	0.26	0.008	12	0.19	0.73	13	4.4	0.26	0.4	1.6	0.002	0.002	0.004	0.41	6.5	0.003
Other VOCs detected																
1,2,4-Trimethylbenz.							0.003									
1,3,5-Trimethylbenz.							0.004									
2-Butanone (MEK)						0.002										

(Blank spaces indicate that the parameter was not detected.)

Overall, redox potential and very low dissolved oxygen levels indicate that site conditions are suitable for strong reductive dechlorination of chlorinated VOCs. The redox conditions are apparently sufficient to maintain continued dechlorination in all areas of the site except, as noted in Section 5.4.1, the area near monitoring well SR-301.

Chloride concentrations detected in site samples can be only partially attributed to the mineralization of chlorinated solvents, since upgradient wells exhibit significant chloride levels. However, other likely products of the mineralization of chlorinated solvents, such as ethene, were detected at relatively high concentrations at mid-plume and downgradient locations.

Since sulfate, even at extremely low levels, inhibits methanogenesis, the methane observed in site groundwater is likely to be originating from the Rochester Shale and not from methanogenesis within the contaminant plume. This is important to note since methanogenesis (production of methane by reduction of carbon) is a process that consumes free hydrogen which could otherwise be utilized in the reductive dechlorination processes. It is generally believed that methanogenesis can preclude reductive dechlorination. The presence of dehalogenated daughter products in site groundwater indicates that reductive dechlorination is not being prevented by methanogenesis. Since dechlorination is occurring in the presence of relatively high levels of both sulfate and methane, methanogenesis is not likely to be the primary source of the methane at the site.

The presence of secondary gypsum in the Rochester Shale in bedding-plane seams, fractures, vugs, and as fossil replacement may be a cause of the high concentrations of sulfate detected in the groundwater at the site. Given the redox conditions of the aquifer, it is likely that sulfate levels would be considerably lower if gypsum was less abundant in the bedrock matrix.

Except at the northwest corner of the site, where results for SR-301 indicate that biodegradation may not be occurring, the levels of chlorinated solvent parent and daughter compounds suggest that biodegradation is occurring without significant impediments to any degradation step. With the exception of three of the remaining wells (R-131, R-103 and R-308), little or no "stacking" at cis-1,2-DCE was noted. This suggests the microbial consortia present at the site are capable of and are actively degrading all the halogenated contaminants. Even in the three wells with elevated cis-1,2-DCE levels, vinyl chloride and ethene were detected in measurable concentrations; this suggests that complete reductive degradation may be slowed but not stopped. While it is thermodynamically easier to degrade the less-chlorinated solvent compounds in an oxidative environment, the aquifer ORP is apparently low enough at the site to allow mineralization to continue reductively.

5.26 Vapor-intrusion Assessment

Results of the sub-slab soil vapor and indoor and ambient air sampling event conducted in April 2005 are summarized on Figure 26 and presented in Table 37.

The results indicate that the facility floor slab and other features of the building system (including the heating and ventilation system) provide a strong measure of protection from intrusion of the high concentrations of VOCs that are present in soil vapor in former degreaser areas. The average concentrations of TCE and tetrachloroethene (PERC) detected in indoor air fell below risk-based screening levels published for these compounds by NYSDOH. All concentrations of compounds detected in indoor air were below permissible exposure limit (PEL) concentrations established by the United States Occupational Safety & Health Administration (OSHA).

As shown on Figure 26, at each indoor sample location some compounds detected in soil vapor were not detected in the corresponding indoor air sample. This was true of TCE and PERC at most locations. The calculated vapor attenuation factors for the compounds that were detected in corresponding (co-located) sub-slab vapor and indoor air samples are shown in the following table.

