

### **Supporting Documentation for Five-Year Review**

## Carroll and Dubies Superfund Site Town of Deerpark, Orange County, New York

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## 1.0 Introduction

The United States Environmental Protection Agency (U.S. EPA) has commenced the Five-Year Review process for the Carroll and Dubies Superfund Site (the Carroll and Dubies Site, or the Site) for Operable Unit 1 (OU1) and Operable Unit 2 (OU2). The OU1 remedy, which consisted of excavation, on-Site waste segregation, and a combination of off-site waste treatment and disposal, was completed in 1999. The OU2 remedy is ongoing. The main element of the OU2 remedy is Monitored Natural Attenuation (MNA) of organic contaminants, with the ultimate goal of achieving drinking water standards in Site groundwater. Other elements of the OU2 remedy are institutional controls to prevent groundwater usage and monitoring of Gold Creek.

The objective of the Five-Year Review is to ensure that the selected remedies continue to be valid and protective of human health and the environment. This determination is made by evaluating whether:

- The remedies are functioning as intended
- The exposure assumptions, cleanup levels, and remedial action objectives used at the time of the remedy selection are still valid
- Other information came to light that could call into question the protectiveness of the remedies

While the review must be completed by the lead agency, the Potentially Responsible Parties (PRPs) are providing technical input into the review through this report.

Cardinal Resources, Inc.'s (Cardinal) report presents the Site history, information on the selection of the remedy, and the trends in groundwater data. The PRPs believe that the Site data and analysis of that data support the MNA remedy selection, show that significant reductions in constituents of concern have been achieved, and that further reductions will also take place over time horizons forecast later in this report.

In general, this report follows the U.S. EPA's guidance on the content of a Five-Year Review with the exception of certain sections that pertain to the agency's review process. The report covers both Operable Units, but emphasizes OU2. All of the data for the report has been presented to the U.S. EPA as part of the ongoing monitoring reports; however, some of the data analysis is new based on current U.S. EPA guidance and models.

The major conclusion of the review is that the OU1 and OU2 remedies are functioning as intended, and are continuing to be protective of human health and the environment, specifically:

#### The remedies are functioning as intended.

- The OU1 remedy removed the majority of the contaminants from the Site through the excavation of wastes and impacted soil. This action also eliminated the primary source of groundwater impacts.
- The OU2 remedy, MNA, is working. Overall concentrations have been significantly reduced. The primary risk drivers in groundwater, benzene and vinyl chloride, have decreased on average by 96 and 91 percent (%), respectively. Drinking water criteria have been achieved in about half of the wells where exceeded in 1999. Continued future reductions in concentrations are expected and the time periods for attaining the remaining drinking water criteria have been estimated.
- The exposure assumptions, cleanup levels, and remedial action objectives used at the time of remedy selection are still valid.
  - There have been no material changes in guidance values or any data developed as a result of the monitoring program to suggest that the Record of Decision (ROD) analyses were incorrect.
  - Since the issuance of the RODs for OU1 and OU2, there has been no significant change in the surrounding or Site land use. The City of Port Jervis gravel operation that recently started on the Site reflects the surrounding land use and does not represent a change in the exposure assumptions.
  - The established cleanup levels at the time of the OU2 ROD (Maximum Contaminant Levels [MCLs] and New York State Department of Environmental Conservation [NYSDEC] Standards and Guidance Values [SGVs]), are conservative from a risk perspective.
  - The exposure risk has been decreased due to the decrease in contaminant concentrations across the Site.
- No other information came to light that could call into question the protectiveness of the remedies.
  - The OU1 remedy, completed in 1999, removed the wastes from the Site. The regraded lagoons remain stable.
  - The protectiveness of the OU2 remedy is still valid as there have been no changes in land use within the area, monitoring indicates a decreasing level of impacts, and there is no current or planned use of the affected groundwater.

## 2.0 Site Chronology

A chronology of the Site, with regulatory milestones, is included below:

- <u>1971</u> The Site began operations as a disposal facility for municipal sewage sludge and septic wastes.
- 1971 through 1979 Industrial wastes were also received at the Site.
- June 1979 The NYSDEC prohibited industrial waste disposal at the Site.
   Lagoons 1 and 2 were then constructed and reportedly received only sewage sludge and septic wastes.
- <u>January 1981</u> U.S. EPA inspected the Site and conducted limited sampling.
   Other investigations were conducted by NYSDEC in later years.
- February 1990 The Site was placed on the National Priorities List (NPL).
- July 1994 A remedial investigation/feasibility study (RI/FS) was completed.
- March 31, 1995 U.S. EPA issued a ROD for OU1, calling for the treatment and long-term containment of lagoon materials on the Carroll and Dubies Site. The ROD called for additional treatability studies to demonstrate the feasibility of biological treatment of Lagoon 7 materials, which were a mixture of industrial and solid wastes. The ROD also included a contingency remedy for Lagoon 7 soils for excavation, off-site treatment, and disposal.
- <u>September 30, 1996</u> U.S. EPA issued the OU2 ROD, calling for natural attenuation of organic contaminants in groundwater, implementation of institutional controls to restrict the use of groundwater wells throughout the plume, and monitoring of groundwater and Gold Creek to evaluate the effectiveness of the remedy.
- 1997 to 1998 Sampling, review, and evaluation during the OU1 design phase led to the conclusion that it would be more cost-effective to segregate the most highly contaminated materials in the lagoons and address them through the contingency remedy for excavation with off-site treatment and disposal. Based on this new information, U.S. EPA modified the remedy selected in the OU1 ROD, through the August 28, 1998 Explanation of Significant Differences (ESD), Carroll and Dubies Sewage Disposal Site, Town of Deerpark, Orange County, New York (U.S. EPA, 1998).
- <u>August 1998</u> The final OU2 Remedial Design Work Plan Addendum (Shield Environmental Associates, Inc. [Shield], 1998) and associated documents were submitted to U.S. EPA.
- October 1998 The final OU1 Remedial Action Work Plan (Shield, 1998a) and associated documents were submitted to U.S. EPA.
- February 1999 An initial, pre-excavation round of groundwater, surface water, and sediment sampling was conducted as part of the OU2 remedy.

- April 1999 OU12 remedial action activities were initiated. The work was completed in late fall 1999, with follow-up inspections with U.S. EPA and NYSDEC in December 1999, January 2000, and May 2000.
- <u>January 2000</u> Following completion of the OU1 action, groundwater monitoring and surface water and sediment sampling commenced in accordance with the approved OU2 Work Plan.
- April 2004 Most recent round of OU2 monitoring and analysis.
- <u>January 2005</u> Initiation of the OU1/OU2 five-year review process.

## 3.0 Background

This brief background summary of the Site setting, land use, contamination history, and overview of the remedies is included to set the stage for the report. Additional information on the Site background and history is provided in the *Prefinal/Final Design Submittal* (Shield Engineering, 1998). The *Final Remedial Design Work Plan Addendum* (Shield, 1998) provides a summary of historic sampling and results, and the *Annual Monitoring Report*, April 2004 (Shield, 2004) provides all OU2 monitoring results.

## 3.1 Site Setting

The three-acre Site is located in the Town of Deerpark in Orange County, New York, which is approximately 3,000 feet northeast of the City of Port Jervis, New York (Figure 1). The Site is situated on the northwestern flank of the Neversink Valley. Gold Creek lies approximately 1,500 feet to the east, and the Neversink River is located approximately 2,000 feet beyond Gold Creek.

The Site is underlain by sand and gravel deposits of glacial and glaciofluvial origin. Groundwater monitoring wells on the Site have been completed in the outwash unit, found above a low-permeability till zone that functions as an aquitard. The outwash unit consists of fine to coarse sand with fine to coarse gravel. The direction of groundwater flow is generally toward the southeast.

## 3.2 Land and Resource Use

The immediate surrounding area includes undeveloped woodlands to the north; undeveloped woodlands and a sand and gravel quarry pit to the northeast; the closed City of Port Jervis landfill, the Orange County Transfer Station, and a concrete products fabrication company to the south; and a sparsely vegetated, shale bedrock hillside to the west. Two Site monitoring wells, OW-21 and OW-22, were installed through the closed landfill, and four other wells, OW-17, OW-18, OW-19, and OW-23, are located at the downgradient edge of the landfill (Figure 2). In 2004, the City of Port Jervis began to operate a small sand and gravel operation on land owned by the City of Port Jervis, immediately to the southeast of the former lagoons, in the vicinity OW-5, OW-6, and OW-7 (Figure 3).

## 3.3 History of Waste Disposal and Contamination

In 1971, the three-acre Carroll and Dubies Site began operating as a disposal facility consisting of a series of lagoons. The majority of wastes disposed in the lagoons were septic waste, municipal sewage sludge, and solid waste. The Site also received liquid industrial wastes from approximately 1971 to 1979. The waste types in the lagoons are as follows:

- Lagoons 1, 2, and 4 received only municipal sewage sludge/septic wastes.
- Lagoon 6 received mainly solid waste and limited municipal sewage sludge/ septic wastes.
- Lagoons 3, 7, and 8 received industrial waste and solid waste.
- No industrial wastes were found in Lagoon 5, and it was eliminated as part of the source area.

Over time, waste constituents in the lagoons leached into groundwater and affected the outwash aquifer. Volatile organic compounds (VOCs) were of particular concern because of their dispersion in the aquifer and relative risk. Benzene, vinyl chloride, and other VOCs were found through a series of investigations to exceed drinking water standards in Site wells.

### 3.4 Overview of Remedies

The remedies selected for the Site were defined by two operable units, the waste lagoons themselves, and the impacted groundwater. Remedies were ultimately selected and executed to remove wastes from the lagoons, restore the Site to a safe and stable condition, and promote and track improvements in groundwater quality.

## 3.4.1 OU1 Remedy

The goals of the OU1 remedy conducted in 1999 were to prevent further leaching of contaminants into groundwater, and to reduce the risks to potential future workers at the Site who could come in contact with lagoon wastes. The steps in this process were:

- Implementation of an air quality monitoring program.
- Excavation of all wastes from Lagoons 1, 2, 3, 4, 6, 7, and 8, along with surrounding soils that exceeded specified levels for indicator chemicals.

- Segregation of wastes and soils as excavation proceeded, so that soils received
  the appropriate off-site treatment and/or disposal regimen. Depending on waste
  classification, wastes were disposed in either hazardous or nonhazardous waste
  landfills. Certain wastes required treatment through incineration before disposal.
- Collection and treatment of surface water and decontamination water. Water was treated to specified treatment levels, and then either used for dust suppression or discharged through an infiltration gallery.
- Placement of imported clean fill in the excavations, followed by grading for drainage control and vegetation.

### 3.4.2 OU2 Remedy

The goals of the OU2 remedy, initiated in 1999 and continuing today, were to reduce or eliminate the risks associated with the ingestion of Site groundwater for future Site workers, protect Gold Creek from Site-related impacts, and ultimately, to reduce the concentrations of contaminants to drinking water standards. Concentrations of organic contaminants were to be reduced following source removal through natural attenuation. The steps in the program are:

- Execution of a groundwater monitoring program in accordance with Work Plans and other documents prepared specifically for the project and approved by U.S. EPA. In the past five years since its implementation, the groundwater monitoring program has been modified through changes approved by U.S. EPA. Today, the sampling program is on an annual monitoring frequency, and includes VOCs and laboratory and field natural attenuation parameters.
- At the same time as groundwater samples are collected, sediment and surface water samples are collected from locations upstream and downstream of the Site.
- With each sampling round, a report is prepared for U.S. EPA that documents the progress made in achieving the remedial goals.

#### Selection of the Approved Monitoring Well Network

The monitoring program at the Site was developed based on the contaminant hydrogeology that was defined in the:

- Preliminary Remedial Investigation Results, Carroll and Dubies Superfund Site, Port Jervis New York, Volumes 1 and 2 (Blasland and Bouck Engineers, 1992).
- Supplemental Hydrogeologic Remedial Investigation (Remediation Technologies, 1995).

- Addendum to Supplemental Hydrogeologic Remedial Investigation: Results of Field Investigation at Carroll and Dubies Site During April 1995 (Remediation Technologies, 1995a).
- Feasibility Study for the Groundwater Operable Unit, Carroll and Dubies Site (Remediation Technologies, 1996).

The key findings of these investigations that were considered in the design of the monitoring network included:

- Of the three aquifer units defined at the Site, outwash, till, and bedrock, the outwash aquifer was the primary unit of concern.
- Hydraulic gradients are upward.
- The groundwater plume was in a quasi-steady state condition prior to the OU1 removal.
- The groundwater plume was at its maximum extent under the current conditions.

Based on the analytical results, the hydrogeologic setting, and modeling results, VOCs in the outwash aquifer were the primary focus of the monitoring efforts.

In the approved OU2 *Final Remedial Design Work Plan Addendum* (Shield, 1998), a subset of the wells that were present on the Site was selected for monitoring based on:

- Past analytical results showing consistent elevated concentrations of VOCs,
- Located to provide indications of changes in VOCs within the areas impacted by the Site, and
- Completed in the outwash aguifer.

Questions have been raised as to why certain wells, OW-3, OW-4, OW-7, OW-17, and OW-23, were not selected in the approved plan. These wells were not selected because other wells provided essentially the same data, an adjacent well had higher concentrations of the constituents of concern, or the well was outside of the flow path of the plumes. Table 1 summarizes why these wells were not selected as part of the routine network. The outwash wells that are not sampled were left in place as backup in case of damage to the selected wells.

## 4.0 Operable Unit 1 Technical Assessment

As stated in the March 1995 ROD, the remedial action objectives for the OU1 remedy were to:

- Prevent leaching of contaminants in the soils and sludges at levels that impact groundwater quality in the vicinity of the Site, and
- Minimize potential risks to potential future excavation workers.

In addition to the broad remedial action objectives for the OU1 remedy, the design documents established performance criteria to be met as part of the remediation program. The specific performance criteria addressed:

- Achievement of post-excavation concentration limits for constituents of concern in soils, to confirm that impacted soils had been removed.
- Compliance with standards and requirements for off-site disposal of hazardous and nonhazardous wastes.
- Compliance with daily volume and concentration discharge limits for water that was collected (lagoon water and surface water) or generated (decontamination) during remedial activities.
- Compliance with NYSDEC criteria for off-site borrow material used to fill the excavations.
- Compliance with Occupational Safety and Health Act (OSHA) worker safety permissible exposure limits (PELs) in air during excavation activities.

This technical assessment reviews the achievement of performance criteria during remedial action. It also evaluates the remedy relative to its long-term protectiveness and its ability to meet the broader remedial action goals.

## 4.1 Achievement of Performance Criteria

The OU1 Remedial Action Report (Shield, 2000) documented the achievement of the performance criteria through field logs, analytical results, and surveyed drawings. The findings are summarized here.

#### 4.1.1 Post-Excavation Soil Performance Criteria

The excavation levels identified in the OU1 ROD for indicator constituents of concern were:

Indicator Constituent of Concern	Excavation Limit, mg/kg
Benzene	0.06
Trichloroethene	1.0
Tetrachloroethene	1.4
Toluene	1.5
1,2-Dichlorobenzene	7.9
1,4-Dichlorobenzene	6.0
Di-n-butyl phthalate	8.1
Naphthalene	13.0
Chromium	61.9
Nickel	36.7

A total of 368 post-excavation soil samples were collected from foundation soils, sidewalls, ditches, and perimeters of the lagoons. Samples were collected at designated grid points located by a licensed surveyor. These confirmatory post-excavation samples were used to show that wastes had been removed from the lagoons, that ditches leading into Lagoons 1 and 2 had not been impacted by historic disposal operations, and that excavation activities did not impact the surrounding soils. In cases where grid samples did not achieve the concentration limits, the area represented by the grid point was over-excavated and re-sampled. This procedure was continued until the analytical results were below the excavation limits. The *Remedial Action Report* (Shield, 2000) provides all results and locations for post-excavation samples. The final post-excavation samples were all below the excavation levels for the indicator constituents of concern, thus these performance standards were met.

## 4.1.2 Compliance with Off-Site Disposal Criteria

Wastes and impacted soils excavated during the OU1 remedial action were managed in accordance with all applicable Federal and State solid and hazardous waste regulations. Industrial wastes that exceeded Land Disposal Requirement (LDR) limits were treated with incineration before disposal. Treated and untreated wastes and soils were disposed in either nonhazardous Subtitle D facilities (municipal sewage sludge, septic waste, impacted soil), or at hazardous Subtitle C facilities (industrial waste, interbedded waste). Copies of waste manifests for all waste shipments were part of the final Remedial Action Report (Shield, 2000).

One change from the work plan and the ESD in terms of waste disposal was to allow off-site disposal of interbedded wastes from Lagoon 8 without prior on-Site treatment. The decision to allow this change was formalized in a letter from U.S. EPA dated

November 12, 1999 (U.S. EPA Region 2, 1999). The allowance was made because the benzene concentration in the wastes in question was below ten times the Universal Treatment Standard, in compliance with the Phase IV Rule.

A summary of the waste disposal facilities and approximate quantities are:

- 22,420 tons of nonhazardous wastes (municipal sewage sludge and septic waste, solid waste, foundation and perimeter soils, and chromium-impacted cover soils) went to Waste Management of Pennsylvania's Pottstown and G.R.O.W.S./ Tullytown Landfill (Subtitle D) for direct landfilling.
- 7,660 tons of nonhazardous interbedded wastes and impacted cover soils were sent to Chemical Waste Management in Model City, New York, for direct landfilling.
- 3,417 tons of hazardous industrial wastes were sent to LWD, Inc. in Calvert, Kentucky, for incineration and subsequent landfilling.
- 838 tons of hazardous interbedded wastes were sent to Chemical Waste Management in Model City, New York for direct landfilling, along with three drums of activated carbon and two drums of bone char used for on-Site water treatment.

In summary, the *Remedial Action Report* documented that the remedy complied with the mandated off-site disposal criteria.

## 4.1.3 Water Treatment and Discharge Performance Criteria

The water discharge performance criteria were established by NYSDEC's Effluent Limitations and Monitoring Requirements memorandum dated November 1998, and updated in July 1999 (NYSDEC, 1998 and 1999). The parameter limits were:

Parameter	Discharge Limit
Flow	30,000 gallons per day
pH	6.5 to 8.5
Benzene	1 microgram per liter (ug/L)
1,2-Dichlorobenzene	3 ug/L
1,4-Dichlorobenzene	3 ug/L
Tetrachloroethene	5 ug/L
Toluene	5 ug/L
Trichloroethene	5 ug/L
Di-n-butyl phthalate	50 ug/L
Naphthalene	10 ug/L
Chromium	100 ug/L
Nickel	200 ug/L
Ammonia-Nitrogen (limit applied if water was used for dust control)	20 milligrams per liter ( mg/L)
Nitrate and Nitrite-Nitrogen	20 mg/L

The water to be treated was either surface water, such as standing water encountered in Lagoon 1 prior to its excavation, or decontamination water generated when cleaning equipment and trucks.

Water was stored in temporary storage tanks, then treated through a 10-gallon per minute treatment system. The treatment system consisted of a pre-filter, activated carbon, and bone char to treat metals. A shallow tray air stripper was added to further reduce VOC concentrations. Discharged water was either used for on-Site dust control or discharged to an on-Site infiltration gallery. Approximately 24,000 gallons of water were treated and discharged.

The treated water was tested prior to discharge, and was not discharged until the performance limits had been met. Sampling and analysis of the treated water was conducted in accordance with the *Remedial Action Work Plan* (Shield, 1998a). The chronology of water treatment, testing, and analysis and all analytical results are provided in the *Remedial Action Report* (Shield, 2000). Fifteen samples for various analyses were collected and tested. The results document that performance criteria for water treatment and discharge criteria were met during implementation of the remedial action.

#### 4.1.4 Off-Site Borrow Soil Performance Criteria

NYSDEC soil cleanup levels presented in the 1994 Technical and Administrative Guidance Document (TAGM) No. 4046 (NYSDEC, 1994) were used to determine the acceptability of off-site borrow material used as fill at the Site.

Approximately 12,000 cubic yards of borrow soil from a single source were used in final grading. Samples were collected from approximately every 500 cubic yards, for a total of 22 samples. Samples were analyzed for an extensive list of VOCs, semivolatile organic compounds (SVOCs), metals, polychlorinated biphenyls (PCBs), pesticides, herbicides, and cyanide. Three samples were slightly above background or TAGM levels for an individual metal (zinc, arsenic, and lead), but average concentrations for all analyses were within TAGM or background levels. Application of a statistical approach in *Methods for Evaluating the Attainment of Cleanup Standards, Volume 1: Soils and Solid Media* (U.S. EPA, 1989) showed that the borrow soil met criteria at the upper 99% confidence level. Therefore, performance criteria were achieved for borrow soil.

## 4.1.5 Compliance with Air Quality Performance Criteria

The air quality performance criteria were compliance with OSHA PELs for VOCs at the excavation area fence line. Air samples were collected during the initial excavation of each of the industrial waste Lagoons 3, 7, and 8. Eight-hour air samples for quantitative analysis were collected upwind, downwind at the fence line, and within the work zone. The PELs were not exceeded during the quantitative sampling. In addition to quantitative sampling, real-time VOC air quality screening was conducted throughout excavation activities. Additional quantitative sampling was not required because real-time screening levels were not exceeded. In conclusion, the real time screening action levels and PELs were not exceeded, therefore the performance criteria were met.

#### 4.2 Protectiveness Determination

U.S. EPA's *Comprehensive Five-Year Review Guidance* (U.S. EPA, 2001) stipulates that the protectiveness of a remedy is to be evaluated by answering these questions:

- 1. Is the remedy functioning as intended by the decision documents?
- 2. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?
- 3. Has any other information come to light that could call into question the protectiveness of the remedy?

These questions are answered individually below.

### 1. Is the remedy functioning as intended by the decision documents?

Yes. The intended purpose of the OU1 remedy was to prevent leaching of contaminants to groundwater and to minimize exposure risks to potential future on-Site excavation workers. These intentions have been met because wastes and contaminated soils that threatened groundwater quality and human health have been permanently removed from the Site and appropriately managed through a combination of treatment and disposal. The success of the remedy is documented by the achievement of performance specifications that were part of the work plan:

 Removing more than 34,000 tons of hazardous and nonhazardous wastes and contaminated soils for off-site treatment and disposal. The wastes and contaminated soils contained constituents of concern that had the potential to leach to groundwater, or to pose risks to persons working on the Site in the future.

- Cleaning up remaining soils in the floors and sidewalls of the excavations and in the ditches and lagoon perimeters to below concentrations established by the U.S. EPA as protective of groundwater and worker health and safety.
- Treating the water encountered or generated during remediation to NYSDEC water quality standards before use as dust suppressant or disposal through infiltration. The NYSDEC standards were selected to be protective of groundwater and human health.
- Documenting that borrow soil imported from an off-site area met NYSDEC soil cleanup criteria designed to be protective of human health and the environment.
- 2. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

Yes - See discussion below.

<u>Exposure Assumptions</u> - The original baseline exposure assumptions, as summarized in the OU1 ROD, were that:

- Based on surrounding industrial use, zoning, and the presence of a steep rock escarpment to the west of the Site, future residential use of the land is not a reasonable scenario. This assumption is still valid.
- Adult or child trespassers could be exposed to hazardous constituents through contact with standing water in the lagoon, and through the ingestion, inhalation, and dermal contact with soils or sludges. The Site is still accessible to trespassers on foot. However, standing water, wastes, sludges, and contaminated soils have been removed; therefore the exposure potential has been eliminated.
- Future workers at the Site engaged in excavation or grading could potentially be exposed to hazardous materials, particularly chromium-containing dust. Wastes and contaminated soils have been removed. Future excavation workers on the Site would only come in contact with uncontaminated native soil or clean fill.