Soil-Vapor Attenuation Factors

Concentrations shown are micrograms per cubic meter

Sample Location	Analyte	Sub-slab Result	Indoor Air Result	Calculated Attenuation Factor
6-DD-33	cis -1,2-DCE	8,800	4.6	0.000523
3-E-19	cis -1,2-DCE	2,300,000	3.2	0.000001
Average for cis-1,2-DCE:				0.000262
6-DD-33	m,p-Xylenes	210	2.2	0.010476
4-FF-37	m,p-Xylenes	58	2.2	0.037931
5-C-13	m,p-Xylenes	57	2.2	0.038596
3-E-19	m,p-Xylenes	2,500	2.1	0.000840
2-T-27	m,p-Xylenes	ND	2	
1-YE-13	m,p-Xylenes	62	3.1	0.050000
Average for m,p-Xylenes:				0.027569
6-DD-33	Tetrachloroethene	420	39	0.092857
6-DD-33	Toluene	380	4.7	0.012368
4-FF-37	Toluene	40	4.7	0.117500
5-C-13	Toluene	41	6.1	0.148780
3-E-19	Toluene	5,400	5.1	0.000944
2-T-27	Toluene	ND	3.4	
1-YE-13	Toluene	55	6.4	0.043636
Average for Toluene:				0.064646
3-E-19	Trichloroethene	37,000	6.0	0.000162

ND = Not Detected

In the April 2005 sub-slab soil vapor sampling event, the sample collection and sample analysis methods used were different than those used in the extensive soil vapor surveying that had been performed previously at the site. (The methods used in April 2005 are the high-sensitivity methods that the New York State DOH has designated in its recent guidance for conducting assessments of soil vapor intrusion.) Nevertheless, the results of the April 2005 sub-slab sampling are consistent with the understanding of the soil-vapor plumes at the site that has been developed during the RI and previous investigations. As shown on Figure 26, April 2005 sub-slab vapor results at all but one location (C-13) are very closely comparable to the sub-slab soil vapor results obtained during the 1990 Degreaser Study and the RI sampling in 2002. At C-13, the April 2005 concentrations of VOCs in sub-slab soil vapor were considerably lower than those detected during the 2002 sampling.

5.27 Nature and Extent of LNAPL

LNAPL at the site consists primarily of either lubricating oils released from metal-machining operations inside the facility or lighter weight fuel-like products used as calibration fluids and test fuel and released from engineering and product-testing operations inside the facility. In most areas, both machining oil and lighter-weight test fluids are present in the LNAPL. The Building 22 Area LNAPL consists primarily of Stoddard solvent, a lighter-weight petroleum-based solvent similar to mineral spirits that was used as a test fluid in Building 22 carburetor testing operations.

LNAPL is present at the water table (in overburden and/or shallow bedrock) in five areas of the site which may, to some degree, be continuous with each other (the plumes may be connected). In a sixth area, LNAPL is present in the intermediate-bedrock groundwater zone although LNAPL is absent at the water table in overlying groundwater zones. The areas in which LNAPL is present include the following:

- Building 1 machining areas and the adjacent Tank Farm area,
- Building 2 machining areas,
- the east side of Building 1 (at well SR-236, in the courtyard between the east side of Building 1 and Building 3),
- the east parking lot intermediate-bedrock LNAPL occurrence,
- the north parking lot, and
- the Building 22 area.

The approximate extent of LNAPL in the overburden and shallow-bedrock zones is shown on Figure 27, and the approximate extent of LNAPL in the intermediate-bedrock zone is shown on Figure 28. Various figures previously discussed summarize the VOC, SVOC, and PCB analysis results for LNAPL samples from each AOC within these areas. The results of these analyses and analyses of physical and other parameters (specific gravity, flashpoint, viscosity, and total organic halogens) are presented in the various sample analysis summary tables for each AOC that are presented in Volume 2. Appendix C of this report presents copies of gas chromatograms for LNAPL samples from each location at the site. The chromatograms show the relative abundance of lighter and heavier petroleum fractions at each location. Appendix C also presents a summary of the results of high-resolution analyses of PCB congeners in LNAPL samples from Building 22 LNAPL Area well PZ-129 and east parking lot area well R-243.

Descriptions of the LNAPL occurrences are presented below.

5.27.1 LNAPL in Building 1 and 2 Machining Areas and the Tank Farm Area

In the machining areas in Buildings 1 and 2, the LNAPL occurrences encompass former degreaser areas that are the source for chlorinated VOCs present in the LNAPL. The Building 1 LNAPL also overlaps former product engineering and fuel-system testing areas which are the sources (from test fluid releases) of aromatic VOCs (BTEX and substituted benzenes).

In both of the machining areas, LNAPL affects the overburden and the shallow-bedrock horizons. The Building 2 LNAPL extends as far north as the CWTA courtyard. The Building 1 LNAPL extends north beyond the northeast corner of Building 1 out into the Tank Farm Area. In the Tank Farm Area, the LNAPL plume is in the overburden.

5.27.2 LNAPL at SR-236 on the East Side of Building 1

As indicated in Section 5.15, the presence of LNAPL on the east side of Building 1 at shallow–bedrock well SR-236 may be a distinct occurrence related to a UST formerly located there that was used for waste automotive fluids (motor oil, gasoline, etc.) from product engineering activities. The SR-236 LNAPL is, like the LNAPL present in the intermediate zone at companion well R-236, primarily composed of heavier, lubricating-oil hydrocarbons. However, unlike LNAPL from R-236 and other Building 1 machining area and east parking lot wells, it lacks chlorinated VOCs.

5.27.3 East Parking Lot LNAPL

As described in Section 5.4.3, LNAPL in the east parking lot area occurs in the intermediate-bedrock groundwater zone although LNAPL is absent at the water table. This occurrence appears to originate from the area of the southeast corner of the Building 1. It extends under the east parking lot of the facility to and slightly beyond the eastern site boundary. It consists of both machining oil and petroleum test fluids and contains chlorinated VOCs. At some locations PCBs are present; these appear to be related to the RG&E substation located on the south side of Lexington Avenue opposite the southeast corner of the Delphi property.

High-resolution analyses of PCB congeners in LNAPL samples from Building 22 LNAPL Area well PZ-129 and Lexington Avenue well R-243 indicate that the Building 22 Area LNAPL has a higher proportion of lightweight, less-chlorinated PCB congeners than the LNAPL in the vicinity of the RG&E substation and the east parking lot. This finding is not definitive in identifying differences in the sources of the PCBs in each area, since the congeners detected in each sample are quite similar. However, more heavily-chlorinated congeners are predominant in electrical transformer oil, and therefore the congener data is consistent with the conclusion that the PCBs in the R-243 LNAPL may be from a source or sources on the offsite RG&E substation.

5.27.4 North Parking Lot LNAPL

In the center of the north parking lot, LNAPL occurs intermittently at some of the shallow-bedrock wells located along the Driving Park leg of the municipal sewer (PZ-136, -137, and -138) near migration-control recovery well GR-2. LNAPL has in the past been noted in GR-2, and LNAPL is present southeast of GR-2 in migration-control trench monitoring well R-240. In the past, LNAPL has been present at sewer tunnel monitoring well PZ-139, located near the southeast end of the migration-control trench.

R-240 is screened down into the intermediate-bedrock zone, but it has a monitoring interval that extends up to above the top of bedrock and it is installed in the blasted zone of the migration-control trench near recovery well GR-2. The presence of LNAPL at R-240 does not represent an occurrence of LNAPL isolated from the water table in the intermediate-bedrock zone.

The light-weight test-fluids hydrocarbon fraction is the dominant fraction in the north parking lot LNAPL, and in this regard it most closely resembles LNAPL from OW-327, which is located in the north end of Building 1 just west of the Tank Farm Area. The source of the LNAPL in the center of the north parking lot is not known, but the RI data suggest that it may have migrated to this area from the Tank Farm Area in the fill surrounding the Driving Park leg of the sewer tunnel. The section of the sewer tunnel located beneath the north parking lot northwest of PZ-139 was constructed in a cut and fill excavation.

5.27.5 Building 22 Area LNAPL

As indicated in Section 5.20, the extent of LNAPL in the area has apparently decreased during the RI, apparently as a consequence the operation of the Building 22 Area LNAPL recovery system IRM. In the past, the Building 22 Area LNAPL extended from the CWTA courtyard north under Building 22 to Building 14. Since October 2003, LNAPL has only been observed in the area south of Building 22 at CWTA courtyard well PZ-129.

Concentrations of PCBs detected in the LNAPL samples from the Building 22 area have consistently been significantly higher in samples collected from locations north and south of the building than from the wells located within the building. The distribution of PCB levels in the LNAPL therefore indicates that the PCBs were not contained in the Stoddard solvent when it was released, and information available on the Building 22 carburetor testing operation also indicates that there were no PCBs in the test fluid when it was released.

No other sources of the PCBs in the Building 22 LNAPL have been identified. The possibility has been considered that there may be an unidentified source of contamination in the fill in the vicinity of Building 22 from which the Stoddard solvent LNAPL has scavenged the PCBs. One such possibility is that PCB-contaminated oils may have been used for dust control on the gravel-surfaced roadways that were present in this area during the period before the area was filled for construction of Building 22. However, such a source has not been found during previous investigations or during recent RI activities.