<u>Toxicity Data and Cleanup Levels</u> - The toxicity data used in the original baseline risk assessment, and the related cleanup criteria for soils excavation, treated water discharge, and clean fill are not known to have changed in the past five years since the OU1 remedy was completed.

<u>Remedial Action Objectives</u> - The remedial action objectives, to prevent further impact to groundwater and to prevent future workers from being exposed to contamination, were valid and important before remedial action was taken. The remedial action

objectives have been permanently met by excavation and off-site treatment and disposal.

In summary, the basis assumptions and objectives that originally guided the development of the remedy are still valid. However, the conditions have changed through remediation; therefore the risks have been significantly reduced.

## 3. Has any other information come to light that could call into question the protectiveness of the remedy?

No. In the five years since the OU1 remedy was completed, the Site has been stable. Groundwater quality has markedly improved following the removal of wastes (see Section 5.0), and the graded and reseeded areas have started to return to native vegetation. There are no areas of erosion, no appreciable changes in drainage, and no significant evidence of dumping or other types of vandalism in the OU1 area.

#### Conclusions

In conclusion, the OU1 remedy was appropriate and effective in eliminating leaching to groundwater and protecting humans from potential exposure. It achieved performance objectives and met the remedial action objectives.

## 5.0 Operable Unit 2 Technical Assessment

The five-year performance of the OU2 remedy is reviewed in this section. According to the September 1996 ROD for OU2, the remedial action objectives to be met for Site groundwater are to:

- Reduce or eliminate the potential health risks associated with ingestion of Site contaminated groundwater by potential future industrial workers, and
- Reduce the concentration of contaminants in the groundwater to drinking water standards.

Groundwater modeling completed in 1995 (Remediation Technologies, Inc., 1996) estimated that natural attenuation would reduce benzene and tetrachloroethene concentrations in groundwater to 5 ug/L or lower within about five years after completion of the OU1 remedy. The OU2 ROD concluded that the groundwater contaminant plume was not expanding even under the no action scenario, and that significant levels of contaminants were unlikely to migrate to or beyond Gold Creek under current conditions or in the future.

The issues to be evaluated in this review are:

- Achievement of Federal drinking water limits and State groundwater standards
- Demonstration of natural attenuation of organic contaminants
- Estimation of future trends in natural attenuation using degradation rate constants
- Review of the ongoing protectiveness of the remedy, including the protection of Gold Creek

# 5.1 Reductions in Compound Concentrations and Achievement of Federal Drinking Water Limits and State Groundwater Standards

The concentrations of VOC contaminants within the groundwater plume have decreased significantly in the past five years, resulting in reductions in the potential health risks associated with Site groundwater. Compounds that have decreased significantly in concentration are benzene, vinyl chloride, and 1,2-dichloroethene (total). Concentrations of tetrachloroethene, trichloroethene, chloroethane, chlorobenzene, methylene chloride, and toluene have also decreased. Downward trends in VOC

concentrations with time are discussed in greater detail under Section 5.2.3, Findings of MNA Program, Evidence of Natural Attenuation from VOC Analysis. The decreasing concentrations are documented graphically for individual compounds in various wells. Decreasing concentrations and contracting limits of the plume are also depicted in a series of drawings that follow (Figures 4 through 11). Moreover, downward trends are expected to continue as natural attenuation proceeds.

As concentrations of target constituents decrease, so do the risks. The primary VOC risk drivers in groundwater, benzene and vinyl chloride, have decreased on average by 96% and 91%, respectively. For discussion of human health risk issues, refer to Section 5.4.1, Protection of Human Health. Risks will continue to decrease as concentrations decline.

As VOC concentrations decline, some, but not all, Federal MCLs and State groundwater standards (collectively referred to as standards and guidance values or SGVs) have been met in monitoring wells downgradient of the former lagoons since completion of the OU1 remedy. SGVs are the same or lower than MCLs. For example, for benzene, a major constituent of concern at this Site, the MCL is 5 ug/L and the SGV is 1 ug/L, one-fifth of the Federal standard.

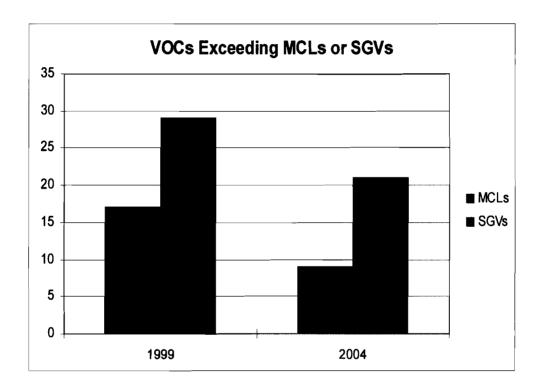
Table 2 shows a comparison between compounds exceeding MCLs and SGVs in February 1999, before remedial action was initiated, and April 2004, the most recent round of groundwater sampling. In February 1999, before OU1 activities were undertaken, there were nine monitoring wells within the monitoring network where MCLs were not being met, and eleven monitoring wells where SGVs were not being met. By April 2004, MCLs had been met in four of the nine monitoring wells. In 1999, there were 17 MCLs exceeded in the nine monitoring wells (some wells exceeded for more than one compound), and by 2004, the number of exceedances had dropped to 9, a decrease of about half. During this five-year period:

- The benzene MCL has been attained in MW-4, OW-19, OW-21, and OW-22
- The trichloroethene MCL has been attained in OW-5
- The vinyl chloride MCL has been attained in OW-19 and OW-22

The number of wells exceeding SGVs did not change between 1999 and 2004. However, SGVs for individual compounds were attained in numerous wells:

- The 1,2-dichloroethene (total) SGV has been attained in MW-4 and OW-13
- The trichloroethene SGV has been attained in OW-5
- The vinvl chloride SGV has been attained in OW-19 and OW-22
- The chloroethane SGV has been attained in OW-19
- The chlorobenzene SGV has been attained in OW-10R
- The methylene chloride SGV has been attained in OW-10R and OW-13
- The toluene SGV has been attained in OW-10R and OW-13

Changes in groundwater conditions between 1999 and 2004 are illustrated for all MCLs and SGVs (Figures 4 and 5), and for benzene, 1,2-dichloroethene, and vinyl chloride (Figures 6 through 11). These findings show significant progress has been made in achievement of these goals over this five-year period.



## 5.2 Demonstration of Natural Attenuation of Organic Contaminants

This discussion of natural attenuation at the Carroll and Dubies Site starts with a description of the monitoring plan, provides an overview of degradation processes, and summarizes the findings to date for the MNA program.

## **5.2.1** Monitoring Program

Field and laboratory parameters that collectively provide information on conditions which are favorable to natural attenuation have been monitored with each groundwater sampling round since 1999. The laboratory parameters that have been analyzed are:

- Alkalinity
- Chloride
- Dissolved gases (ethane, ethane, methane)
- Ferrous iron
- Nitrate
- Sulfate
- Sulfide
- Total organic carbon (TOC)

In addition, these MNA parameters are routinely monitored in the field:

- Temperature
- Hq •
- Dissolved oxygen
- Reduction/oxidation potential (redox)

MNA parameter results over time for wells in the monitoring network are provided in Appendices A and B. Trends and patterns in these parameters have been evaluated along with VOC chemical data, which provides information on the concentration changes and the breakdown or degradation products of the more highly chlorinated compounds tetrachloroethene and trichloroethene.

An understanding of degradation products is critical in evaluating natural attenuation of chlorinated VOCs. As trichloroethene and tetrachloroethene are degraded through natural attenuation, other chlorinated VOCs for which there are MCLs and SGVs, primarily 1,2-dichloroethene and vinyl chloride, are created. Ultimately, it is possible for the compounds to be completely degraded to ethane and ethane (Figure 12), but in the process, concentrations of degradation products may increase while the concentrations of primary products decrease.

## 5.2.2 Degradation Processes

The contaminant plume at the Carroll and Dubies Site is complex, in that it shows impacts from chlorinated VOCs and benzene from industrial waste disposal, and

organic carbon and methane from disposal of sewage and septic wastes. Likewise, natural attenuation pathways are complex, and interpretation of natural attenuation data is challenging.

Preferential natural attenuation pathways for benzene and chlorinated VOCs are different (U.S. EPA, 1999a). For benzene, natural attenuation proceeds at higher rates under aerobic conditions than under low-oxygen conditions. Anaerobic conditions, or conditions in which oxygen is not present, are most conducive for natural attenuation of chlorinated compounds through reductive dechlorination (Figure 12). Sources of degradable carbon, separate from the chlorinated compounds, are required to drive reductive dechlorination. Vinyl chloride can be degraded under either anaerobic or aerobic conditions, and other chlorinated compounds including trichloroethene and 1,2-dichloroethene can be degraded in the presence of oxygen through what are known as cometabolic processes. An example of cometabolism is found in certain types of naturally-occurring bacteria that can produce enzymes for metabolizing methane, if methane and oxygen are present in the aquifer. These same enzymes can nonspecifically degrade chlorinated compounds as well (U.S. EPA, 1999a).

### 5.2.3 Findings of MNA Program

#### Waste Characteristics and the Contaminant Plume

To better understand the findings of the MNA program, the characteristics of the former lagoon wastes were reviewed. Former Lagoons 3, 7, and 8 received the majority of the industrial wastes, including wastes containing aromatic and chlorinated VOCs, along with septic wastes and sewage sludge. Former Lagoons 1, 2, 4, and 6 contained mainly septic wastes and sewage sludge. Groundwater impacts have reflected this pattern. The highest concentrations of VOCs were found downgradient of Lagoons 3, 7, and 8, with a benzene concentration of 1,900 ug/L in OW-10 in February 1999, before OU1 remedial action began (Figure 6).

#### **MNA Pattern Evaluation**

MNA parameters fluctuate with season and have changed over time in certain cases (Appendix A; Appendix B), but average values for the past three years (2002 through 2004) show clear patterns indicative of natural attenuation.

The patterns are consistent with a groundwater plume containing VOCs from industrial wastes, as well as organic carbon and methane from sewage sludge and septic wastes.

(The closed City of Port Jervis Landfill, which underlies OW-18, OW-19, OW-21, and OW-22, could also be a source of methane and organic carbon in groundwater.) Figures 13 through 16 show average values for redox, dissolved oxygen, TOC, and methane relative to the 1 ug/L isoconcentration line for benzene (April 2004). These figures illustrate that reduced aquifer conditions, indicated by relatively lower redox values and dissolved oxygen concentrations, coincide closely with the benzene plume, as do areas with relatively higher TOC and methane concentrations.

The reduced conditions within the plume are typical of an aromatic VOC plume undergoing natural attenuation (U.S. EPA, 1999a). Conditions are reduced because microorganisms have consumed oxygen to degrade benzene and other organics that are most amenable aerobic degradation. Within the plume the reduced environment, combined with available carbon as indicated by TOC results, has created conditions conducive to natural attenuation of chlorinated compounds through reductive dechlorination (U.S. EPA, 1999a). The presence of methane may also result in degradation of chlorinated compounds through cometabolic processes. As Figures 8 through 11 show, chlorinated VOC degradation products 1,2-dichloroethene (total) and vinyl chloride have degraded in extent and concentration within these reduced areas over the past five years.

Monitoring wells OW-2, OW-5, OW-6, and OW-16 are on the aerobic margin of the plume. The aquifer in this area is more oxidized, and dissolved oxygen concentrations are somewhat higher. Also, TOC and methane concentrations are lower. Natural attenuation is occurring to some degree within these areas, as evidenced by the presence of 1,2-dichloroethene and occasional detections of vinyl chloride. However, natural degradation in these areas is slower, and is more likely to occur through cometabolism than reductive dechlorination.

#### Evidence of Natural Attenuation from VOC Analysis

Trends in VOC data over time document that the natural attenuation of target constituents is taking place. Refer to Appendix C for VOC results for all wells in the monitoring network. Figure 17 shows benzene concentrations over time in three wells, OW-10R, OW-13, and OW-22. Exponential trend lines show that concentrations are trending downward with time, reflecting the efficacy of the OU1 source removal action, combined with natural attenuation.

Although results are somewhat more variable for chlorinated VOCs, results for two wells, OW-5, on the aerobic edge of the benzene contaminant plume, and OW-13, within the reduced zone of the benzene contaminant plume, also show generally downward trends over time (Figure 18).

Downward trends in OW-2 and OW-6, also on the aerobic edge of the contaminant plume, are not yet apparent. There has been a reduction in the size and concentration of chlorinated VOCs overall since completion of the OU1 remedy (Figures 8 through 11), and concentrations of the more highly chlorinated trichloroethene and tetrachloroethene have decreased in nearby OW-5. However, in OW-2 and OW-6, chlorinated VOC concentrations have been relatively stable over the past five years, fluctuating with groundwater elevations (Figure 19). Chlorinated VOC concentrations are anticipated to gradually decline through physical changes and cometabolism, but the process will be slower than has been observed for other monitoring wells.

#### Conclusions

In conclusion, the findings of the MNA program are:

- MNA parameters have been monitored in all wells in the monitoring network, beginning in 1999.
- The contaminant plume is complex, reflecting the mixture of industrial wastes, sewage sludge, and septic wastes that were disposed in the lagoons.
- The two types of VOCs of greatest concern in groundwater are benzene, an aromatic VOC, and chlorinated VOCs, including trichloroethene and tetrachloroethene and their associated degradation products. The aquifer conditions that favor biological degradation of these two constituent types are different. Aerobic conditions are most favorable for benzene degradation, and anaerobic conditions are most favorable for degradation of chlorinated VOCs.
- The pattern of MNA parameters found in the contaminant plume downgradient of the former industrial waste lagoons is typical for an aromatic VOC plume undergoing natural attenuation. Conditions are reduced within the plume because microorganisms have consumed oxygen to degrade benzene and other organics amenable to aerobic degradation. The reduced environment, combined with available carbon, has subsequently created conditions conducive to natural attenuation of chlorinated compounds.
- Groundwater conditions on the aerobic edge of the plume, in the area of OW-2, OW-6, and OW-5, are less conducive to degradation of chlorinated VOCs, and the processes are proceeding more slowly in these areas.

 An evaluation of VOC trends supports the MNA data patterns, and documents that source removal combined with natural attenuation has reduced concentrations of benzene and chlorinated VOCs in groundwater over time.

## 5.3 Estimation of Natural Attenuation Trends Using Degradation Rate Constants

Five years of data are now available for the wells at the Carroll and Dubies Site. These results have been used to estimate future trends in natural attenuation. The method presented in the U.S. EPA's article titled *Calculation and Use of First-Order Rate Constants for Monitored Natural Attenuation Studies* (U.S. EPA, 2002), were used for these estimates. This technique uses historic data to calculate the reduction in contaminant concentration over time at a single point, such as a monitoring well. This information can then used to predict the additional time required to meet the selected goals for the contaminants of concern.

#### 5.3.1 Methods

The first step in the evaluation process was to plot the following data against time:

- Benzene
- Tetrachloroethene
- Trichloroethene
- 1,2-Dichloroethene (total)
- Vinyl chloride
- Total chlorinated VOCs

In all of the wells, the benzene levels have either reached the MCL, or have been consistently declining since the source removal action was completed in 1999. For these wells, a rate constant ( $K_{point}$ ) was derived using regression analysis. This  $K_{point}$  is the rate at which the compounds of interest will degrade based on the historical data. A trend line, regression equation, and  $R^2$  value were calculated automatically in Excel for each monitoring well. The slope of the line is the  $K_{point}$ , and the y intercept is the calculated value at time 0 (Appendix D).

Levels of the chlorinated VOCs in monitoring wells OW-2 and OW-6 did not show the same trend as seen in the benzene levels, and appeared to fluctuate with changes in groundwater elevations (see Section 5.2.3, Evidence of Natural Attenuation from VOC Analysis). Therefore, the same technique could not be used to calculate a rate constant for OW-2 and OW-6. Concentrations of chlorinated VOCs in well OW-5 also showed

effects from changes in groundwater elevations. However, the effects were not as distinct in OW-5, and it was possible to calculate a rate constant using a slightly modified method. This same method was then used to calculate the tetrachloroethene rate constant for this well.

Levels of 1,2-dichloroethene (total) and vinyl chloride in OW-10R and OW-13 showed decreasing trends over time, and rate constants were calculated for these compounds. The levels of other chlorinated VOCs in these two wells were below both the SGV and MCLs; therefore, they were not included in this evaluation.

#### 5.3.2 Results

After reviewing all of the data, rate constants were calculated for the following wells/compounds:

- MW-4 benzene
- OW-5 total chlorinated VOCs and tetrachloroethene
- OW-10R benzene and cis-1,2-dichloroethene (total)
- OW-13 benzene and cis-1,2-dichloroethene (total)
- OW-19 benzene
- OW-21 benzene
- OW-22 benzene

Calculations show that compliance with the MCLs will be achieved within the next three years and within the next seven years for SGVs for the above wells (Figures 20 and 21). The well with the longest time to reach compliance, OW-21, will not reach compliance until 2012. This is because the levels of benzene in this well were 5.8 ug/L initially and were 2.9 ug/L in April 2004. Therefore, the slope of the regression line is relatively flat and the resultant K<sub>point</sub> very low.

In addition to the calculating a single point in time for each well/compound to meet the regulatory limits, U.S. EPA (2002) recommends calculating an upper confidence limit to account for potential error that enters into the calculations. The confidence limits were calculated for each well/compound, and are included in Figures 20 and 21. The actual analytical results for the wells match more closely with the single time point calculations than with the upper confidence limit calculations. For example, calculations for OW-22 indicate that the MCL for benzene (5 ug/L) should be met in 2004, while the upper confidence limit calculation indicates that the MCL will be met no later than 2007.

Actual analytical data from 2004 show that benzene in OW-22 was 4.2 ug/L, thereby meeting the MCL.

### 5.4 Protectiveness Determination

As specified in U.S. EPA's *Comprehensive Five-Year Guidance* (U.S. EPA, 2001), the protectiveness of the OU2 remedy must be evaluated in terms of:

- 1. Is the remedy functioning as intended by the decision documents?
- 2. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection still valid?
- 3. Has any other information come to light that could call into question the protectiveness of the remedy?

This determination is addressed in two sections, the first dealing with protection of human health and the second dealing with ecological considerations. The focus of the OU2 remedy was on the protection of human health relative to groundwater consumption. There was no quantitative assessment of the potential impact on human health from exposure to Gold Creek and no detailed ecological risk assessment, because of the conclusion that it was unlikely that Site groundwater would adversely impact surface water or sediment quality in Gold Creek. Because of the interest in Gold Creek that has arisen in the five-year review process, it is discussed as part of Question 2 in the human health section and the ecological section.

#### 5.4.1 Protection of Human Health

#### 1. Is the remedy functioning as intended by the decision documents?

Yes. Natural attenuation, the primary element of the OU2 remedy, is working. Drinking water criteria have been achieved in about half of the wells where exceeded in 1999. The primary risk drivers in groundwater, benzene and vinyl chloride, have decreased on average by 96% and 91%, respectively. VOC concentrations have declined significantly throughout the plume, and the extent of the plume has been reduced. As concentrations decline, so have human health risks.

2. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection still valid?

Yes. The exposure assumptions, toxicity data, and remedial action objectives are still valid, while the established groundwater cleanup levels at the time of the OU2 ROD, Federal MCLs, and NYSDEC SGVs, are conservative from a risk perspective.

This question is examined in greater detail in the sections reviewing the OU2 risk assessment and potential human health issues today for groundwater and Gold Creek.

#### **OU2 Risk Assessment**

The baseline risk assessment for OU2 summarized in the September 1996 OU2 ROD (U.S. EPA Region 2, 1996) evaluated potential human health effects for current and future receptors at the Site under baseline conditions, that is, conditions before source removal and natural attenuation resulted in reduced concentrations of organic contaminants in groundwater. In summary, the findings of the baseline risk assessment were:

- Hazard Identification and Chemicals of Concern All chemicals that were detected in at least one outwash unit monitoring well were quantitatively evaluated.
- Exposure Assessment The exposure assessment identified potential current and future receptors at the Site. There were no current on-Site groundwater users of the outwash aquifer. A production well north and west (upgradient) of the lagoons on the Joe Carroll property was completed in bedrock. This well was tested in 2003 and was nondetectable for VOCs except for acetone, which was also detected in the trip blank (Shield, 2003). The potential off-site current and future receptors that were evaluated were residents to the east or southeast of Gold Creek that use groundwater as drinking water, and recreational users of Gold Creek. Measured groundwater concentrations in Site wells combined with groundwater modeling, sediment data from Gold Creek, and sampling results from off-site residences on the other side of Gold Creek indicated that exposure was not occurring; therefore these receptors were not quantitatively evaluated in the risk assessment.

The receptors who were quantitatively evaluated in the baseline risk assessment were future on-Site workers who could potentially be exposed to chemicals of concern in groundwater used for drinking. Future residential use of the Site was not quantitatively evaluated because the Site and immediately adjacent land are zoned exclusively for industrial land use.

 <u>Toxicity Assessment</u> - Established toxicity indices for chemicals of concern were obtained from U.S. EPA guidance. The toxicity indices used in the original risk assessment are not known to have changed. • Risk Characterization - For potential future on-Site industrial users exposed to groundwater at the Site, the total cancer risk was calculated as 1.4 x 10<sup>-4</sup>, which is within the U.S. EPA target range of 10<sup>-4</sup> to 10<sup>-6</sup>. The total hazard index was 0.55, less than the acceptable level of 1.0. For the cancer risk from organic chemicals, vinyl chloride accounted for 68% of that risk, benzene accounted for 8%, tetrachloroethene accounted for 2.5%, and trichloroethene accounted for 0.4%

#### Groundwater

Today, the exposure assessment conducted for the baseline risk assessment is still appropriate. The Site and surrounding land continue to be zoned for industrial use only. Downgradient groundwater users continue to be protected because the contaminant plume has been substantially reduced in extent and concentration. Although there are no on-Site industrial workers who are ingesting Site groundwater, and it is unlikely that there will ever be, concentrations of organic contaminants in on-Site monitoring wells have substantially decreased, especially for those chemicals, vinyl chloride and benzene, that pose the greatest risk. In 1999, the average vinyl chloride concentration in monitoring wells where detected (5 wells) was 12.9 ug/L; in 2004, the average concentration where detected (6 wells) was 1.1 ug/L, an average decrease of 91%. In 1999, the average benzene concentration in Site wells where detected (12 wells) was 205.2 ug/L; in 2004, the average concentration in wells where detected (10 wells) was 7.2 ug/L, an average decrease of 96%. There is no need for quantitative risk analysis at this point, but it is clear that risks which were originally within the acceptable range have been further reduced by the OU2 remedy.

#### Gold Creek

There are two sediment/surface water locations on Gold Creek that have been sampled with every round of groundwater sampling, SED/SW-001, downgradient of the Site, and SED/SW-002, upgradient of the Site. SED/SW-001 is also downgradient and within about 200 feet from the closed city landfill. The sampling points on Gold Creek were selected to be as close as possible to the western bank, at the point where groundwater from upgradient areas would first discharge to surface water.

The premise of the baseline risk assessment was that constituents of concern in groundwater from the Site were unlikely to impact Gold Creek. This premise was based on sampling data and flow and transport modeling. Five years of groundwater monitoring following source removal continues to support this premise. Groundwater quality in OW-18 and OW-19, the furthest downgradient monitoring wells before Gold

Creek, continues to improve, and concentrations of VOCs throughout the plume have declined. Although there have been occasional detections of organic constituents in sediment and surface water, there is no pattern of impact from Site-related chemicals.

Tables 3 and 4 summarize VOCs and SVOCs that have been detected in surface water and sediment samples. The occasional low detection of a VOC or SVOC in surface water or sediment was in most cases for compounds that are common artifacts of sampling or laboratory analysis (acetone, 2-butanone, methylene chloride, toluene, bis 2-ethylhexyl phthalate, di-n-butyl phthalate). For all other constituents, reported concentrations were estimated results below the reporting limits (J-qualified).

Since August 2001, detected constituents in surface water have been below MCLs and SGVs; the only constituent detected at all since September 2002 has been acetone in the upgradient sample.

NYSDEC (1998) developed a guidance manual for screening contaminated sediments. The screening tables provided in this guidance document do not provide default concentrations for the constituents reported for Gold Creek. There are guidance values for human health bioaccumulation for benzene and vinyl chloride that can be applied if the organic carbon content of the sediments is known. The organic carbon content of Gold Creek sediments has not been measured. However, if a concentration of 1% organic carbon is assumed, a screening value of 6 micrograms per kilogram (ug/kg) would be derived. All reported benzene concentrations were below this level.

Because no default concentrations have been identified that specifically relate to human exposure to sediments, the conservative U.S. EPA Region 9 Preliminary Remediation Goals (U.S. EPA, 2005) for residential soil are provided in Table 4 as a comparison. Region 9 PRGs are risk-based values derived from standard risk assumptions, and are used as a guide for review and planning. Reported concentrations in sediments in all cases are an order of magnitude or more below the PRGs.

## 3. Has any other information come to light that could call into question the protectiveness of the remedy?

No. Human health continues to be protected by the OU2 remedy. Risks to potential future on-Site industrial workers who may ingest groundwater are likely to be much lower than the acceptable risk projected in the baseline risk assessment, because VOCs posing the highest relative risk have been substantially reduced. Although there

have been low detections of VOCs and SVOCs on occasion in sediment and surface water in Gold Creek, concentrations are below drinking water standards and risk-based guidelines that are acceptable for residential soil.

## 5.4.2 Protection of Ecological Receptors

#### 1. Is the remedy functioning as intended by the decision documents?

Yes. The decision documents found no evidence that Gold Creek was or would be impacted by the Site, and therefore ecological receptors would not be harmed. Today, five years after implementation of the OU2 remedy, there continues to be no indication of impact to Gold Creek that could result in harm to ecological receptors. Source material has been removed, the groundwater plume continues to degrade, and the potential for harm to Gold Creek has been reduced even further.

## 2. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection still valid?

A quantitative baseline ecological risk assessment was not performed before the ROD process, because the baseline risk assessment found no evidence that Gold Creek was or would be impacted by the Site.

As described above for protection of human health, VOCs and SVOCs have occasionally been detected in surface water and sediment samples from Gold Creek. These concentrations have been compared to currently available guidance.

The NYSDEC standards for surface water quality found in 6 New York Code of Rules and Regulations (NYCRR) Part 703 (NYSDEC, 2005) have been reviewed relative to aquatic protection standards. Although there are SGVs for the protection of human health, which are shown in Table 3, there are not standards for aquatic protection for the detected constituents.

Guidance values for sediment quality can be found in the Screening Quick Reference Tables developed by the National Oceanic and Atmospheric Administration (NOAA), which can also be accessed through the U.S. EPA website (NOAA, 2005). Di-n-butyl phthalate is the only chemical detected in sediments over the past five years for which a sediment guidance value is available in the reference tables. There is an upper effects threshold guidance concentration of 100 ug/kg for di-n-butyl phthalate, based on bioassay results for *Hyalella azteca*, a crustacean. Concentrations of this chemical

were reported in both upstream and downstream sediment samples in 1994, 1997, and 1999, but have not been detected since. The NYSDEC guidance on contaminated sediments (NYSDEC, 1998) provides a value for one detected constituent, bis (2-ethylhexyl)phthalate, that can be applied if sediment organic carbon content is known. If a 1% organic content is assumed, the guidance value is 1995 ug/kg, greater than the concentration of 590 J ug/kg reported in 2000.

## 3. Has any other information come to light that could call into question the protectiveness of the remedy?

No, based on the low concentrations of VOCs and SVOCs that have been occasionally detected in surface water and sediment samples from Gold Creek and the lack of applicable standards or guidance values for the constituents detected, it is unlikely that conditions pose ecological risks.

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Tables

### Table 1 Strategy for Monitoring Well Selection

Location	Criteria
OW-3	- MW-4 and OW-3 have essentially the same completion - MW-4 and OW-3 are both immediately downgradient of Lagoon 1 - MW-4 and OW-3 had the same suite of contaminants, and similar concentrations
OW-4	- OW-4 was within the area of excavation for Lagoons 4 and 8 - OW-13, OW-22, and OW-21 are downgradient of this location - OW-4 was nondetect or had low estimated values below MCLs in sampling episodes prior to excavation
OW-7	- OW-7 had low detections of benzene compared to OW-13, and was nondetect for other VOC constituents of concern - OW-13, near OW-7, had benzene detections and chlorinated detections
OW-17	- OW-17 is outside of the maximum extent of the impacted groundwater - Upgradient OW-16 is nondetect - OW-17 was nondetect during the RI sampling - Upgradient wells have continued to decrease in concentration
OW-23	Originally installed to test for vertical dispersion and hydraulic gradient     Completed immediately adjacent to OW-18     Both wells non-detect for VOCs pre-excavation     OW-18 was selected as a better sentinel well based on its completion depth

Table 2
MCL and SGV Exceedances, 1999 and 2004

Well	Compound	MCL	SGV		99 dance		04 dance
		ug/L	ug/L	MCL	SGV	MCL	SGV
MW-4	Benzene	5	1	X	X		X
101 4 4	1,2-Dichloroethene (1,2-DCE)	70	5		X		
	Benzene	5	1				Х
OW-2	Tetrachloroethene (PCE)	5	5	Х	Х	Х	Х
OVV-2	Trichloroethene (TCE)	5	5	Х	Х	Х	Х
	1,2-Dichloroethene (1,2-DCE)	70	5	Х	Х	Х	Х
	Tetrachloroethene (PCE)	5	5	Х	Х	Х	Х
OW-5	Trichloroethene (TCE)	5	5	Х	Х		
	1,2-Dichloroethene (1,2-DCE)	70	5		Х		Х
	Tetrachloroethene (PCE)	5	5	Х	Х	Х	Х
OW-6	Trichloroethene (TCE)	5	5			Х	Х
	1,2-Dichloroethene (1,2-DCE)	70	5		Х		Х
	Benzene	5	1	Х	Х	Х	Х
OW 40/D)*	Chlorobenzene	100	5		Х		
OW-10(R)*	Methylene chloride	5	5	Х	Х		
	Toluene	1,000	5		Х		
	Benzene	5	1	Х	Х	Х	Х
	1,2-Dichloroethene (1,2-DCE)	70	5		Х		
OW-13	Methylene chloride	5	5	Х	Х		
	Toluene	1,000	5		Х		
	Vinyl chloride	2	2	Х	Х	Х	Х
OW-15	Benzene	5	1		Х		Х
OM/ 49	Benzene	5	1		Х		Х
OW-18	Chlorobenzene	100	5				Х
	Benzene	5	1	Х	Х		Х
OW-19	Chlorobenzene	100	5		Х		Х
O44-18	Chloroethane	NA	5		Х		
	Vinyl chloride	2	2	Х	Х		
OW-21	Benzene	5	1	Х	Х		Х
	Benzene	5	1	Х	Х		Х
OW-22	Chlorobenzene	100	5		Х		Х
	Vinyl chloride	2	2	Х	Х		

<sup>\*</sup>OW-10 was replaced with OW-10R in 2000. OW-10 was abandoned because it was within the OU1 construction area.

# Detected TCL Volatile and Semivolatile Organic Compounds in Surface Water (ug/L) April 2004

### Carroll and Dubies Superfund Site Town of Deerpark, Orange County, New York

	Di-n-butyl phthalate	50 (S)	NE	SVOC	<10	<10	<10	<10	<10	NA	NA	NA	NA	<10	<10	<10	<10	.0 <10	.0 0.77 J/<10	O. NA	O. NA	NA NA
	Vinyl	2 (S)	2	XIMX	<2.0	0.99 J	<2.0	0.52 J	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0 / <2.0	<2.0 / <2.0	<2.0 / <2.0	<2.0 / <2.0	<2.0 / <2.0
	Toluene	\$ (S)*	1,000		<1.0	<1.0	<1.0	<1.0	<1.0	1.0 U	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 / <1.0	<1.0 / <1.0	<1.0 / <1.0	<1.0 / <1.0	<1.0 / <1.0
S. Commission of the Commissio	Methylene Chloride	5 (S)*	5		<1.0	0.15 J,B	<1.0	<1.0	<1.0	1.5 U	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 / <1.0	1.2 U / 1.0 U	<1.0 / <1.0	<1.0 / <1.0	<1.0 / <1.0
	1,2-Dichloroethene (total)	5 (S)*	02		<1.0	<1.0	<1.0	0.39 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 / <1.0	<1.0 / <1.0	<1.0 / <1.0	<1.0 / <1.0	<1.0 / <1.0
	1,2-Dichloroethane	0.6 (S)	5	VOCs	<1.0	<1.0	<1.0	0.61J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 / <1.0	<1.0 / <1.0	<1.0 / <1.0	<1.0 / <1.0	<1.0 / <1.0
	Chloroethane	5 (S)*	NE		<2.0	0.85 J	<2.0	L 76.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0 / <2.0	<2.0 / <2.0	<2.0 / <2.0	<2.0 / <2.0	<20/20
St. Links and the	2-Butanone	NE	NE		<10	<10	<10	<10	<10	0.60 J	<10	<10	<10	<10	<10	<10	<10	<10 / <10	<10 / <10	<10 / <10	<10 / <10	<10 / <10
	Benzene	1 (S)	5		<1.0	0.19 J,B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 / <1.0	<1.0 / <1.0	<1.0 / <1.0	<1.0 / <1.0	<1.0 / <1.0
	Acetone	50 (G)	NE		<10	<10	<10	<10	<10	<10	<10	<10	10 U	<10	<10	<10	<10	<10 / <10	10 U / 10 U	<10 / <10	1.3 J / 2.0 J	<10 / <10
	te	SGV	MCL	Date	02/18/99	01/04/00	00/80/90	03/15/01	08/28/01	04/23/02	09/17/02	04/08/03	04/23/04	02/18/99	01/04/00	00/80/90	03/15/01	08/28/01	04/23/02	09/17/02	04/08/03	04/23/04
	Analyte	NYSDEC SGV	U.S. EPA MCL	Sample ID					SW-1						CW2	7-400				SW-27 Duplicate		

### Notes:

TCL = Target Compound List

NYSDEC SGV = New York State Department of Environmental Conservation Standards (S) and Guidance (G) values for groundwater.

= The principal organic contaminant (POC) standard for groundwater of 5 ug/L applies to this substance.

U.S. EPA MCL = United States Environmental Protection Agency Maximum Contaminant Level for drinking/groundwater.

NE = Not established; no criteria specified.

< = Analyte not detected at reporting limit.</p>

J = Estimated result; result is less than reporting limit.

B = Method blank contamination. The associated method blank contains the target analyte at a reportable level.

U (DATA VALIDATION QUALIFIER) = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

LA = Lab accident; during the concentration process, sample was inadvertently concentrated to dryness due to analyst error. Insufficient sample volume was received to re-extract; sample could not be analyzed.

NA = Not analyzed
Blue = Analyte detected at less than regulatory limit, or analyte detected but no regulatory criteria specified.

Red = Analyte detected at or above SGV or MCL.



### Detected TCL Volatile and Semivolatile Organic Compounds in Sediment (ug/kg) April 2004

### Carroll and Dubies Superfund Site Town of Deerpark, Orange County, New York

Sample ID	Date				VOCs					SVOCs	
Ar	alyte	Acetone	Benzene	2-Butanone	Carbon Disulfide	1,2-Dichloro- ethene (total)	Toluene	Vinyl Chloride	bis(2-Ethylhexyl) phthalate	Di-n-butylphthalate	4-Methylphenol
	ry Remedial RG), ug/kg	1.4E+7	6.4E+2	2.2E+7	3.6E+5	4.3E+4	5.2E+5	7.9E+1	3.5E+4	6.1E+6	3.1E+5
	09/27/94	58	ND	<20	NR	ND	ND	<20	ND	190 J,B	ND
1	02/18/99	<28	<6.9	<28	<6.9	<6.9	<6.9	<14	<450	77 J	<450
[ [	01/04/00	370	<31	82 J	<31	<31	<31	6.9 J	<2,000	<2,000	<2,000
1	06/08/00	60 J,B	<13	17 J	<13	<13	<13	<27	590 J	<880	<880
SED 1	03/15/01	55 J	<16	<62	<16	<16	<16	<31	<1,000	<1,000	<1,000
SCD 1	08/28/01	27 J	2.1 J	9.4 J	<12	4.6 J	1.3 J	<24	<790	<790	<790
	04/23/02	1,100 R	<57 R	260 R	<57 R	<57 R	28 JR	<110 R	<3,800 R	<3,800 R	<3,800 R
1	09/17/02	180 B,J	2.7 J	58 J	3.5 J	2.1 J	54 J	34 UJ	NA	NA	NA
	04/08/03	110 J	3.4 J	34 J	<21	5.7 J	<21	3.0 J	NA	NA	NA
	04/23/04	28 J,FB,TB	<10	7.2 J	<10	<10	<10	<20	NA	NA	NA
SED-2	09/27/97	76	ND	<23	NR	ND	ND	<23	ND	220 J,B	ND
JLD-2	02/18/99	140 J,B	<44	50 J	<44	<44	<44	<88	<2,900	370 J	<2,900
	01/04/00	180 J / <190	<55 / <47	<220 / <190	<55 / <47	<55 / <47	<55 / <47	<110 / <94	<3,600 / <3,100	<3,600 / <3,100	<3,600 / <3,100
	06/08/00	150 J / <160	<46 / <41	49 J / <160	<46 / <41	<46 / <41	13 J / <41	<91 / <81	2,900 J / 1,500 J	<3,000 / <2,700	480 J,# / <2,700
l	03/15/01	36 UJ / 69 UJ	17 UJ / 17 UJ	70 UJ / 69 UJ	<17 / <17	17 UJ / 17 UJ	17 UJ / 17 UJ	35 UJ / 35 UJ	<1,200 / <1,100	<1,200 / <1,100	<1,200 / <1,100
SED-2 / Duplicat	08/28/01	44 J / 22 J	<16 / <13	14 J / 7.6 J	<16 / <13	<16 / <13	<16 / <13	<32 / <25	<1,100 / <830	<1,100 / <830	<1,100 / <830
e	04/23/02	63 J / 85 UJ	30 UJ / 21 UJ	21 J / 85 UJ	30 UJ / 21 UJ	30 UJ / 21 UJ	30 UJ / 21 UJ	59 UJ / 42 UJ	2,000 UJ / 1,400 UJ	2,000 UJ / 1,400 UJ	2,000 UJ / 1,400 UJ
	09/17/02	40 B / 29 J,B	<9.6 / <9.3	17 J / 9.3 J	<9.6 / <9.3	<9.6 / <9.3	1.0 J / 0.91 J	<19 / <19	NA	NA	NA
	04/08/03	79 J / 27 J	<41 / <44	21 J / <180	<41 / <44	<41 / <44	<41 / <44	<83 / <88	NA	NA	NA
	04/23/04	38 J,FB / <53	<14 / <13	12 J / <53	<14 / <13	<14 / <13	<14 / <13	<28 / <27	NA	NA .	NA

### Notes:

PRG = Preliminary remedial goals established by U.S. EPA Region 9 for residential soil.

TCL = Target Compound List

ND = Not detected at reporting limit prior to 06/08/00.

< = Not detected at the method detection limit.

NR = Analyte not reported

NA = Not analyzed

J = Estimated result; result is less than method reporting limit

TB = Detected in trip blank

FB = Detected in field blank

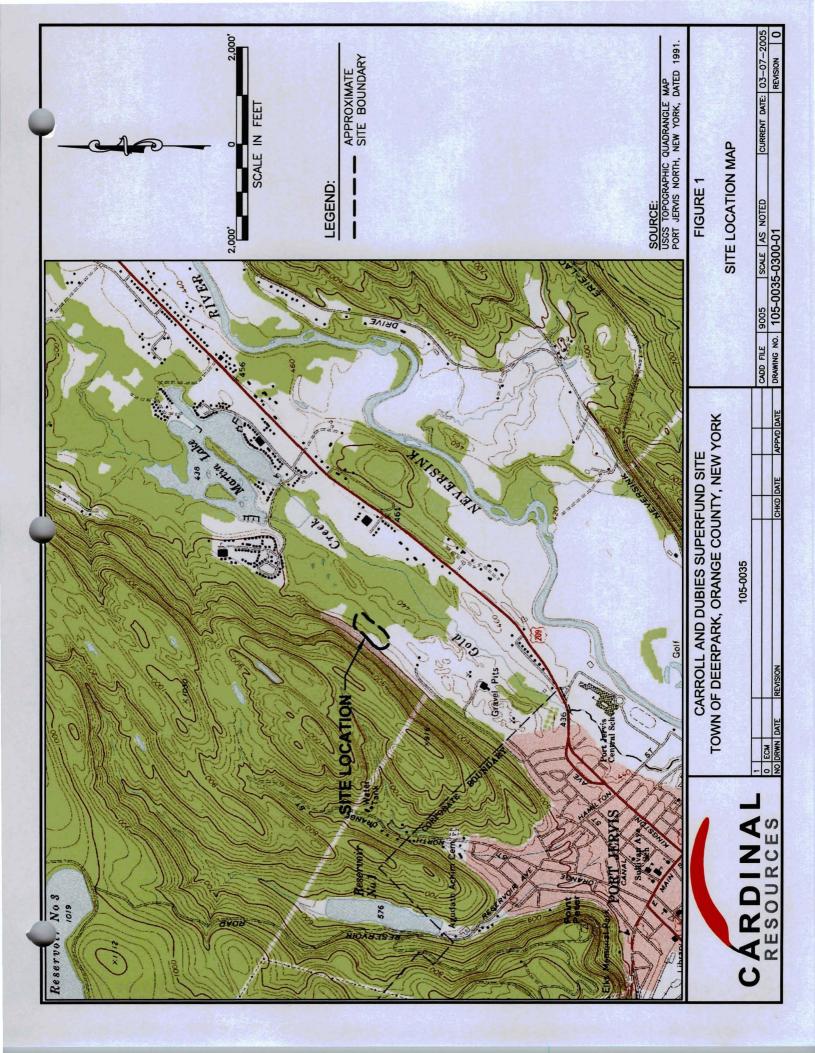
Methylene Chloride (2.6 ug/kg J, FB, TB) was detected in SED-1 during 4/04 sampling round.

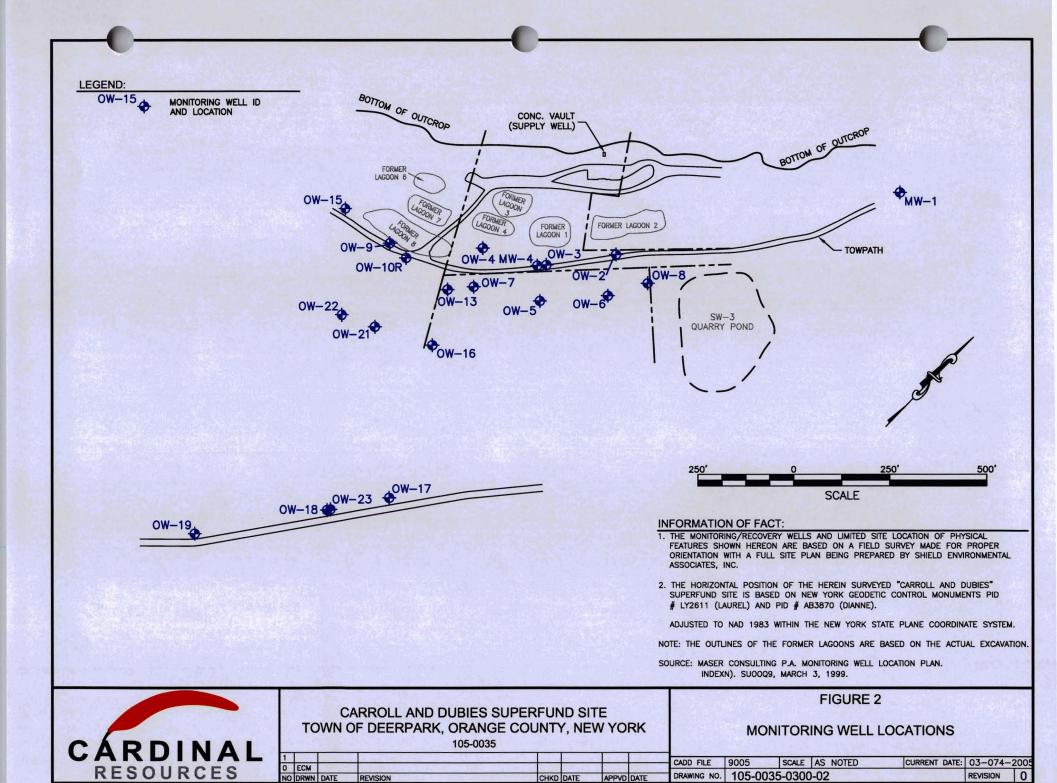
B = Method blank contamination. The associated method blank contains the analyte at a reportable level.

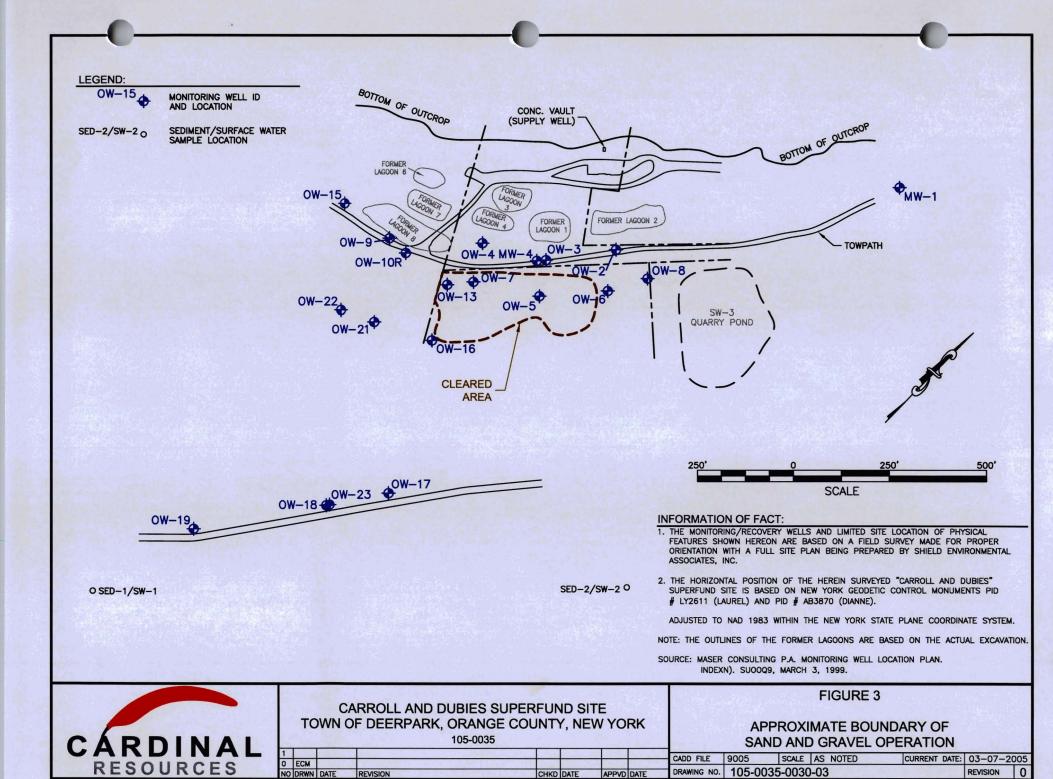
R (DATA VALIDATION QUALIFIER) = The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. The presence or absence of the analyte cannot be verified. # = This value represents a probable combination of 3-methylphenol (m-cresol) and 6-methylphenol (p-cresol).