5.28 Summary Figures

Figures 27 and 28, which show the extent of LNAPL in the shallow (overburden and shallow-bedrock) and intermediate-bedrock groundwater zones across the site and at off-site locations, also present a summary of the exceedances of groundwater screening criteria in each zone that were detected in groundwater samples collected on- and off-site in 2004 and 2005. Figure 5 presents similar information on exceedances of groundwater screening criteria in the deep bedrock zone, although Figure 5 includes data from 1999 through 2005.

Figures 29 through 32 present site-wide summaries of exceedances of screening criteria in soil. The four soil summary figures are organized by contaminant type: inorganics (metals and cyanide), PCBs, SVOCs, and VOCs.

Figure 33 shows a site plan with the locations of profile lines for two hydrogeologic cross-sections of the site. A north-south cross-section is presented on Figure 34, and an east-west section is presented on Figure 35.

6. CONCLUSIONS

The principal findings of the RI concerning environmental contamination and conditions at the site are summarized as follows:

- Site groundwater is contaminated with chlorinated VOCs. A chlorinated VOC contaminant plume originates from 6 source areas inside the manufacturing building where releases of chlorinated solvents occurred at locations of former solvent degreasers. To a variable extent, portions of the chlorinated VOC plume contain non-chlorinated VOCs that are related to releases of petroleum products used in product testing and engineering operations.

  The vertical extent of contamination is limited by geologic conditions to groundwater in the overburden and top 25 feet of bedrock. Laterally, the VOC plume extends downgradient to the northern boundary and to 400 feet beyond the eastern boundary.

- A groundwater migration-control system is in place along the northern edge of the site to limit northward lateral migration of groundwater contaminants. The migration-control system has been in operation since 1992, and in the area along the northern site boundary it has effectively reversed the gradient of groundwater flow in the horizons affected by the contaminant plume. Off-site migration of contamination to the north is prevented by the migration-control system.

- The RI results confirmed that natural attenuation of chlorinated VOCs is occurring in the subsurface at the site and that site conditions are conducive to natural attenuation of the VOC contaminants.

- Where it extends off-site beyond the eastern boundary, the groundwater contamination is at relatively low concentrations and is found in the intermediate-bedrock zone. It is not found offsite in shallow groundwater or in deep groundwater.

  Groundwater flow in the intermediate-bedrock zone at the east site boundary in the area of the east parking lot is generally to the northeast. This area of the site may be outside the capture zone of the existing groundwater migration-control system, although water levels at offsite wells indicate that flow directions in the intermediate zone further east and north may turn to the west (towards the Delphi migration-control trench). Regardless of whether or not the capture zone includes the off-site area of contamination in intermediate-bedrock groundwater along the east site boundary, the off-site extent of contamination to the north and east of the east site boundary appears to be limited. Both natural attenuation and the hydraulic influence of the migration-control system may serve to limit the off-site extent of contamination in this area. Additional study of the feasibility of potential remedies for conditions in the intermediate-bedrock zone at and beyond the eastern site boundary is planned.

- Between the east site boundary and the east side of the manufacturing building, the intermediate-bedrock zone is also contaminated with LNAPL. The LNAPL occurs at depth although LNAPL is absent at the water table. The LNAPL in the intermediate-bedrock in this area appears to originate from under the southeast corner of the manufacturing building. Its occurrence extends under the east parking lot of the facility to and slightly beyond the eastern site boundary. The LNAPL consists of a light-weight test-fuel fraction and a heavier-weight lubricating-oil fraction, and it contains chlorinated VOCs.

- PCBs are present in the east parking lot LNAPL at locations adjacent to and downgradient of the off-site electrical transformer substation located south of the east parking lot. The substation is suspected of being the source of the PCBs. Where the Lexington Avenue municipal sewer tunnel, which is at a depth that corresponds to the intermediate-bedrock zone, passes along the substation property, PCBs have been detected in oil seeping into the south (substation) side of the tunnel.

- Occurrences of LNAPL in shallow groundwater are present in several areas within the interior of the site. As with the LNAPL in the east parking lot area, the shallow LNAPL occurrences consist of lubricating oils released from metal-machining operations inside the facility and/or lighter-weight test-fluid products (petroleum distillates used as calibration fluids and test fuel) released from engineering and product-testing operations inside the facility.