UJ (DATA VALIDATION QUALIFIER) = Analyte not detected above the reporting limit; however, the reporting limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Figures





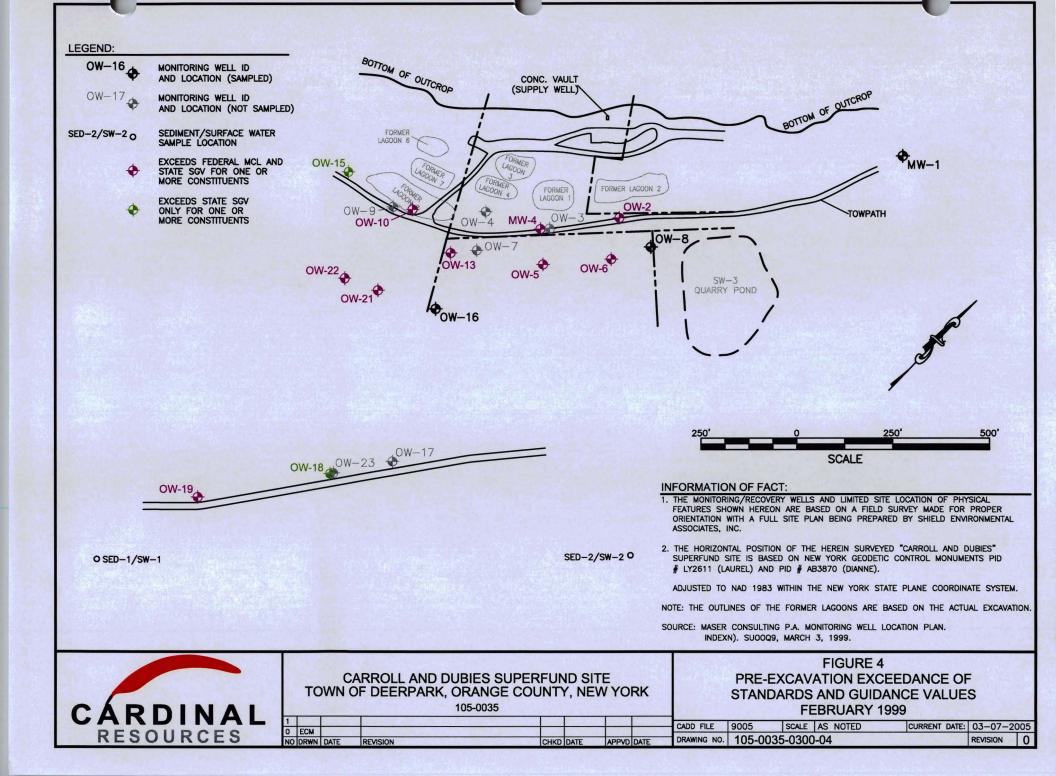


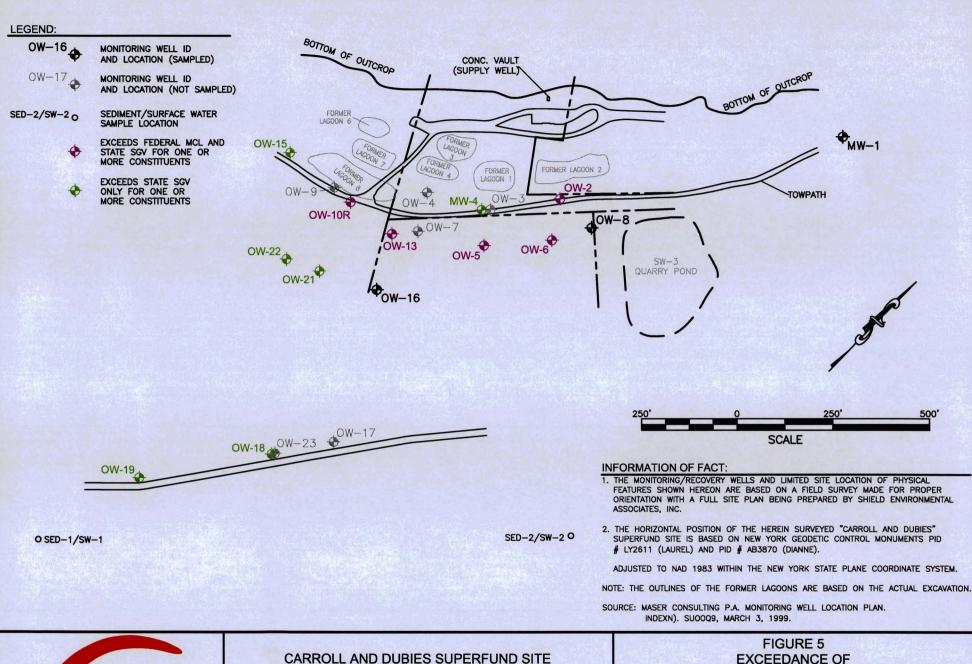
CHKD DATE

REVISION

APPVD DATE

REVISION





TOWN OF DEERPARK, ORANGE COUNTY, NEW YORK

CHKD DATE

APPVD DATE

STANDARDS AND GUIDANCE VALUES

**APRIL 2004** 

CURRENT DATE: 03-07-2005

REVISION

SCALE AS NOTED

CADD FILE

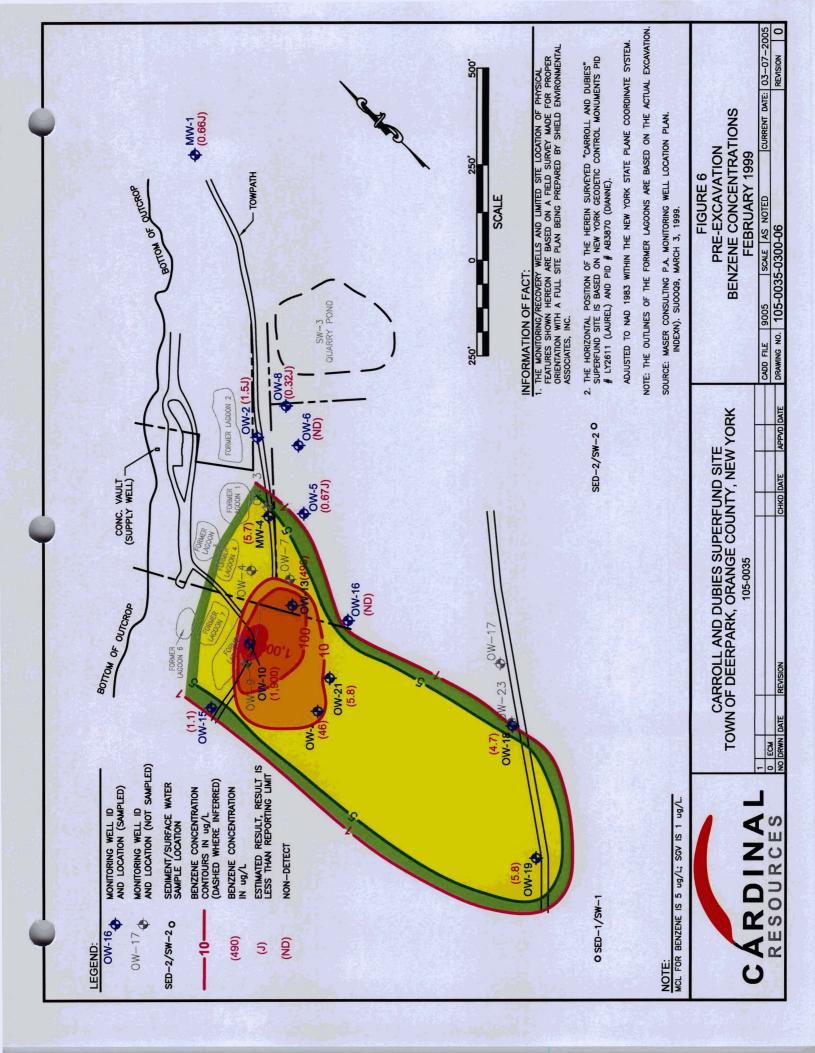
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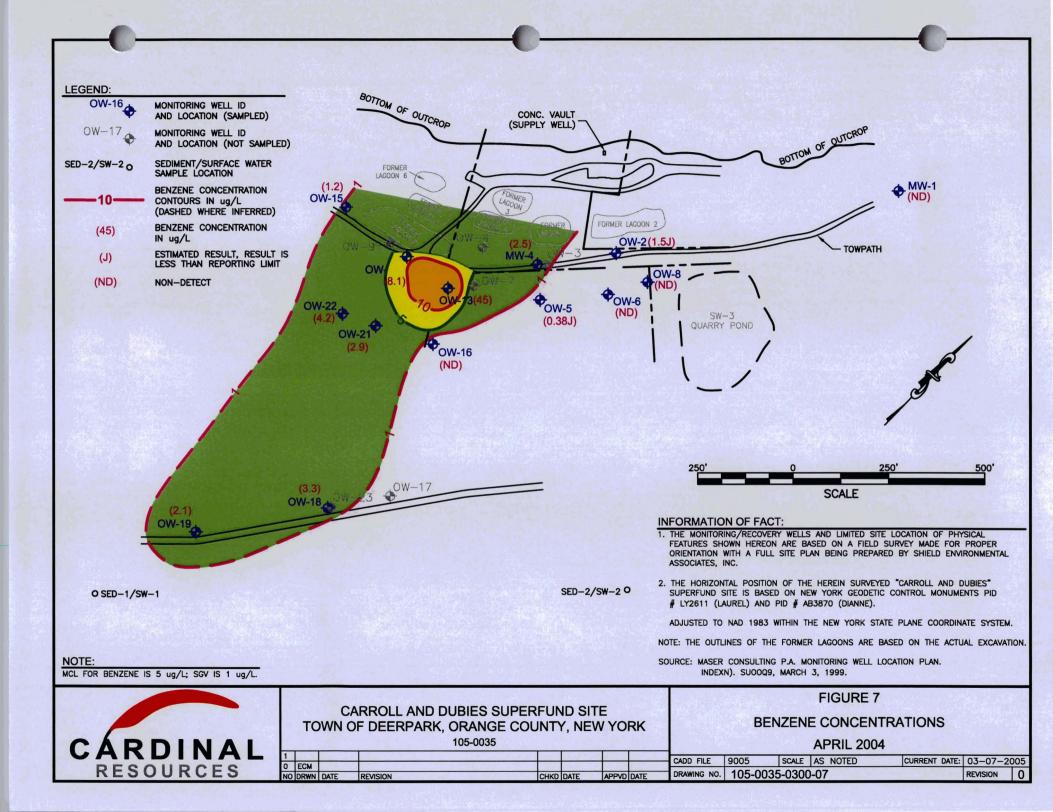
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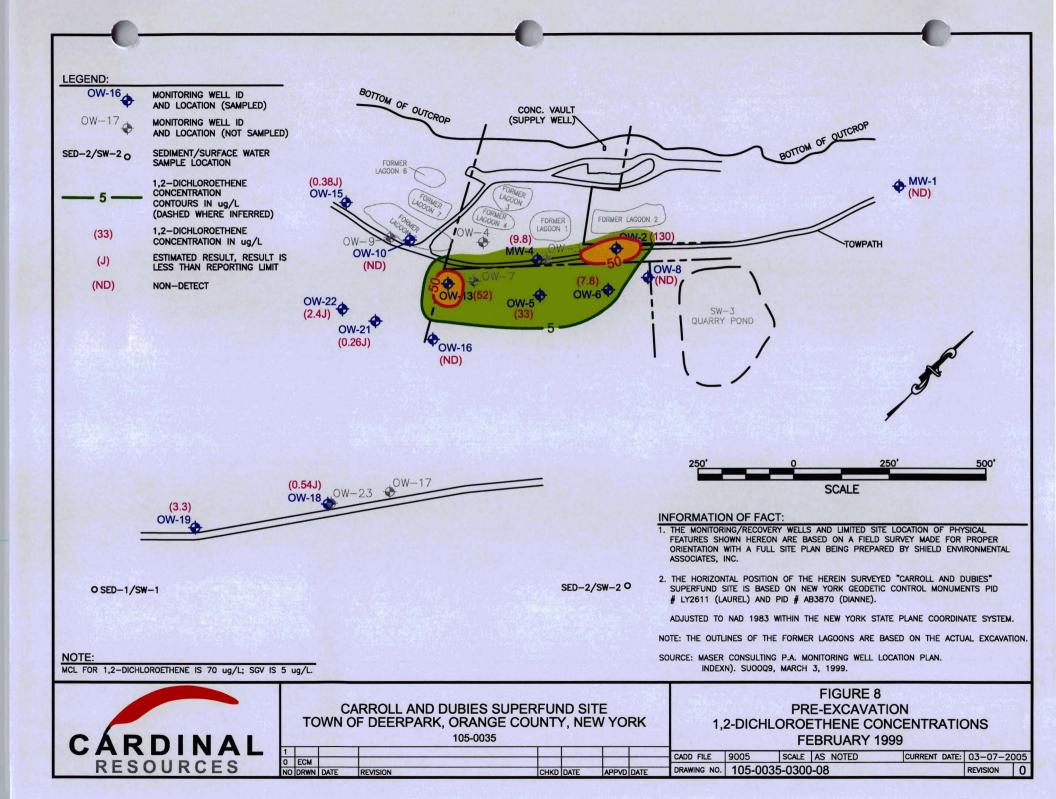
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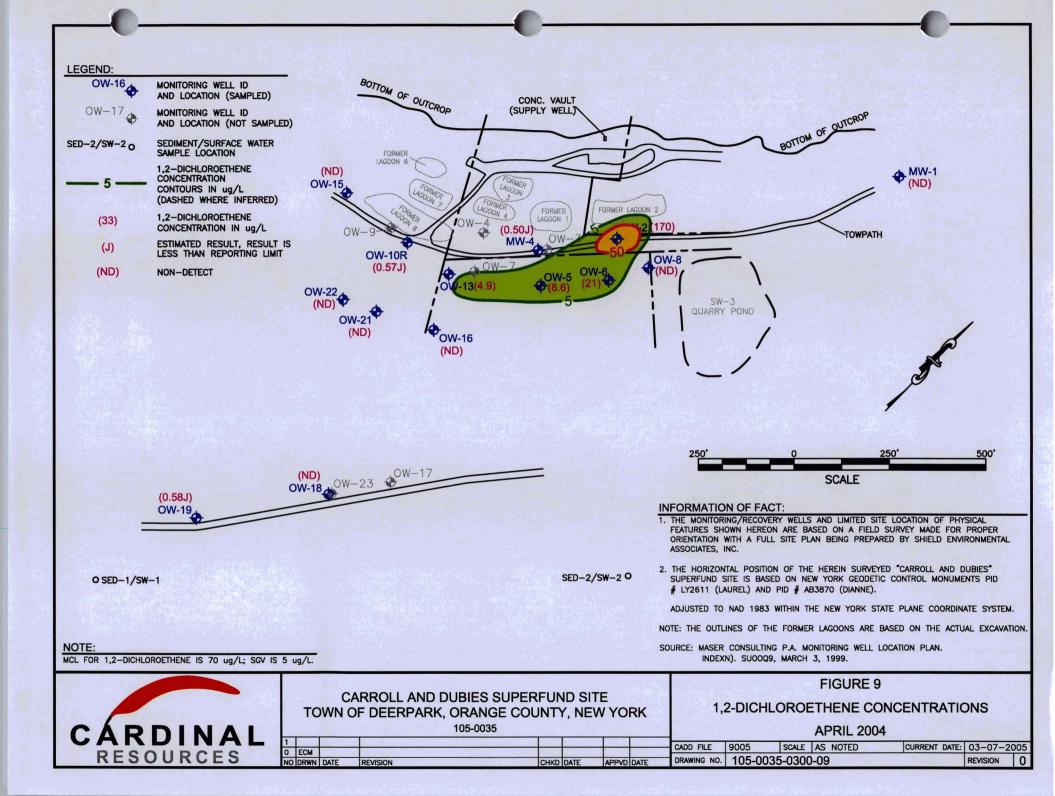
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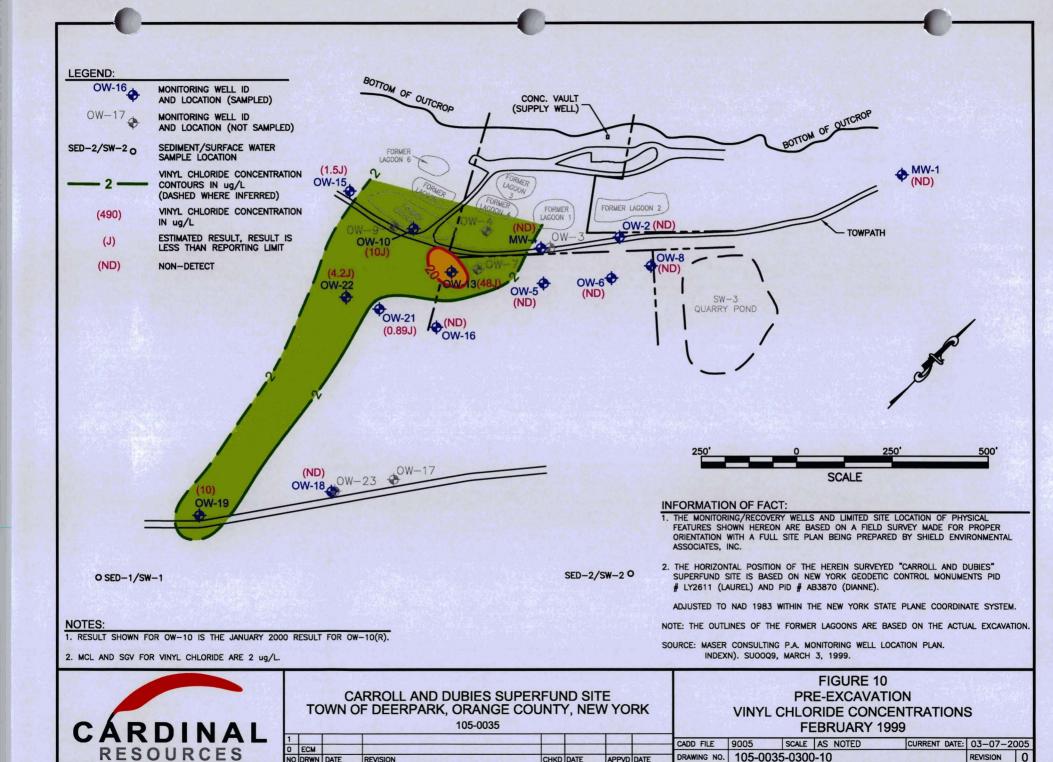
REVISION











CHKD DATE

REVISION

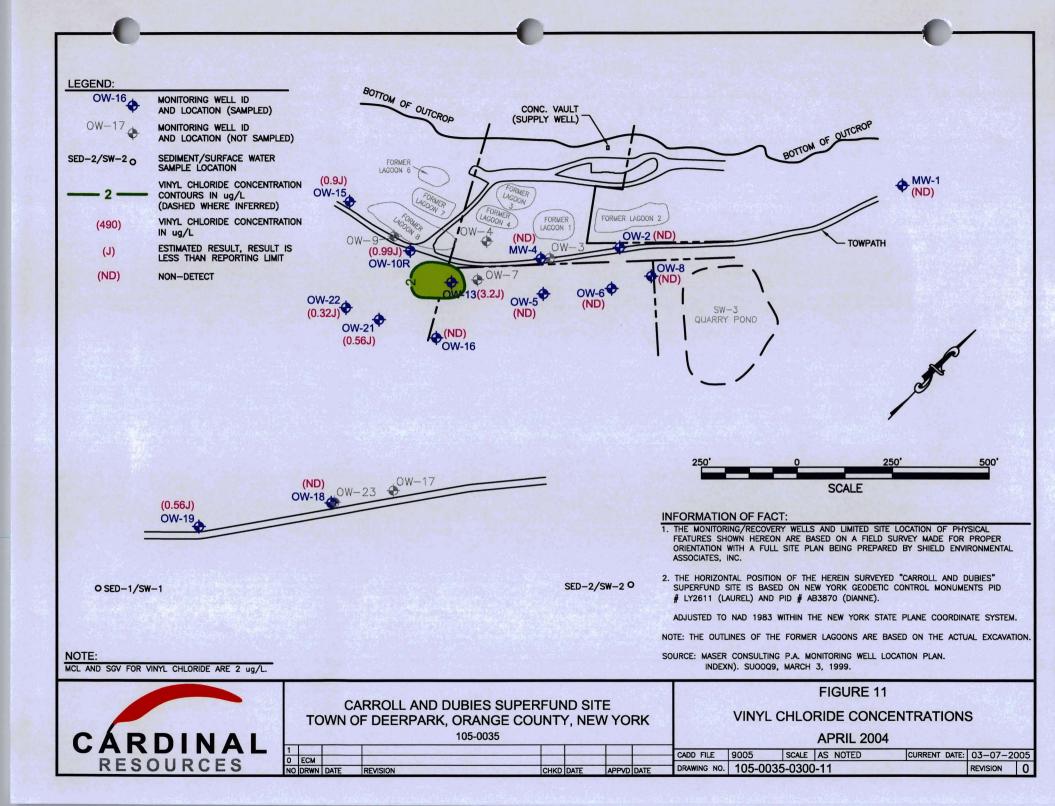
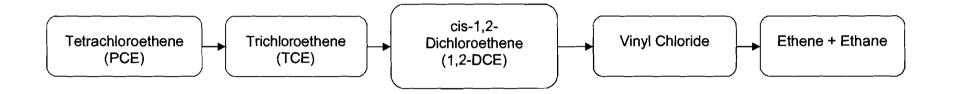
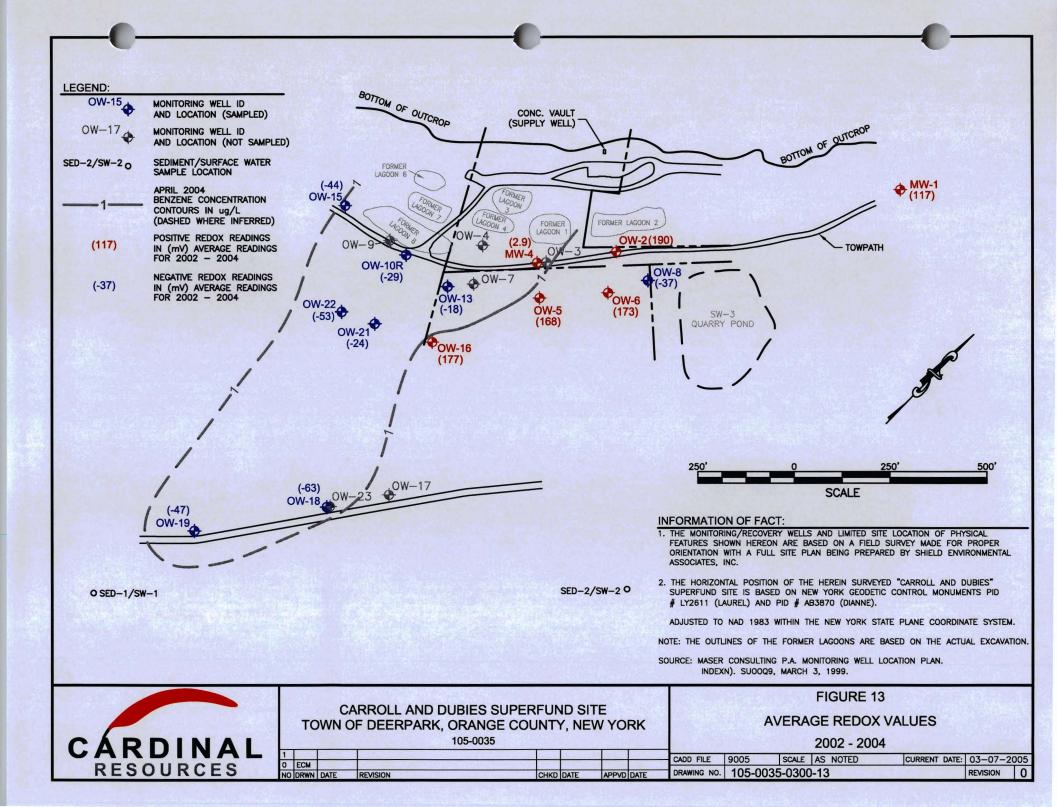


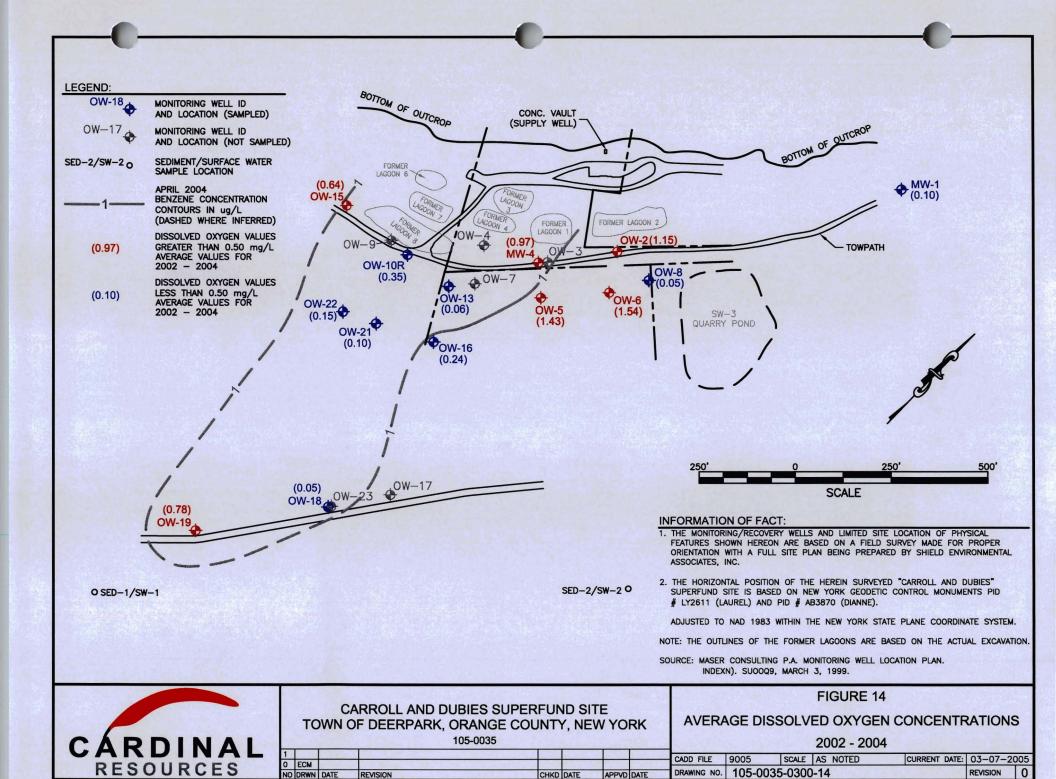
Figure 12

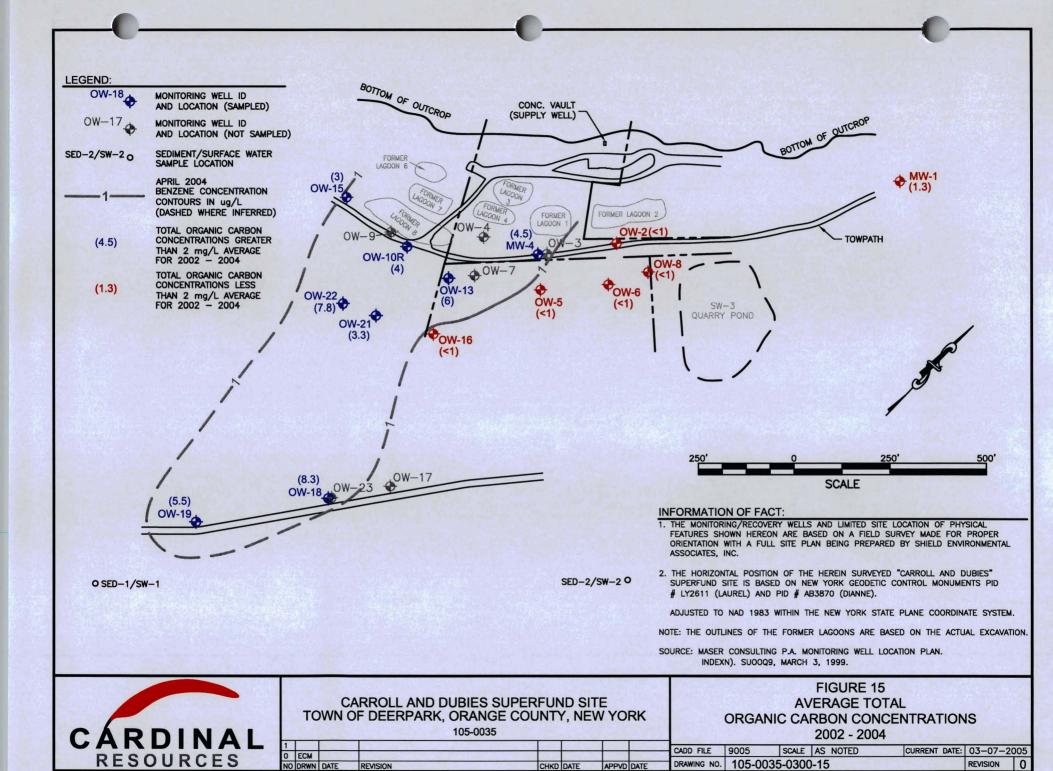
Anaerobic Degradation through Reductive Dechlorination
Pathway for Tetrachloroethene and Trichloroethene



Source: P. L. McCarty, 1996.







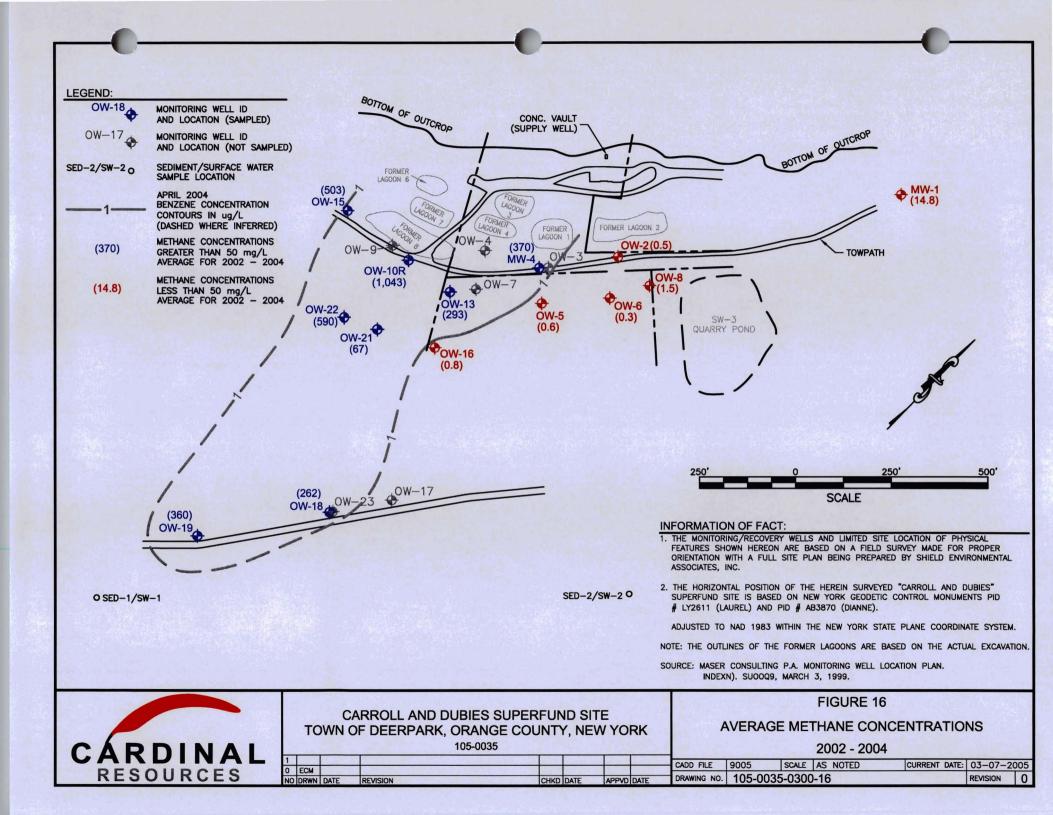
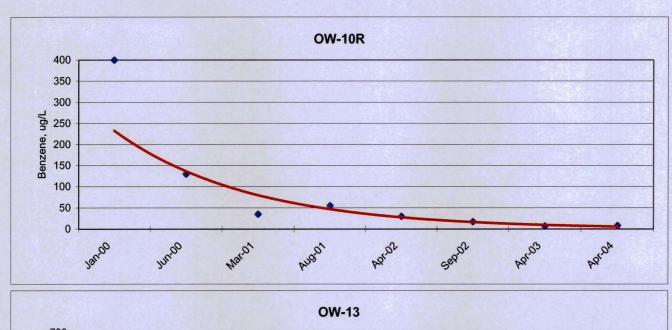
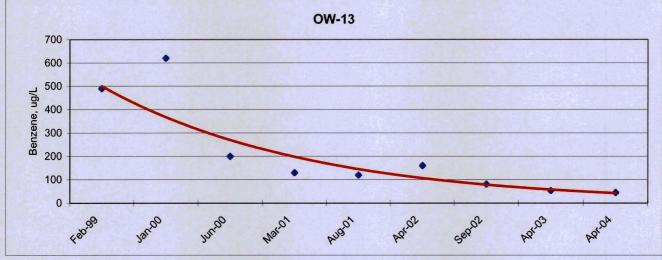


Figure 17
Benzene Concentration Trends
Pre-Excavation to April 2004





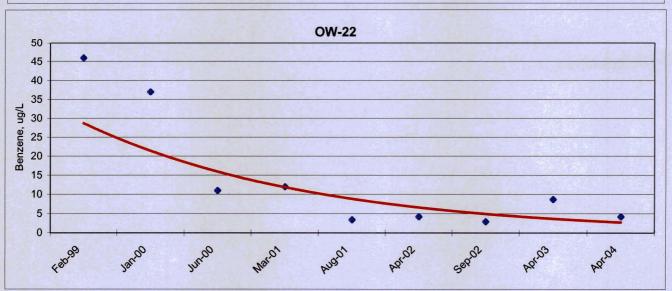
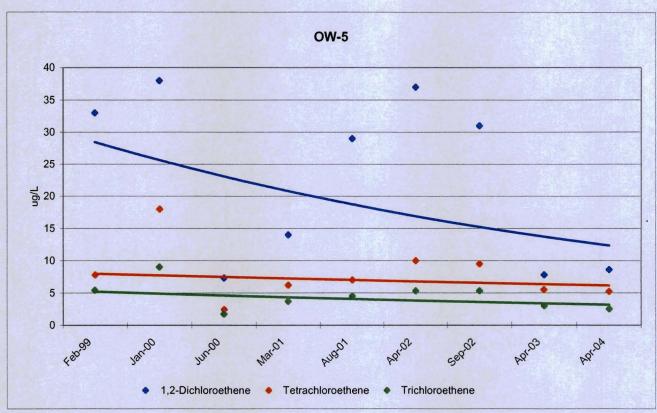


Figure 18
Chlorinated VOC Concentration Trends
Pre-Excavation to April 2004



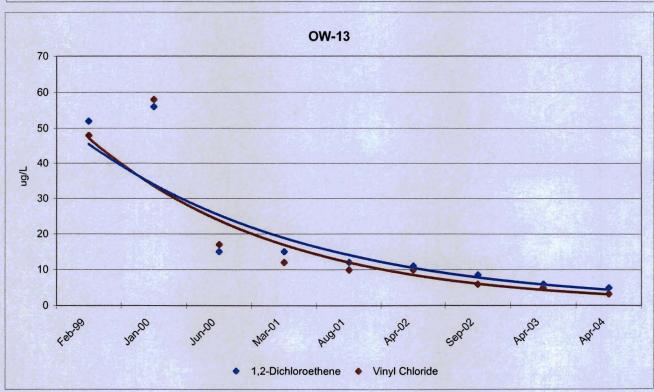
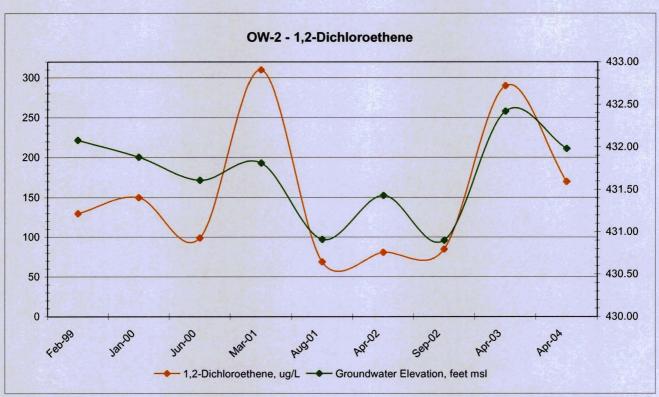


Figure 19
Relationship Between Groundwater Elevations
and Chlorinated VOC Concentrations



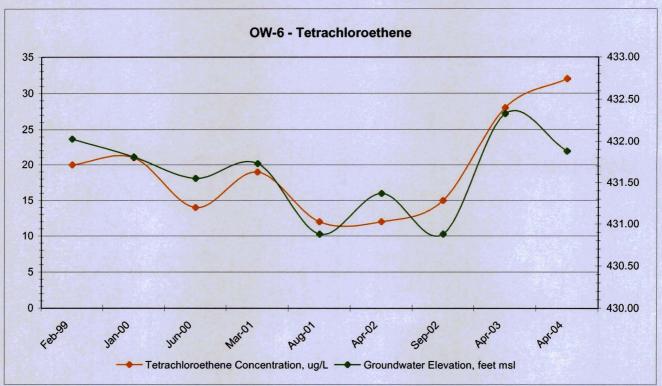


Figure 20
Predicted Range of Time for Monitoring Wells to Achieve
Benzene SGV of 1 ug/L and MCL of 5 ug/L<sup>(1)</sup>

	1 4	artist Table											-	Later Control	ALL LANG		The Control of the			- Maria
YES	Heli									Ye	ear		-17		412			44.57	W.	
Well	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
MW-4	•				•••••						<b>生</b> 位		13			46.5				
OW-10R													-95-8							
		••••																		
OW-13							•													
OW-15							•••••													
OW-19				•					***************************************		• • • • • • • • • • • • • • • • • • • •								¥ (B)	
OW-21								•												
OW-22			•												2				13	

### Notes:

(1)SGV = 1 ug/L; MCL = 5 ug/L. MCL of 5 ug/L was met in all wells but OW-10R and OW-13 in the following years: MW-4: 2003; OW-19: 2000; OW-21: 2001; OW-22: 2004.

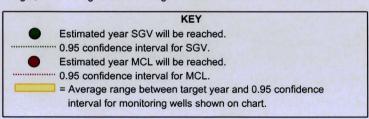
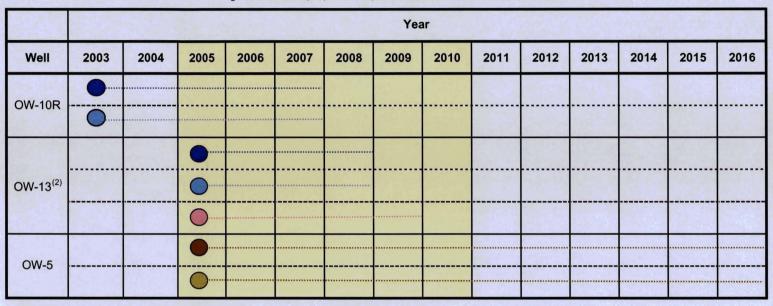
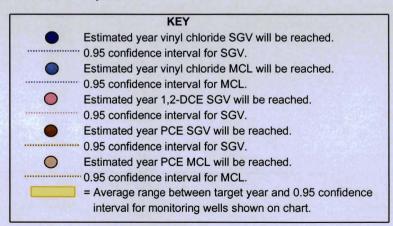


Figure 21
Predicted Range of Time for Monitoring Wells to Achieve
Vinyl Chloride, 1,2-DCE, and PCE SGVs and MCLs<sup>(1)</sup>

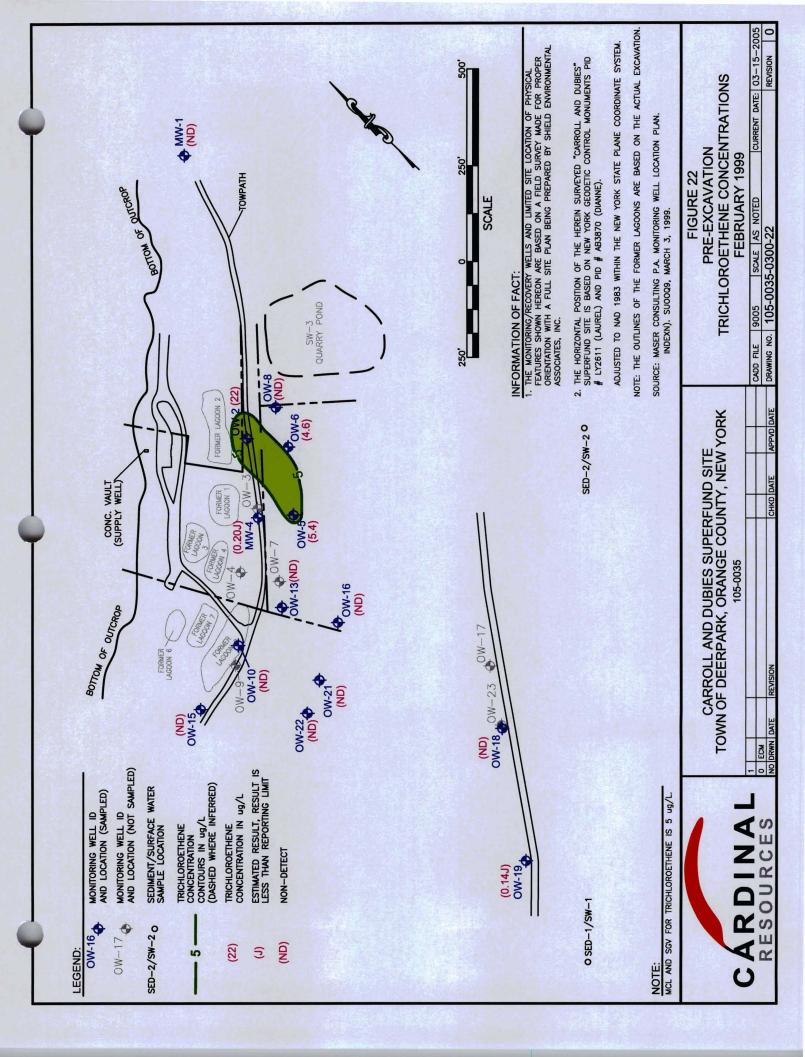


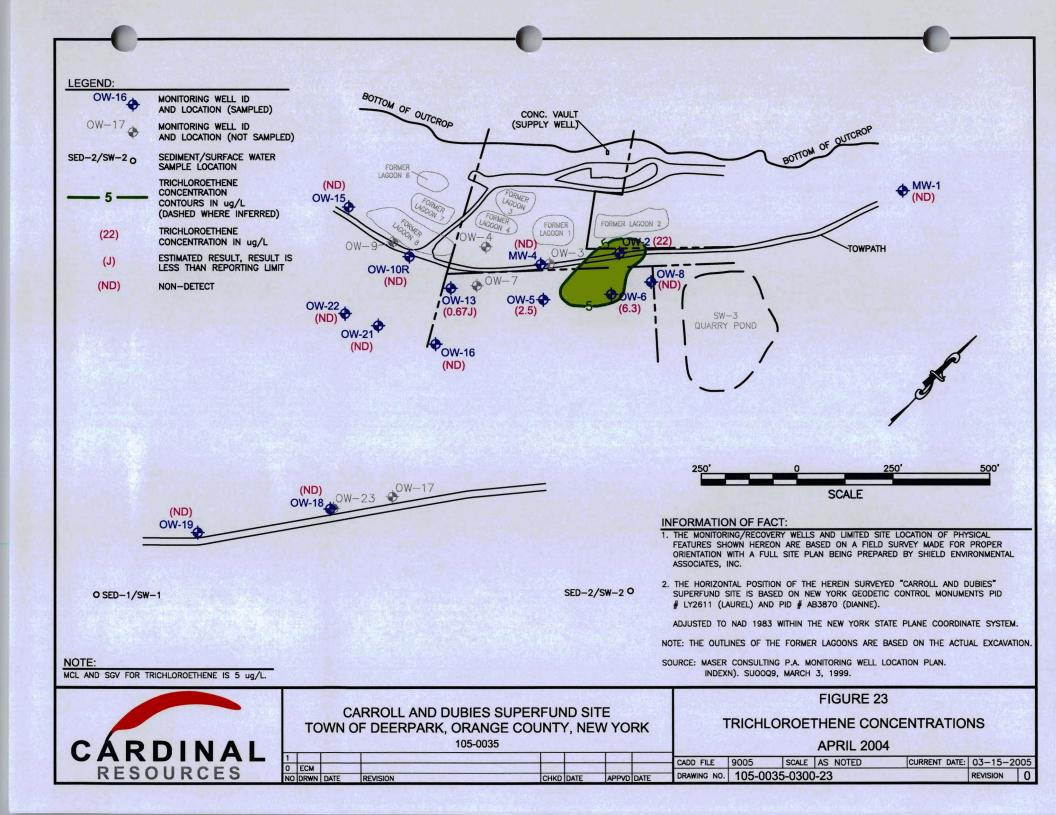
### Notes:

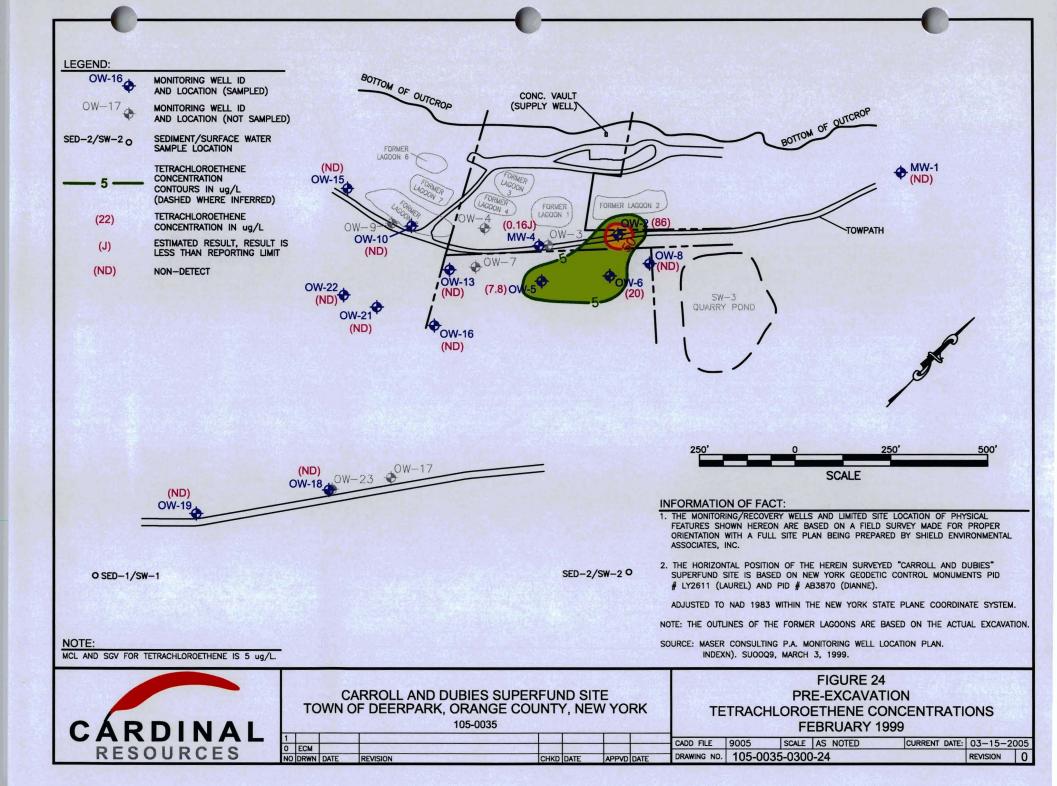
<sup>(2)</sup>MCL for 1,2-DCE already met.