  In some areas, the shallow LNAPL areas overlap the impacts of former degreasers, and LNAPL at the site often contains chlorinated VOCs. A former degreaser area in the southeast part of the facility is presumed to be the source of the chlorinated VOCs found in the LNAPL that occurs in the intermediate-bedrock zone in the east parking lot area.

  Poly-chlorinated biphenyl (PCB) compounds, apparently desorbed by the LNAPL from soil in minor source areas that the RI could not identify, are present in the shallow LNAPL at a few locations where the LNAPL has a significant test-fluid component. The primary occurrence of PCBs in shallow LNAPL is at Building 22, where the LNAPL consists of lighter weight Stoddard solvent used as test fluid in carburetor testing. It is unlikely that the test fluid contained PCBs when it was released. No other known sources for the PCBs have been identified, and so it is presumed that there may be an unidentified source of contamination in the fill in the vicinity of Building 22 from which the Stoddard Solvent LNAPL has scavenged the PCBs. One such possibility is that PCB-contaminated oils may have been used for dust control on the gravel-surfaced roadways that were present in this area during the period before the area was filled for construction of Building 22.

  Although the groundwater-migration-control system was not specifically designed to address the LNAPL occurrences, the primary shallow LNAPL occurrences are upgradient of and within the groundwater capture zone of the migration-control system. A shallow LNAPL occurrence in the north parking lot is north of the groundwater-recovery trench for the migration-control system, but it is located close to the trench and within its groundwater capture zone.

In two of the LNAPL areas located south of the migration-control trench, interim remedial measures are operating to recover LNAPL by pumping LNAPL and groundwater from recovery wells. The Tank Farm Area LNAPL IRM, which has been in operation since 1989, was recovering approximately 95 gallons of oily LNAPL per week when the recovery rate was measured in a 5-week trial during the RI. The Building 22 IRM has recovered 2000 gallons of LNAPL since 1999. The rate of recovery has steadily declined since 1999 (to a current rate of approximately one gallon per month), and the extent of LNAPL in the Building 22 area has diminished significantly.

- At the former degreaser locations inside the manufacturing building, soil contamination by chlorinated VOCs is present, and in these areas chlorinated VOCs are present in soil vapor beneath the floor slab. The SVE system IRM operating in Degreaser Study Area 5 has significantly reduced the concentrations of VOCs in soil vapor in that area.

  In areas of test fluid releases, volatile petroleum compounds are present in the sub-slab soil vapor.

  Impacts on indoor air quality from intrusion of sub-slab VOC vapors into indoor air appear to range from negligible or none to very minor.

- Soil contamination by metals including chromium, copper and zinc is present beneath the manufacturing building in three areas where metal plating operations were formerly conducted. Soil contamination by these metals is also present in subsurface soils along the path of a former wastewater drainage ditch in an area north of Building 14 at the north end of the facility. In these areas, the impacts to downgradient groundwater quality appear to be negligible.

- The RI data indicate that infiltration of site contaminants into on-site or off-site sewers does not have a significant adverse impact on wastewater conditions. The RI data also indicate that the sewers are not significant pathways for the off-site migration of contaminants.

Observations concerning current site conditions and associated risks include the following:

- Groundwater at the site and in the surrounding area is not known to be used as a source of water for drinking or other domestic, commercial, industrial, or agricultural purposes, and site groundwater does not discharge to surface water bodies. Groundwater use in the area is prohibited by a City of Rochester ordinance.

- Buildings and pavements cover approximately 95% of the site. The building floor slabs and outdoor pavements currently provide an effective barrier that prevents exposure of site workers and the public to contaminants present in soil at the site.

- Continued management and control of public access to the site and enhancements to the existing groundwater migration-control system that give it hydraulic control in the shallow and intermediate-bedrock zone on the east side of the site are two of the options for mitigating potential risks to human health and the environment that will be evaluated fully in the next phases of the RI/FS.

The findings of the RI will form the basis for an assessment of human-health and ecological risks related to the contamination present at the site. A risk assessment report is being prepared and will be submitted under separate cover. The findings of the RI and the risk assessment will then be used together to form the basis for the feasibility study and the selection of a feasible remedial alternative for the site.

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