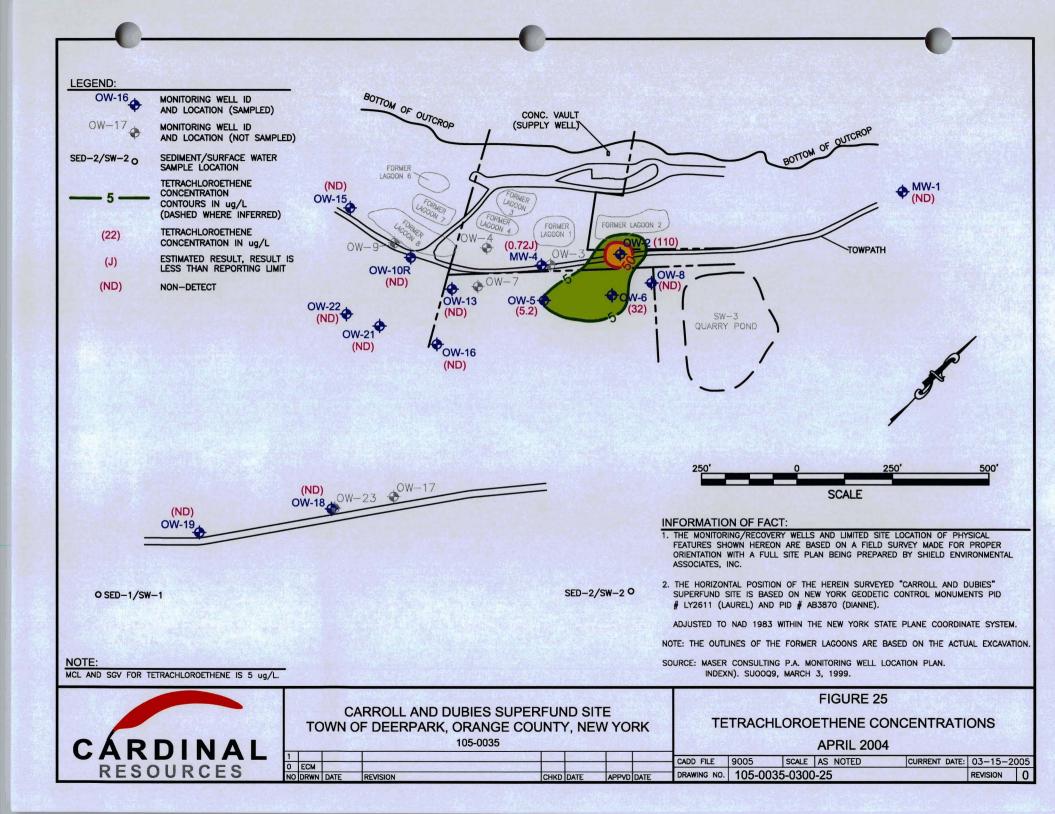


<sup>(1)</sup>SGV and MCL for vinyl chloride is 2 ug/L. SGV for 1,2-DCE is 5 ug/L, and the MCL is 70 ug/L; SGV and MCL for PCE is 5 ug/L.









Appendix A
Summary of Natural Attenuation Field Monitoring Parameters

Appendix A
Summary of Natural Attenuation Field Monitoring Parameters
April 2004
Carroll and Dubies Superfund Site
Town of Deerpark, Orange County, New York

				Specific	Dissolved		
Well ID	Date	Temperature	펍	Conductance	Oxygen	Redox	Turbidity
		(0°)	(standard units)	(uS/cm)	(mg/L)	(mV)	(NTU)
	04/20/95	12.90	6.25	178	1.30	82.0	NA
	02/18/99	8.16	5.89	409	1.87	261.6	543.10
	01/05/00	10.52	5.76	387	0.28	140.7	-11.70
	00/90/90	10.79	6.31	333	-1.83	171.6	135.70
MANA 4	03/15/01	7.80	6.37	380	0.00	96.0	4.70
1 - 0 0 10 1	08/29/01	10.56	6.64	368	0.32	137.5	1.05
	04/25/02	10.02	5.66	519	0.24	98.1	2.02
	09/18/02	11.30	6.67	429	0.02	8.96	0.00
	04/09/03	9.45	5.49	317	0.00	126.0	-5.40
	04/25/04	9.94	6.04	237	0.13	149.7	0.00
	04/24/95	12.60	6.28	758	2.15	0.7-	NA
	02/19/99	10.38	6.21	1,549	4.13	22.5	43.00
	01/02/00	10.89	5.86	2,559	0.74	-19.8	-11.20
	00/90/90	11.52	6.54	1,449	0.02	19.5	3.20
NAMA. A	03/14/01	9.50	6.21	1,400	00:00	19.0	2.40
******	08/29/01	13.61	6.79	2,011	2.02	15.1	1.67
	04/25/02	11.38	5.89	2,325	3.55	-22.7	0.47
	09/18/02	13.62	6.49	1,996	0.04	13.7	12.60
	04/09/03	11.50	5.72	1,600	0.00	-27.0	0.10
	04/26/04	11.03	6.51	867	0.27	38.9	2.90
	04/23/95	12.10	5.44	148	1.02	342.0	NA
	02/17/99	9.53	5.25	384	3.84	157.4	10.10
	01/05/00	10.93	5.20	517	99.0	241.2	-11.80
	06/06/00	11.80	5.75	232	0.26	303.3	08'0
CWC	03/15/01	10.60	5.65	320	0.00	242.0	2.60
7440	08/29/01	13.56	5.75	253	0.84	230.4	0.83
	04/25/02	10.00	5.02	324	0.68	166.7	0.00
	09/18/02	13.65	5.68	244	0.02	200.0	0.00
	04/09/03	10.75	4.87	285	2.29	188.0	-6.80
	04/26/04	10.90	5.67	153	1.61	203.3	0.00

Appendix A
Summary of Natural Attenuation Field Monitoring Parameters

### April 2004 Carroll and Dubies Superfund Site Town of Deerpark, Orange County, New York

				Specific	Dissolved		
Well ID	Date	Temperature	Ħ	Conductance	Oxygen	Redox	Turbidity
		(°C)	(standard units)	(nS/cm)	(mg/L)	(mV)	(NTU)
	04/25/95	12.90	2.50	303	1.40	71.0	₹
	02/18/99	10.11	5.44	549	2.50	270.6	10.90
	01/06/00	11.47	5.44	485	0.04	227.0	-11.80
	00/20/90	11.68	6.03	708	0.32	118.2	626.00
OW-5	03/14/01	10.40	5.93	1,100	0.00	129.0	4.70
)	08/30/01	12.14	6.13	397	0.52	200.7	0.61
	04/24/02	11.78	5.47	324	0.00	182.0	0.00
	09/19/02	12.86	96'9	532	0.01	190.5	0.00
	04/10/03	11.61	5.26	575	5.32	146.0	-7.90
	04/25/04	11.11	5.98	360	0.40	151.3	0.00
	04/23/95	12.30	5.55	71	1.75	125.0	NA
	02/18/99	10.37	5.41	132	2.32	207.2	14.90
	01/06/00	14.71	5.37	102	0.55	207.7	-11.10
	00/20/90	12.17	60.9	140	1.05	222.9	1.20
9-MO	03/15/01	10.70	5.73	140	0.00	192.0	6.70
	08/29/01	12.49	6.04	125	0.59	228.9	1.05
	04/24/02	11.19	5.47	127	0.44	159.2	0.00
	09/19/02	12.44	5.82	131	0.10	188.2	0.00
	04/09/03	10.43	4.83	114	1.23	163.0	-4.50
	04/25/04	10.42	5.59	85	4.39	181.5	1.60
	04/20/95	13.50	6.23	79	1.00	11.0	AN
	02/18/99	11.27	6.27	201	1.43	32.8	38.70
	01/06/00	11.73	6.13	143	0.11	-50.3	-5.60
	00/20/90	10.52	6.7	195	0.04	-21.5	4.70
8-WO	03/15/01	10.10	6.54	220	0.00	-74	12.90
)	08/29/01	11.47	6.87	195	0.25	20.5	5.31
	04/24/02	11.24	6.30	188	0.07	-45.1	5.88
	09/19/02	11.58	6.93	199	0.00	-28.9	56.50
	04/09/03	9.94	5.56	184	0.00	-45.0	1.60
	04/25/04	9.81	6.29	142	0.11	-27.7	3.73

Appendix A
Summary of Natural Attenuation Field Monitoring Parameters
April 2004

				L											L
		Redox	(mV)	-87.0	-22.0	-162.3	-42.6	-64	9.7-	-28.4	-16.6	-55.0	-14.0	-5.0	
ite sw York	Dissolved	Oxygen	(mg/L)	1.10	2.08	0.07	-0.08	1.81	1.53	0.84	0.41	0.00	0.13	1.15	
Carroll and Dubies Superfund Site of Deerpark, Orange County, New	Specific	Conductance	(nS/cm)	472	732	714	9//	730	958	1,086	906	499	476	338	
Carroll and Dubies Superfund Site Town of Deerpark, Orange County, New York		చ	(standard units)	6.04	5.95	6.13	6.62	6.37	6.64	5.69	6.38	5.66	6:39	5.62	
Tov		Temperature	(°C)	14.50	12.38	12.49	10.81	10.70	17.53	11.09	12.78	10.41	11.23	11.40	
		Date		04/27/95	02/16/99	01/02/00	00/90/90	03/14/01	08/30/01	04/25/02	09/19/02	04/09/03	04/26/04	04/25/95	

				Specific	Dissolved		
Well ID	Date	Temperature	Hd	Conductance	Oxygen	Redox	Turbidity
		(°C)	(standard units)	(nS/cm)	(mg/L)	(mV)	(NTU)
OW 10	04/27/95	14.50	6.04	472	1.10	-87.0	NA
	02/16/99	12.38	5.95	732	2.08	-22.0	68.10
	01/02/00	12.49	6.13	714	0.07	-162.3	10.10
	00/90/90	10.81	6.62	9//	-0.08	-42.6	6.10
	03/14/01	10.70	6.37	730	1.81	-64	33.40
OM-10P	08/30/01	17.53	6.64	958	1.53	-7.6	23.70
	04/25/02	11.09	5.69	1,086	0.84	-28.4	10.13
	09/19/02	12.78	6.38	906	0.41	-16.6	0.14
	04/09/03	10.41	5.66	499	0.00	-55.0	15.80
	04/26/04	11.23	6.39	476	0.13	-14.0	0.70
	04/25/95	11.40	5.62	338	1.15	-5.0	NA
	02/16/99	11.74	5.94	855	3.59	5.9	NA
	01/06/00	11.16	5.79	996	0.15	-22.3	-11.9
	00/20/90	11.68	6.44	654	0.59	2.5	1.00
OW-13	03/14/01	10.20	6.24	780	7.43	-44	5.30
	08/30/01	12.68	6.61	692	0.94	18.4	0.92
	04/24/02	12.12	5.66	820	0.07	-17.1	0.00
	09/19/02	12.18	6.31	786	0.00	-0.3	0.00
	04/10/03	11.66	5.56	634	0.00	-44.0	-7.40
	04/25/04	11.35	6.19	394	0.15	-11.0	0.35
	04/26/95	13.00	6.12	160	1.50	14.0	NA
	02/16/99	10.98	5.78	384	1.26	-21.2	143.30
	01/02/00	12.29	5.75	393	0.08	-32.1	-9.50
	00/90/90	11.71	6.36	374	-0.09	-16.0	5.10
OW-15	03/14/01	9.00	6.14	480	0.00	-64	24.00
	08/28/01	16.29	6.5	279	0.43	12.6	5.20
	04/25/02	10.05	5.67	349	2.13	-18.2	3.76
	09/18/02	14.84	6.63	339	0.10	-30.5	00.00
	04/08/03	9.87	5.33	420	0.00	-76.0	4.00
	04/23/04	10.83	6.26	293	0.33	-49.3	3.30

Appendix A
Summary of Natural Attenuation Field Monitoring Parameters
April 2004
Carroll and Dubies Superfund Site
Town of Deerpark, Orange County, New York

OI IIOM	Ć.	ļ	-	Specific	Dissolved		
Meli ID	Date	emperature	F	Conductance	Oxygen	Redox	Turbidity
		(၁့)	(standard units)	(mS/cm)	(mg/L)	(mV)	(NTU)
	04/26/95	10.90	69'9	101	2.00	339.0	NA
	02/16/99	10.82	5.51	255	1.44	141.0	NA
	01/06/00	10.95	5.49	314	0.22	175.6	-10.90
	00/20/90	10.18	28.9	257	1.72	232.6	2.70
OW-16	03/14/01	9.50	5.54	250	0.31	242.0	2.90
2	08/29/01	12.07	5.96	241	2.98	262.9	0.97
	04/24/02	11.69	5.29	301	0.10	213.5	0.00
	09/19/02	11.93	5.84	270	0.04	204.7	0.00
	04/10/03	9.82	5.03	268	0.00	128.0	-5.00
	04/25/04	9.61	5.58	224	0.83	162.1	0.05
	04/29/95	11.50	5.65	492	2.05	-46.0	NA
	02/17/99	986	9	758	5.76	-27.9	00.09
	01/02/00	12.83	5.94	1,009	0.05	-71.8	-2.10
	00/80/90	12.56	6.45	831	0.35	-36.8	7.10
OW-18	03/16/01	9.80	6.55	670	0.00	-100	24.00
2	08/28/01	14.87	99.9	651	1.09	-13.4	2.51
	04/24/02	11.25	6.23	496	0.05	-79.2	4.32
	09/17/02	14.71	6.34	891	90.0	-54.9	1.38
	04/08/03	10.01	5.56	869	0.00	-75.0	35.20
	04/23/04	9.95	6.41	605	0.08	-42.0	4.30
	04/28/95	11.80	5.97	335	1.50	-51.0	NA
	02/17/99	9.02	5.94	1,018	2.28	-28.6	29.30
	01/02/00	11.14	5.86	571	0.14	-52.1	-9.60
	00/80/90	12.23	6.45	497	0.27	-22.7	11.10
OW-19	03/16/01	9.60	6.44	540	0.00	-78	3.30
2	08/28/01	15.97	6.5	512	1.19	18.4	4.12
	04/23/02	9.94	5.86	445	90.0	-44.0	11.10
	09/17/02	15.12	6.42	416	0.16	-55.3	1.85
	04/08/03	9.27	5.49	601	2.50	-60.0	22.00
	04/24/04	11.06	6.36	455	0.40	-29.0	22.00

Appendix A
Summary of Natural Attenuation Field Monitoring Parameters

## April 2004 Carroll and Dubies Superfund Site Town of Deerpark, Orange County, New York

				Specific	Dissolved		
Well ID	Date	Temperature	Hď	Conductance	Oxygen	Redox	Turbidity
		(°C)	(standard units)	(mS/cm)	(mg/L)	(mV)	(NTU)
	04/29/95	12.40	5.82	274	1.50	-19.0	NA
	02/16/99	11.94	5.98	625	1.77	-23.1	Ą
	01/04/00	12.07	5.93	741	1.59	-29.2	-0.80
	00/20/90	12.04	6.47	899	0.47	4.7	06:0
OW-21	03/13/01	10.30	6.27	069	3.61	-57	06:9
7	08/30/01	14.51	6.56	929	1.23	19.8	1.63
	04/25/02	11.20	5.89	785	0.00	-32.6	0.11
	09/18/02	12.50	6.63	738	90.0	-12.4	00'0
	04/09/03	10.84	5.51	694	0.00	41.0	-7.90
	04/24/04	12.51	6.33	444	0.33	-8.6	0:30
	04/28/95	13.10	5.88	448	2.00	-46.0	N A N
	02/17/99	10.28	5.87	780	3.20	-33.0	13.80
	01/04/00	11.68	5.79	775	1.40	-45.6	4.00
	00/20/90	12.14	6.42	725	0.50	-34.8	06'0
OW-22	03/13/01	10.70	6.2	950	13.32	-94	5.70
	08/30/01	12.84	6.51	797	0.84	-15.7	0.84
	04/25/02	11.50	5.65	929	0.20	-55.1	0.00
	09/18/02	12.50	6.51	861	0.02	-43.4	0.00
	04/09/03	10.41	5.5	822	0.00	-73	-5.8
	04/24/04	12.65	6.32	505	0.37	-39.5	0.15

### Notes:

NTU = nephelometric turbidity units 1995 Data from RETEC 1995 NA = Not analyzed Appendix B
Summary of Natural Attenuation Analytical Parameters

# Appendix B Summary of Natural Attenuation Analytical Parameters April 2004 Carroll and Dubies Superfund Site Town of Deerpark, Orange County, New York

		Alkalinity	Chloride	Ethane	Ethene	Ferrous Iron	Methane	Nitrate	Sulfate	Sulfide	TOC
Well ID	Date	(ma/L)	(ma/L)	(1/01/)	(1/0/1)	(ma/l )	(  /טוו)	( I/ou/	( I/bu/	( I/ou/	( I/ou/
	02/18/99	150	14	<0.5	<0.5	<0.05	120 B.D	7.7	22	<0.5	2
	01/05/00	130	14	<0.50	<0.50	<0.050	62 B	8.8	37	<0.50	1
	00/90/90	100	48	<0.50	<0.50	<0.050	76 D,B	4.1	15	<1.0	2
	03/15/01	140	5.8	<1.0	<1.0	620'0	86 D,B	2.9	15	<1.0	-
MW-1	08/29/01	150	8.4	<0.50	<0.50	0.079	99 D,B	0.3	10	<1.0	2
	04/25/02	150	11.6	<0.50	<0.50	090'0	35 B	13	22	<1.0	2
	09/18/02	150	8.4	<0.50	<0.50	0.0	13	0.39	17.4	<1.0	2
- 50.9	04/09/03	130	4.7	<0.5	<0.5	0.0	11	1.8	19.4	<1.0	<1.0
	04/25/04	120	4.6	<0.5	<0.5	0.0	0.26 J	5.4	12.1	<1.0	1
	02/18/99	290	330	<0.5	<0.5	15	1,400 B,D	0.08 J	28	<0.5	4
	01/05/00	250	029	<0.50	<0.50	53	280 D,B	<0.1	38	<0.50	4
	00/90/90	200	250	<0.50	<0.50	8.9	1,100 D,B	0.3	40	<0.50	4
	03/14/01	160	235	<0.50	<0.50	1.5	460 D,B	2.3	89	<1.0	5
MW-4	08/29/01	270	403	<0.50	<0.50	6.6	2,900 D,B	0.1	55	<1.0	9
	04/25/02	300	319	<5.0	<5.0	19	500 D,B	<0.1	230	<1.0	7
	09/18/02	260	213	<1.0	<1.0	5	540	1.2	210	<1.0	7
	04/09/03	180	219	<0.5	<0.5	2.2	66	7.0	150	<1.0	2
	04/26/04	200	149	<0.5	<0.5	3.4	340	1.0	128	<1.0	2
	04/23/95	TN	TN	TN	TN	IN	TN	11	44	<0.2	TN
	02/17/99	45	14	<0.5	<0.5	<0.05	0.49 J,B	9.6	87	<0.5	1
	01/05/00	51	25	<0.50	<0.50	<0.050	0.23 J,B	14 J	160	1.4	1
	00/90/90	46	12	<0.50	<0.50	<0.050	0.51 B	4.4	33	<1.0	1
OW-2	03/15/01	29	11.2	<0.50	<0.50	<0.050	0.35 J,B	6.2	33	<1.0	1
:	08/29/01	45	10.7	<0.50	<0.50	<0.050	0.57 B	1.2	25	<1.0	1
	04/25/02	55	15.6	<0.50	<0.50	<0.050	0.53 B	8.3	32	1.1	<1
	09/18/02	42	7.4	<0.50	<0.50	0.0	<0.50	2.7	30.3	<1.0	1
	04/09/03	45	8.7	<0.5	<0.5	0.0	<0.5	4.4	55.8	<1.0	<1.0
	04/26/04	45	5.2	<0.5	<0.5	0.0	0.93 J	3.7	27.5	<1.0	۲۷
	04/25/95	NT	N	Z	L	LN	F	0.51	89	<0.2	TN
	02/18/99	42	81	<0.5	<0.5	<0.05	0.45 J,B	3.8 B	12	<0.5	1
	01/06/00	62	21	<0.50	<0.50	<0.050	0.49 J,B	12	110	0.79	1
	00/20/90	96	170	<0.50	<0.50	3.8	17	1.6	68	5.9	1
OW-5	03/14/01	110	131	<0.50	<0.50	0.42	3.8 B	7.1	220	<1.0	2
:	08/30/01	79 J	18.5	<0.50	<0.50	<0.050 J	3.1B	8.5 J	55	<1.0	1
	04/24/02	09	9.1	<0.50	<0.50	<0.050	0.77	0.5	64	<1.0	۷1
	09/19/02	98	20.6	<0.50	<0.50	0.0	0.99	7.6	76	<1.0	2
	04/10/03	100	27.8	<0.5	<0.5	0.0	<0.5	7	114	<1.0	<1.0
	04/25/04	110	20.5	<0.50	<0.50	0.0	0.21 J	3.4	73.6	<1.0	+

## Appendix B Summary of Natural Attenuation Analytical Parameters April 2004 Carroll and Dubies Superfund Site Town of Deerpark, Orange County, New York

Well ID		Allelinite	Oblemal		PAL			711.7		. 21 0	001
	Date	Alkallility	Culoride	Ethane	Ernene	rerrous Iron	Metnane	Nitrate	Sulrate	Sumde	2
		(mg/L)	(mg/L)	(ng/L)	(ng/L)	(mg/L)	(ng/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
	04/23/95	Ā	M	LΝ	TN	LN	IN	12	23	0.79	TN
	02/18/99	<5.0	3	<0.5	<0.5	<0.05	0.49 J,B	0.1	28	<0.5	<1
	01/06/00	25	4	<0.50	<0.50	<0.050	0.38 J,B	<0.1	29	1.1	<1
	00/20/90	46	43	<0.50	<0.50	<0.050	1.5	0.2	20	<0.50	۲>
9-MO	03/15/01	44	2.2	<0.50	<0.50	<0.050	1.3 B	0.2	17	<1.0	1>
)	08/29/01	36	1.6	<0.50	<0.50	<0.050	1.2 B	<0.1	18	<1.0	۲>
	04/24/02	36	1.6	<0.50	<0.50	0.070	0.72B	0.2	17	<1.0	<b>^</b>
	09/19/02	32	1.7	<0.50	<0.50	0.0	<0.50	0.2	18.4	3.7	۲۷
	04/09/03	24	-	<0.5	<0.5	0.0	<0.5	0.4	22.3	<1.0	<1.0
	04/25/04	27	1.2	<0.5	<0.5	0.0	0.16 J	0.37	21.4	<1.0	<b>1</b> >
	02/18/99	75	3	<0.5	<0.5	9.6	6.0 B	<0.1	13	<0.5	0.6 J
	01/06/00	41	9	<0.50	<0.50	9.7	0.56 B	<0.1	21	<0.50	۲۷
	00/20/90	63	120	<0.50	<0.50	12.1	3.1	<0.1	13	<0.50	۲>
	03/15/01	78	3.1	<0.50	<0.50	4.7	5.3 B	<0.1	17	<1.0	۲>
8-MO	08/29/01	64	2.2	<0.50	<0.50	4.9	3.1 B	<0.1	12	<1.0	۲۷
	04/24/02	65	1.6	<0.50	<0.50	6.7	3.2	<0.1	15	<1.0	۲۷
	09/19/02	53	2.2	<0.50	<0.50	3.8	0.62	<0.10	13.6	3.6	۲۷
	04/08/03	22	3	<0.5	<0.5	3.3	1.3	<1.0	16.7	<1.0	<1.0
	04/25/04	64	2.4	<0.5	<0.5	3.4	1	<0.1	16.1	<1.0	<b>1</b> >
OW-10	02/16/99	340	21	6	0.12 J	55.2	2,900 B,D	0.03 J	<5	<0.5	13
	01/02/00	300	28	<0.50	<0.50	22.1	1,100 D,B	<0.1	10	0.63	11
	00/90/90	320	230	0.97	0.81	43.6	1,700 D	<0.1	48	<0.50	9
	03/14/01	300	7.3	0.62	1.6	12.3	3,700 D,B	<0.1	35	<1.0	4
OW-10R	08/30/01	430 J	7.9	0.41 J	2.1	11.4 J	2,200 D,B	<0.1 J	26	<1.0	9
	04/25/02	490	6.4	<25	<25	44	2,400 D,B	<0.1	23	<1.0	7
	09/19/02	350	4.8	<5.0	<5.0	3.2	720	<0.10	47.4	<1.0	2
	04/09/03	190	<1.0	<0.5	<0.5	2.8	550	<0.1	36.1	<1.0	2
	04/26/04	280	2.4	<2.5	<2.5	0.1	200	<0.1	35.3	<1.0	2
	02/16/99	370	4	3.2	18	17.5	1,300 B,D	0.02 J	31	<0.5	7
	01/06/00	400	79	24	35	24.9	1,100 D,B	<0.1	33	<0.50	10
	00/20/90	280	270	1.5	7.1	12.7	1,200 D	<0.1	26	<1.0	9
	03/14/01	360	9.4	0.95	4.1	11.6	570 D,B	<0.1	21	<1.0	5
OW-13	08/30/01	310 J	7.1	1.2	4.7	8.8 J	930 D,B	<0.1 J	21	<1.0	5
	04/24/02	340	9.2	0.91 J	3.8 J	20	530 D,B	<0.1	51	<1.0	12
	09/19/02	310	7.2	0.34 J	0.87	5.4	290	0.10	33.6	<1.0	2
	04/09/03	290	2.9	<0.5	0.45J	2.2	210	<0.1	31.5	<1.0	4
	04/25/04	250	2.7	0.19 J	0.38 J	2.8	140	<0.1	14.4	<1.0	3

# Appendix B Summary of Natural Attenuation Analytical Parameters April 2004 Carroll and Dubies Superfund Site Town of Deerpark, Orange County, New York

					i						
Well ID	Date	Alkalinity	Chloride	Ethane	Ethene	Ferrous Iron	Methane	Nitrate	Sulfate	Sulfide	100
		(mg/L)	(mg/L)	(ng/L)	(ng/L)	(mg/L)	(ng/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
	02/16/99	140	5	3.2	0.17 J	23.6	3,800 B,D	<0.1	20	<0.5	4
	01/02/00	140	5	<0.50	<0.50	25.6	2,100 D,B	<0.1	16	0.79	4
	00/90/90	120	110	-	<0.50	59.2	3,200 D	<0.1	16	<0.50	4
	03/14/01	170	5.7	1.1	<0.50	18.3	3,700 D,B	<0.1	17	<1.0	5
OW-15	08/29/01	82	2.1	0.45 J	<0.50	7.4	670 D,B	<0.1	21	<1.0	3
	04/25/02	140	4.8	<25	<25	26	1,700 D,B	<0.1	24	<1.0	4
	09/18/02	92	2.3	<1.0	<1.0	3.8	190	<0.10	27.5	<1.0	3
	04/09/03	170	4.5	<0.5	<0.5	4	<0.5	<0.1	14.8	<1.0	1
	04/23/04	150	3.3	<2.5	<2.5	3.2	440	<0.10	5.9	<1.0	4
	02/16/99	75	12	<0.5	<0.5	0.15	0.81 B	0.2	38	<0.5	1
	01/06/00	85	20	<0.50	<0.50	<0.050	2.0 B	0.8	100	<0.50	1
	00/20/90	72	5	<0.50	<0.50	<0.050	8.7	2.6	28	<1.0	1>
	03/14/01	62	4.7	<0.50	<0.50	<0.050	0.32 J,B	5.3	14	<1.0	1
OW-16	08/29/01	61	10.5	<0.50	<0.50	ر 050.0>	4.2 B	3.0 J	20	<1.0	1
	04/24/02	89	13.7	<0.50	<0.50	<0.050	0.85	2	28	<1.0	<b>1&gt;</b>
	09/19/02	70	6.3	<0.50	<0.50	0.0	1.8	1.7	27.6	<1.0	1
	04/10/03	73	104	<0.5	<0.5	0.0	<0.5	4.2	21.4	IN	<1.0
	04/25/04	82	10.8	<0.5	<0.5	0.0	0.25 J	1.6	38.6	<1.0	<b>L&gt;</b>
	02/17/99	220	20	1.6	<0.5	24.1	3,100 B,D	0.1	7 J,G	<0.5	6
	01/02/00	410	21	<0.50	<0.50	48.4	2,500 D,B	0.4	5	0.63	6
	00/80/90	320	120	<0.50	<0.50	34.3	1,100 D	<0.1	5	<0.50	11
	03/16/01	250	7.3	<0.50	<0.50	17.2	1,300 D,B	0.1	14	<1.0	6
OW-18	08/28/01	240	8	<0.50	<0.50	16.6	1,000 D,B	<0.1	11	<1.0	10
	04/24/02	170	2.9	<1.0	<1.0	4.5	97 D	0.2	18	<1.0	4
	09/17/02	320	9	<1.0	<1.0	4.3	310	<0.10	6.5	<1.0	10
	04/08/03	270	8.4	<0.5	<0.5	4	170	0.1	25.7	<1.0	8
	04/23/04	320	10.2	<2.5	<2.5	2.5	470	<0.10	15.2	2.5	11
	04/28/95	IN	NT	TN	TN	IN	TN	1.1	12	<0.2	IN
	02/17/99	140	94	2.9	<0.5	43.8	2,800 B,D	<0.1	10	<0.5	6
	01/05/00	220	13	<0.50	20	39.1	690 D,B	<0.1	18	0.63	2
	00/80/90	180	120	0.17 J	0.15 J	30.1	720 D	<0.1	13	<0.50	9
OW-19	03/16/01	190	7.2	0.22 J	0.39 J	32.4	890 D,B	<0.1	19	<1.0	9
	08/28/01	160	8.6	0.19 J	<0.50	27.1	710 D,B	<0.5 G	14	<1.0	2
	04/23/02	130	4.6	<3.0	<3.0	15.2	400 D,B	<0.1	21	<1.0	4
	09/17/02	120	4.1	0.31 J	<0.50	4	320	<0.10	14.7	<1.0	4
	04/08/03	250	10.2	<0.5	<0.5	3.5	320	<0.1	13.6	<1.0	2
	04/24/04	220	11.6	<2.5	<2.5	3.6	400	<0.1	12.1	<b>~1.0</b>	7
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### Appendix B Summary of Natural Attenuation Analytical Parameters Carroll and Dubies Superfund Site **April 2004**

## Town of Deerpark, Orange County, New York

Sulfide TOC	(mg/L)		3	5 3	50 2	55 30 0 3 0	3 3 3 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	5 3 3 3 2 3	3 3 3 3 3 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0	3 3 3 3 3 3 3 0 0 0 0 0 0 0 0 0 0 0 0 0	2 3 3 3 3 3 3 0 0 0 0 0 0 0 0 0 0 0 0 0	N 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3								
	/L) (mg/L)		6.0>	+	+							<del>                                     </del>		<del>                                     </del>						
	(mg/L) (mg/L)	<0.1 40		<0.1 40																
(   (   /   )		260 B,D		63 B														<del></del>	<del></del>	<del></del>
	(mg/L)	28.6	185	0.0	25.3	25.3	25.3 15.5 0.069	25.3 15.5 0.069	25.3 15.5 0.069 13	25.3 15.5 0.069 13 4.2 2.8	25.3 15.5 0.069 13 4.2 2.8 3.4	25.3 15.5 0.069 13 4.2 2.8 3.4 NT	25.3 15.5 0.069 13 4.2 2.8 3.4 NT	25.3 15.5 0.069 13 4.2 2.8 3.4 NT 47.1	25.3 15.5 0.069 13 4.2 2.8 3.4 NT 47.1 69.5	25.3 15.5 0.069 13 4.2 2.8 3.4 NT 47.1 69.5 34.9	25.3 15.5 0.069 13 4.2 2.8 3.4 NT 47.1 69.5 6.4	25.3 15.5 0.069 13 4.2 2.8 3.4 NT 47.1 36.7 69.5 34.9 6.4	25.3 15.5 0.069 13 4.2 2.8 3.4 NT 47.1 36.7 69.5 34.9 6.4 39	25.3 15.5 0.069 13 4.2 2.8 3.4 NT 47.1 36.7 69.5 34.9 6.4 39 4.2
	(ng/L)	0.28 J	1 080 0	0.000.0	0.24 J	0.23 J	0.24 J 0.23 J <0.50	0.24 J 0.23 J <0.50 <1.0	0.24 J 0.23 J <0.50 <1.0 <1.0	0.24 J 0.23 J <0.50 <1.0 <0.50 <0.50	0.24 J 0.23 J 0.23 J <0.50 <1.0 <0.50 <0.5	0.24 J 0.23 J 0.23 J 0.23 J <0.50 <1.0 <0.50 <0.5	0.24 J 0.23 J 0.23 J 0.23 J 0.50 <1.0 <0.50 <0.5 <0.5 NT 2.7	0.24 J 0.23 J 0.23 J <0.50 <1.0 <0.50 <0.5 <0.5 NT 2.7 <0.50	0.24 J 0.23 J 0.23 J <0.50 <1.0 <0.50 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 0.32 J	0.24 J 0.23 J 0.23 J <0.50 <1.0 <0.50 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <	0.24 J 0.23 J 0.23 J 0.23 J 0.50 0.05 0.05 0.32 J 0.32 J 0.32 J 0.32 J	0.24 J 0.23 J 0.23 J 0.23 J 0.50 0.50 0.50 0.32 J 0.32 J 0.32 J 0.50 0.50 0.50	0.24 J 0.23 J 0.23 J 0.23 J 0.50 <1.0 <0.5 <0.5 0.5 0.5 0.32 J <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50 <0.50	0.24 J 0.23 J 0.23 J 0.23 J 0.50 0.50 0.50 0.32 J 0.32 J 0.32 J 0.32 J 0.32 J 0.32 J 0.32 J 0.32 J 0.32 J 0.32 J 0.50 0.30 O 0.50
	(ng/L)	96.0	<1.5		0.32 J	0.32 J 0.44 J	0.32 J 0.44 J 0.094 J	0.32 J 0.44 J 0.094 J <1.0	0.32 J 0.44 J 0.094 J <1.0 <0.50	0.32 J 0.44 J 0.094 J <1.0 <0.50 <0.50	0.32 J 0.44 J 0.094 J <1.0 <0.50 <0.5 <0.5	0.32 J 0.44 J 0.094 J <1.0 <0.5 <0.5 NT	0.32 J 0.44 J 0.094 J <1.0 <0.50 <0.5 <0.5 NT NT 6.9	0.32 J 0.44 J 0.094 J <1.0 <0.5 <0.5 <0.5 NT 6.9	0.32 J 0.44 J 0.094 J <1.0 <0.50 <0.5 <0.5 NT NT 6.9 22 3.2	0.32 J 0.44 J 0.094 J <1.0 <0.50 <0.5 <0.5 NT 6.9 6.9 22 3.2 1.2	0.32 J 0.44 J 0.094 J <1.0 <0.50 <0.5 <0.5 NT 6.9 22 3.2 1.2 2.4	0.32 J 0.44 J 0.094 J <1.0 <0.5 <0.5 <0.5 NT 0.9 22 22 3.2 1.2 1.2 J	0.32 J 0.44 J 0.094 J <1.0 <0.50 <0.5 0.5 0.5 NT 0.9 22 3.2 3.2 1.2 1.2 J <1.0	0.32 J 0.44 J 0.094 J <1.0 <0.5 <0.5 <0.5 <0.5 NT 6.9 6.9 2.2 2.2 3.2 1.2 1.2 J <1.0 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5 <0.5
	(mg/L)	28	65	310		26	26 38.6	26 38.6 41	26 38.6 41 26.9	26 38.6 41 26.9 21.1	26 38.6 41 41 26.9 21.1 8.3	26 38.6 41 41 26.9 21.1 8.3 NT	26 38.6 41 41 26.9 21.1 8.3 NT	26 38.6 41 41 26.9 21.1 8.3 NT NT 30	26 38.6 41 41 26.9 21.1 8.3 NT NT 150	26 38.6 41 41 26.9 21.1 8.3 NT NT 150 22 30 150	26.3 38.6 41 41 26.9 21.1 8.3 8.3 NT 72 22 30 150 28.2 22.4	26.3 38.6 41 41 26.9 21.1 8.3 8.3 8.3 8.3 150 22 30 150 22.4 22.4 33.9	26.3 38.6 41 41 26.9 21.1 8.3 8.3 NT 72 30 150 150 22.4 22.4 33.9	26.3 38.6 41 41 26.9 21.1 8.3 NT NT NT 150 22 30 150 22.4 33.9 13.7
( )/ com/	(mg/L)	250	210	200		740	1	+			++++		<del>                                     </del>							
		02/16/99	01/04/00	00/20/90	03/13/01	100000	08/30/01	08/30/01	08/30/01 04/25/02 09/18/02	08/30/01 04/25/02 09/18/02 04/09/03	04/25/02 09/18/02 04/09/03 04/24/04	08/30/01 04/25/02 09/18/02 04/09/03 04/24/04 04/28/95	08/30/01 04/25/02 09/18/02 04/09/03 04/24/04 04/28/95	08/30/01 04/25/02 09/18/02 04/09/03 04/24/04 04/28/95 02/17/99	08/30/01 04/25/02 09/18/02 04/09/03 04/24/04 04/28/95 02/17/99 01/04/00	08/30/01 04/25/02 09/18/02 04/24/04 04/28/95 02/17/99 01/04/00 06/07/00	08/30/01 04/25/02 09/18/02 04/24/04 04/28/95 02/17/99 01/04/00 06/07/00 08/30/01	08/30/01 04/25/02 09/18/02 04/09/03 04/24/04 04/28/95 01/04/00 06/07/00 08/30/01 04/25/02	08/30/01 04/25/02 09/18/02 04/29/03 04/28/95 02/17/99 01/04/00 06/07/00 08/30/01 09/18/02	08/30/01 04/25/02 09/18/02 04/29/03 04/28/95 02/17/99 01/04/00 06/07/00 08/30/01 08/30/01 09/18/02 04/09/03
						AN 24	Ow-21	7-MO	7-MO	Ow-2	OW-Z-	7-200	7-200		7-200	- Z-MO	OW-22	OW-22	OW-22	OW-22

TOC - Total Organic Carbon

< = Analyte not detected at method reporting limit.</p>

B - Method blank contamination. The associated method blank contains the target analyte at a reportable level.

D - Result was obtained from the analysis of a dilution.
J - Estimated result; result is less than the reporting limit.
1995 Data from RETEC 1995

NT = Not tested

G - Elevated reporting limit. The reporting limit is elevated due to matrix interference.

### Appendix C Historical Summary of Detected Volatile Organic Compounds in Groundwater

Xvlenes	(total)	5 (S)*	10,000		<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<5.0	<5.0	<3.3	<10	<2.5	<2.5	<2.9	<12	<6.7
Vinvi	Chloride	2 (S)	2		<0.5	<10	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.5	<10	<10	<2.0	0.30 J	0.18 J	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.5	<10	<10	<10	0.72 J	<6.7	<20	<5.0	0.95 J	<5.7	<25	<13
	TCE	5 (S)*	5		<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	0.20 J	0.15 J	<1.0	0.42 J	<1.0	<1.0	<1.0	<1.0	<1.0	22	24	22	22	21	19	32	15	18	18	59	22
	Toluene	5 (S)*	1,000		<0.5	<10	<10	<1.0	L 760.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.1 J	<10	<10	0.16 J	L 060.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<5.0	<5.0	<3.3	<10	<2.5	<2.5	<2.9	<12	1.3 J
	PCE	5 (S)*	5		<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	0.16 J	<1.0	0.30 J	0.66 J	<1.0	<1.0	<1.0	<1.0	0.72 J	90	100	92	98	80	80	160	61	09	89	160	110
	1,1,2,2-PCA	5 (S)*	AN		<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<5.0	<5.0	<3.3	<10	<2.5	<2.5	<2.9	<12	<6.7
Methylene	Chloride	5 (S)*	5		<0.1 B	<10	<10	<1.0	0.35 J,B	<1.0	<1.0	<1.0	1.0 U	<1.0	<1.0	<1.0	<4.1 B,J	<10	<10	<1.0	0.11 J,B	<1.0	<1.0	<1.0	1.0 U	<1.0	<1.0	<1.0	<1.3 B	<10	<10	3.6 J,B	<5.0	<3.3	4.6 J	<2.5	1.2 U	<2.9	<12	<6.7
	2-Hexanone	50 (G)	AN		NR	NR	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NR	NR	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NR	NR	<10	<50	<50	<33	<100	<25	<25	<29	<120	<67
Ethvi-	benzene	5 (S)*	200		<0.5	<10	<10	<1.0	0.14 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.24 J	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<5.0	<5.0	<3.3	<10	<2.5	<2.5	<2.9	<12	<6.7
1.2-DCE	(total)	5 (S)*	02		<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.3 J	<10	<10	9.8	3.3	3.8	3.2	1.5	1.2	1.0	0.84 J	0.50 J	22	130	85	130	150	66	310	69	81	85	290	170
	1,1-DCE	5 (S)*	7		<0.5	<10	<10	<1.0	0.22 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	0.45 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<5.0	<5.0	<3.3	<10	<2.5	<2.5	<2.9	<12	<6.7
	1,2-DCA	0.6 (S)	5		<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<0.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<5.0	<5.0	<3.3	<10	<2.5	<2.5	<2.9	<12	<6.7
	1,1-DCA	5 (S)*	NA		<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	0.13 J	0.11 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<5.0	<5.0	<3.3	<10	<2.5	<2.5	<2.9	<12	<6.7
Chloro-		NA	NA		<0.5	<10	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.5	<10	<10	<2.0	<2.0	<2.0	<2.0	0.26 J	<2.0	<2.0	<2.0	<2.0	<0.5	<10	<10	<10	<10	<6.7	<20	<5.0	<5.0	<5.7	<25	<13
	Chloroform	7 (S)	AN		<0.5	<10	<10	<1.0	0.083 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<5.0	<5.0	<3.3	<10	<2.5	<2.5	<2.9	<12	<6.7
Chloro-	ethane	5 (S)*	NA		<0.5	<10	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.5	<10	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.5	<10	<10	<10	<10	<6.7	<20	<5.0	<5.0	<5.7	<25	<13
Chloro-		5 (S)*	100		<0.5	<10	<10	0.40 J	0.37 J	0.30 J	0.38 J	0.32 J	0.17 J	<1.0	<1.0	<1.0	0.4 J	<10	<10	0.20 J	0.26 J	0.20 J	<1.0	0.21 J	0.21 J	<1.0	<1.0	<1.0	<0.5	<10	<10	<5.0	<5.0	<3.3	<10	<2.5	<2.5	<2.9	<12	<6.7
Carbon	Tetrachloride	5 (S)	5		9.0	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<5.0	<5.0	<3.3	<10	<2.5	<2.5	<2.9	<12	<6.7
Carbon	Disulfide	NA	NA		NR	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NR	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	R	<10	<10	<5.0	<5.0	<3.3	<10	<2.5	<2.5	<2.9	<12	<6.7
1	Benzene	1 (S)	5		0.9 J	<10	<10	0.66 J	0.65 J,B	0.57 J	0.40 )	<1.0	<1.0	<1.0	<1.0	<1.0	18 J	11	15	5.7	6.9 B	4.8	3.6	12	10	7.8	2.2	2.5	<0.5	<10	<10	<5.0	0.46 J	<3.3	<10	<2.5	<2.5	<2.9	<12	1.5 J
	Acetone	50 (G)	NA		NR	<10	<10		<10	<10	10 UJ		10 U		<10	<10	NR	<10	<10		<10		<10		_	<10									Ľ	<25		4		10 U
	Analyte	NYSDEC SGV	U.S. EPA MCL		03/22/93	09/26/94	04/20/95	02/18/99	01/02/00	00/90/90	03/15/01	08/29/01	04/25/02	09/18/02	04/09/03	04/25/04	03/24/93	09/26/94	04/24/95	02/18/99	01/05/00	00/90/90	03/14/01	08/29/01	04/25/02	09/18/02	04/09/03	04/26/04	03/23/93	09/23/94	04/23/95	02/17/99	01/05/00	00/90/90	03/15/01	08/29/01	04/25/02	09/18/02	04/09/03	04/26/04
	An	NYSD	U.S. El	Well ID						MW-1							408.90					WW-4												OW-2						3

Xylenes (total)	5 (S)*	10,000		9.0>	<10	<10	<1.7	<1.0	<1.0	<1.0	<1.2	<1.4	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	53	30 J	<200
Vinyl	2 (S)	2		1.8	<10	<10	<3.3	0.26 J	<2.0	<2.0	<2.5	<2.9	<2.0	<2.0	<2.0	1.1	<10	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.5	<10	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<1.0	<10	<50	<400
TCE	5 (S)*	5		<1.3	<10	<10	5.4	0.6	1.7	3.7	4.5	5.3	5.3	3	2.5	<2.9	f 0.9	f 0'9	4.6	4.6	2.6	3.9	2.3	2.9	3.9	6.8	6.3	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<50	<200
Toluene	5 (S)*	1,000		<0.5	<10	<10	<1.7	0.041 J	<1.0	<1.0	<1.2	<1.4	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	0.097 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.5 J	8 3	<50	25 J
PCE	5 (S)*	5		1.0	<10	<10	7.8	18	2.4	6.2	7.0	10	9.5	5.5	5.2	13	21	61	20	21	14	19	12	12	15	28	32	<0.5	<10	<10	0.17 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<50	<200
1,1,2,2-PCA	5 (S)*	NA		9.0>	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.2	<1.4	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<50	<200
Methylene Chloride	5(S)*	5		<3.8	<10	<10	1.3 J,B	0.25 J,B	<1.0	<1.0	<1.2	1.4 U	<1.0	<1.0	<1.0	<0.7 J,B	<10	<10	3.7 B	0.26 J,B	<1.0	<1.0	<1.0	1.10	<1.0	0.34 J	<1.0	<0.8 B	<10	<10	0.32 J	0.35 J,B	<1.0	<1.0	<1.0	1.0 U	<1.0	<1.0	<1.0	2.9 B	<10	<50	100 J,B
2-Hexanone	50 (G)	AN		NR	NR	<10	<17	<10	<10	<10	<12	<14	<10	<10	<10	NR	NR	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NR	NR	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NR	NR	<50	<2,000
Ethyl- benzene	5(S)*	200		<0.5	<10	<10	<1.7	<1.0	<1.0	<1.0	<1.2	<1.4	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<10	0.14 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	61	<50	<200
1,2-DCE (total)	5(S)*	70		8.0 R	19	7.3	33	38	7.3	14	59	37	31	7.8	8.6	<1.3 J	4.3	<10	7.8	5.1	2.2	6.9	6.7	4.7	7.8	21	21	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<50	<200
1,1-DCE	5 (S)*	7		<0.5	<10	<10	<1.7	0.20 J	<1.0	<1.0	<1.2	<1.4	<1.0	<1.0	<1.0	0.1 J	<10	<10	<1.0	0.28 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	0.22 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<50	<200
1,2-DCA	0.6 (S)	5		9.0>	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.2	<1.4	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<50	<200
1,1-DCA	5 (S)*	AN		<0.5	<10	<10	<1.7	<1.0	<1.0	<1.0	<1.2	<1.4	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<50	<200
Chloro- methane	AN	AN		<1.3	<10	<10	<3.3	<2.0	<2.0	<2.0	<2.5	<2.9	<2.0	<2.0	<2.0	<0.5	<10	<10	<2.0	0.17 J	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.5	<10	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<1.0	<10	<50	<400
Chloroform	7 (S)	NA		<0.5	<10	<10	<1.7	<1.0	<1.0	<1.0	<1.2	<1.4	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	0.083 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3	<10	<50	<200
Chloro- ethane	5 (S)*	AN		<0.5	<10	<10	<3.3	<2.0	<2.0	<2.0	<2.5	<2.9	<2.0	<2.0	<2.0	<0.5	<10	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.5	<10	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<1.0	<10	<50	<400
	5 (S)*	100		0.13	<10	<10	0.20 J	0.29 J	0.19 J	<1.0	0.21 J	0.20 J	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	0.37 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	4 )	<50	23 J
Carbon Tetrachloride	5 (S)	5		<0.5	<10	<10	<1.7	<1.0	<1.0	<1.0	<1.2	<1.4	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<50	<200
- 9	AN	NA		NR	<10	<10	<1.7	<1.0	<1.0	<1.0	<1.2	<1.4	<1.0	<1.0	<1.0	NR.	<10	<10	<1.0	0.58 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NR	<10	<10	0.17 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NR	<10	<50	<200
Benzene	1(S)	5		<3.0 J	<10	<10	0.67 J	0.66 J	0.91 J	0.46 J	<1.2	0.35 J	<1.0	<1.0	0.38 J	<1.3 J	<10	<10	<1.0	0.19 J,B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<10	<10	0.32 J	0.49 J	<1.0	<1.0	0.20 J	0.20 J	<1.0	<1.0	<1.0	37	1,100	2,600	1,900
Acetone	50 (G)	AN		NR	<10	<10	<17	1.3 J	<10	<10	<12	14 U	<10	<10	<10	NR	<10	<10	<10	1.4.1	<10	<10	<10	10 U	<10	<10	<10	NR	<10	<10	<10	<10	<10	<10	<10	10 U	<10	<10	<10	NR	89	<50	<2,000
yte	C SGV	A MCL	Date	03/23/93	09/29/94	04/25/95	02/18/99	01/06/00	00/20/90	03/14/01	08/29/01	04/24/02	09/19/02	04/10/03	04/25/04	03/23/93	09/27/94	04/23/95	02/18/99	01/06/00	00/20/90	03/15/01	08/29/01	04/24/02	09/19/02	04/09/03	04/25/04	03/23/93	09/26/94	04/20/95	02/18/99	01/06/00	00/20/90	03/15/01	08/29/01	04/24/02	09/19/02	04/09/03	04/25/04	10/29/93	09/25/94	04/27/95	02/16/99
Analyte	NYSDEC SGV	U.S. EPA MCL	Well ID						OWE						100	Section 200					S-WO	200											9-MO								OW-10		W. Salah

Analyte	NYSDEC SGV	U.S. EPA MCI	Well ID Date	01/07/00	00/90/90	03/14/01	08/29/01	04/25/02	09/19/02	04/09/03	04/26/04	10/28/93	09/29/94	04/25/95	02/16/99	01/06/00	00/2/00	03/14/01	08/29/01	04/24/02	09/19/02	04/10/03	04/25/04	09/24/94	04/26/95	02/16/99	01/07/00	00/90/90	OW-15 03/14/01	08/28/01	04/25/02	09/18/02	04/08/03	
Acetone	V 50 (G)		H	00/	9,00 <50	1/01 <10	10/6	5/02 <10	3/02 <10	3/03 <10	3/04 <10	3/93 NR		6/95 <10	3/99 <330	3/00 <200	//00 <83	1/01 <50	3/01 <62	1/02 <56	3/02 <33		5/04 <17	1/94 <10	3/95 <10	3/99 <10	1.3 J	3/00 <10	1/01 <10	3/01 2.2 J,B	5/02 <10	3/02 <10	3/03 <10	Į
one Benzene	(S) 1 (S)	L		0 400	0 130 J	0 35	0 55	0 30	11 0	0 6.8	0 8.1	3 230		0 350	30 490	00 620	3 200	0 130	2 120	9 160	3 81			0 <10	0 <10	1.1	J 1.0B	0.91 J	0 1.2	J,B 0.61 J	0.99 J	C 69'0 0	0 1.2	
ne Carbon Disulfide	NA (	-		<17	J <5.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	NR.		<10	<33	<20	<8.3	<5.0	<6.2	<5.6	<3.3		<1.7	<10	<10	<1.0	B 0.92 J	J <1.0	<1.0	J <1.0	J <1.0	J <1.0	<1.0	
Carbon Tetrachloride	(S) 9	2		<17	<5.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<33	<20	<8.3	<5.0	<6.2	<5.6	<3.3		<1.7	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Chloro- de benzene	5(S)*	100		3.6 J,B	3.0 J	3.6	1.4 J	4.0	2.9	3.1	2.2	<1.0	<10	<10	<33	<20	0.84 J	<5.0	<6.2	<5.6	<3.3	<2.5	0.38 J	<10	<10	0.52 J	0.64 J	09.0	U.67 J	0.35 J	0.47 J	0.43 J	C 29.0	
Chloro- ethane	5(S)*	AN		<33	<10	0.80	1.1.1	2.8	1.3 J	0.54 J	0.80	<1.0	<10	<10	<b>29&gt;</b>	<40	<17	<10	<12	<11	<6.7	<5.0	<3.3	<10	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
Chloroform	7 (S)	AN		<17	<5.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<33	3.5 J,B	<8.3	<5.0	<6.2	<5.6	<3.3	<2.5	<1.7	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Chloro- methane	AN	AN		<33	<10	<2.0	<4.0	<2.0	<2.0	<2.0	<2.0	<1.0	<10	<10	29>	<40	<17	<10	<12	<11	<6.7	<5.0	<3.3	<10	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
1,1-DCA	5 (S)*	AN		<17	<5.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	0.4 J	<10	<10	<33	<20	<8.3	<5.0	<6.2	<5.6	<3.3	<2.5	<1.7	<10	<10	0.25 J	0.31 J	0.28 J	<1.0	<1.0	<1.0	<1.0	0.33 J	
1,2-DCA	0.6 (S)	5		<17	<5.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<33	<20	<8.3	<5.0	<6.2	9.5>	<3.3	<2.5	<1.7	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
1,1-DCE	5(S)*	7		<17	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<33	<20	<8.3	<5.0	<6.2	9.5>	<3.3	<2.5	<1.7	<10	<10	<1.0	0.57 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
1,2-DCE (total)	5 (S)*	70		<17	<5.0	1.0	3.5	2.7	1.5	<1.0	0.57 J	12	69	20	52	99	15	15	12	11	8.5	6.9	4.9	<10	<10	0.38 J	<1.0	<1.0	0.37 J	<1.0	<1.0	<1.0	<1.0	
	5(S)*	200		4.3 J	2.2 J	0.89 J	<1.0	2.0 U	0.91 J	<1.0	0.22 J	0.2.0	<10	<10	<33	2.3 J	5.5 J	4.0 J	<6.2	<5.6	1.8.1	1.6 J	1.0.1	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
2-Hexanone	50 (G)	AN		<170	<50	<10	<20	<10	<10	<10	<10	NR	NR	<10	<330	<200	<83	<50	<62	>26	24 J	<25	<17	NR	<10	<10	<10 (	<10	<10	<10	<10	<10	<10	
Methylene Chloride	5 (S)*	5		<17	<5.0	<1.0	<1.0	1.2 U	<1.0	0.43 J	1.0 U	1.2 J,B	<10	<10	18 J,B	<20	<8.3	3.0 J	<6.2	<5.6	<3.3	<2.5	<1.7	<10	<10	<1.0	0.35 J,B	<1.0	<1.0	<1.0	1.0 U	<1.0	<1.0	
1,1,2,2-PCA	5 (S)*	NA		<17	<5.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<33	<20	<8.3	<5.0	<6.2	<5.6	<3.3	<2.5	<1.7	<10	<10	<1.0	0.15 J,B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1
PCE	5 (S)*	5		<17	<5.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<33	<20	<8.3	<5.0	<6.2	<5.6	<3.3	<2.5	<1.7	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Toluene	5 (S)*	1,000		8.5 J	0.52 J	0.44 J	<1.0	1.0 U	0.39 J	<1.0	0.27 J	4.8	<10	<10	7.6 J	2.7 J,B	<8.3	<5.0	<6.2	5.6 U	<3.3	<2.5	0.31 J	<10	<10	<1.0	0.074 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
TCE	5 (S)*	5		<17	<5.0	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	C 6.0	<10	<10	<33	1.3 J	<8.3	<5.0	1.1 J	1.2 J	<3.3	<2.5	0.67 J	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Vinyl	2 (S)	2		101	2.2 J	2.4	9.5	4.5	6.3	0.72 J	0.99 J	<1.0	6	34	48 J	58	17	12	6.6 J	6.6	£.9 J	4.9 J	3.2 J	<10	<10	1.5 J	1.4.1	1.0.1	1.1 J	0.52 J	0.91 J	<2.0	<1.0.1>	
Xylenes (total)	5(S)*	10,000		6.2 J	<5.0	<1.0	<2.0	1.0 U	<1.0	<1.0	<1.0	0.8 J	<10	<10	<33	<20	<8.3	<5.0	<6.2	<5.6	<3.3	<2.5	<1.7	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	

	Vinyl	2(S)	2		<10	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<10	<10	<3.3	0.29 J	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<10	<10	10	2.1	<2.0	1.3 J	<2.0	<2.0	<2.0	0.68 J	0.56 J
	TCE	5 (S)*	5		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<1.7	0.14 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	0.14 J	0.15 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Toluene	5 (S)*	1,000		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	1.1	<1.7	0.22 J	<1.0	<1.0	<1.0	1.0 U	<1.0	<1.0	<1.0	<10	<10	0.16 J	0.15 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	PCE	5 (S)*	5		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<1.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	1,1,2,2-PCA	5 (S)*	AN		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<1.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Methylene Chloride	5 (S)*	5		<10	<10	<1.0	0.30 J,B	<1.0	<1.0	0.80 J	1.9 U	<1.0	<1.0	<1.0	<10	<10	1.0 J,B	0.40 J,B	<1.0	<1.0	<1.0	1.6 U	<1.0	<1.0	<1.0	<10	<10	0.16 J,B	0.25 J,B	<1.0	<1.0	<1.0	1.0 U	<1.0	<1.0	<1.0
	2-Hexanone	50 (G)	NA		NR	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NR	<10	<17	<10	<10	<10	<10	<10	<10	<1.0	<10	NR	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
45	Ethyl- benzene	5 (S)*	700		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<1.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
John of Deel park, Clange County, New York	1,2-DCE (total)	5 (S)*	20		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	0.54 J	<1.0	<1.0	0.38 J	0.38 J	0.28 J	<1.0	<1.0	<1.0	<10	<10	3.3	1.5	1.0	0.96 J	0.46 J	0.43 J	<1.0	0.81 J	0.58 J
	1,1-DCE	5 (S)*	7		<10	<10	<1.0	0.61 J	<1.0	<1.0	0.36 J	<1.0	<1.0	<1.0	<1.0	<10	<10	<1.7	0.29 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<1.0	<1.0	<1.0	<1.0	0.35 J	<1.0	<1.0	<1.0	<1.0
in or	1,2-DCA	0.6 (S)	2		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<1.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<1.0	0.27 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
100	1,1-DCA	5(S)*	AN		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<1.7	0.66 J	0.24 J	<1.0	0.18 J	<1.0	0.36 J	<1.0	<1.0	<10	<10	0.27 J	0.16 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Chloro- methane	NA	AN		<10	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<10	<10	<3.3	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<10	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Chloroform	7 (S)	AN		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<1.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Chloro- ethane	5 (S)*	AN		<10	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<10	<10	1.0 J	3.0	1.3 J	<2.0	<2.0	<2.0	1.3 J	1.2 J	0.74 J	15	<10	6.1	2.7	1.9 J	1.4 J	0.92 J	0.71 J	0.73 J	1.7 J	1.3 J
	Chloro-	5(S)*	100		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	101	3.4	4.5	4.6	3.0	3.6 J	4.3	5.5	9.6	7.3	5 3	69	7.1	10	5.5	3.8	7.2 J	6.5	4.9	4.9	9
	Carbon	5(S)	5		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<1.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Carbon	NA	AN		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<1.7	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Benzene	1(S)	5		<10	<10	<1.0	0.082 J,B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	12	4.7	5.6 B	4.8	3.1	2.4 J	1.5	2.9	2.9	3.3	101	8	5.8	3.7B	2.3			1.3	0.64 J	8	2.1
	Acetone	50 (G)	AN		4 <10	2 <10	9 <10	1.4 J	0 <10	1 <10	1 <10	10 U	2 <10	3 <10	4 <10	4 <10	5 <10	9 <17	2.7 J		10 UJ	1 2.3 J,B	10 U	2 <10		4 10 U	4 <10	5 <10	9 <10	0.94 J			2				10 D
	Analyte	NYSDEC SGV	U.S. EPA MCL	Date	09/24/94	04/26/95	02/17/99	01/06/00	00/20/90	03/14/01	08/28/01	04/24/02	09/19/02	04/10/03	04/25/04	09/23/94	04/29/95	02/17/99	01/02/00	00/80/90	03/16/01	08/28/01	04/24/02	09/17/02	04/08/03	04/23/04	09/27/94	04/28/95	02/17/99	01/02/00	_		08/28/01	04/23/02	09/17/02	04/08/03	04/24/04
	An	NYSD	U.S. E	Well ID						OW-16											OW-18											OW-19					

## Appendix C Historical Summary of Detected TCL Volatile Organic Compounds in Groundwater (ug/L) **April 2004**

### Town of Deerpark, Orange County, New York Carroll and Dubies Superfund Site

Analyte	NYSDEC SGV	U.S. EPA MCL	Well ID						OW-21						0.000					OW-22					
yte	SGV	A MCL	Date	09/22/94	04/29/95	02/16/99	01/04/00	00/20/90	03/13/01	08/30/01	04/25/02	09/18/02	04/09/03	04/24/04	09/24/94	04/28/95	02/17/99	01/04/00	00/20/90	03/13/01	08/30/01	04/25/02	09/18/02	04/09/03	
Acetone	50 (G)	NA		69	<10	<10	<10	<10	10 UJ	10 U	<10	<10	<10	<10	<10	<10	<25	1.5 J	<10	10 UJ	10 U	<10	<10	<10	
Benzene	1(S)	5		63	8 3	5.8	3.8 B	5.4	4.5	3.2	2.4	2.5	3.7	2.9	100	48	46	37 B	11	12	3.4	4.2	2.9	8.7	
Carbon	NA	NA		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<2.5	0.41 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Carbon Tetrachloride	5 (S)	5		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<2.5	<1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Chloro- benzene	5 (S)*	100		<10	<10	0.11 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6	101	8.0	5.8	5.8	8.2	4.6	3.7	4.2	8.5	
Chloro- ethane	5 (S)*	AN		<10	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<10	<10	<5.0	<2.5	<2.0	<2.0	<2.0	<2.0	<2.0	0.66 J	
Chloroform	7 (S)	AN		101	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<2.5	<1.2	<1.0	<1.0	0.34 J	<1.0	<1.0	<1.0	
Chloro- methane	AN	AN		<10	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	5.5	<2.0	<10	<10	<5.0	<2.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
1,1-DCA	5 (S)*	NA		<10	<10	<1.0	0.11 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<2.5	0.21 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	I
1,2-DCA	0.6 (S)	5	100000	<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<2.5	<1.2	<1.0	<1.0	<1.0	0.29 J	<1.0	<1.0	
1,1-DCE	5(S)*	7		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<2.5	<1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	I
1,2-DCE (total)	5 (S)*	02		<10	<10	0.26 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	2.4 J	<1.2	<1.0	0.70 J	0.36 J	<1.0	<1.0	<1.0	
Ethyl- 2 benzene	5 (S)*	200		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<2.5	0.098 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
2-Hexanone	50 (G)	AN		NR	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NR	<10	<25	<12	<10	<10	<10	<10	<10	<10	
Methylene Chloride	5 (S)*	5		<10	<10	<1.0	0.10 J,B	<1.0	<1.0	0.38 J	1.0 U	<1.0	0.51 J	<1.0	<10	<10	1.1 J,B	0.23 J,B	<1.0	<1.0	0.36 J	1.2 U	<1.0	0.40 J,B	
1,1,2,2-PCA	5 (S)*	AN		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<2.5	<1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
PCE	5(S)*	5		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<2.5	<1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Toluene	5 (S)*	1,000		<10	<10	<1.0	0.055 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	11	0.87 J	0.58 J	<1.0	0.56 J	0.45 J	1.0 U	<1.0	<1.0	
TCE	5 (S)*	5		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<10	<2.5	0.073 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Vinyl	2 (S)	2		<10	<10	0.89 J	0.46 J	0.54 J	0.70 J	0.25 J	0.33 J	0.39 J	0.88 J	0.56 J	<10	<10	4.2.J	1.5.1	<1.0	0.76 J	<2.0	0.39 J	<2.0	0.56 J	
Xylenes (total)	5 (S)*	10,000		<10	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	f S	<10	3.5	1.7	1.4	1.9	1.7	2.7 U	1.8	1.6	

TCL = Target Compound List

NYSDEC SGV = New York State Department of Environmental Conservation Standards (S) and Guidance (G) Values for groundwater

U.S. EPA MCL= United States Environmental Protection Agency Maximum Contaminant Level for drinking/groundwater

\* = The principal organic contaminant (POC) standard for groundwater of 5 ug/L applies to this substance.

NA = Not applicable; no criteria specified

NR = Analyte not reported

U (DATA VALIDATION QUALIFIER) = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

J = Estimated result, result is less than reporting limit.

< = Analyte not detected at reporting limit</p>

B = Method blank contamination. The associated method blank contains the target analyte at a reportable level.

UJ = (DATA VALIDATION QUALIFIER) = Analyte not detected above the reporting limit; however, the reporting limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely.

Blue = Analyte detected at less than regulatory limit, or analyte detected but no regulatory criteria specified

R = Data rejected during validation

measure the analyte in the sample.

Red = Concentrations detected at or above regulatory limit

Pre-1999 data from RETEC 1995

Pre-1999 analysis performed by Method 8240 1999 and later analyses performed by Method 8260B

Appendix D
Supporting Information for Calculation of Degradation Rate Constants



### Memorandum

To: Barbara Jones

From: Joyce O'Conno

Date: February 3, 200(5)

Subject: Carroll and Dubies Site - Estimate of Time

This memo summarizes the results of calculations performed to estimate the time until groundwater in the wells at Carroll and Dubies (C&D) decrease to levels that meet the New York State Department of Environmental Conservation Standards (S) and Guidance (G) Values for groundwater (NYSDEC SGV) as well as the United States Environmental Protection Agency (USEPA) Maximum Contaminant Level (MCL) for drinking/groundwater. USEPA's article entitled Calculation and Use of First-Order Rate Constants for Monitored Natural Attenuation entitled Calculation and Use of First-Order Rate Constants for Monitored Natural Attenuation Entitled Studies (November 2002) was used. This publication provides a method for calculating the reduction in contaminant concentration over time at a single point.

The following is a summary of the technique used.

### Methodology

Both parent and degradation compounds are present in groundwater at the site. Therefore, the original compound and the known degradation compounds were totaled for each sampling event. In accordance with the referenced USEPA article, the natural log of these numbers was calculated, and the results were plotted over time in Excel. Excel calculated a linear regression line, and this information was used in the following calculation:

$$T = -Ln[C_{goal}/C_{start}]/K_{point}$$

Where T = time  $C_{goal} = remediation goal$   $C_{start} = contaminant level at time <math>t_0$   $K_{point} = time per year (derived from regression analysis)$ 

After completion of this initial calculation, results were re-calculated using a 95 percent, one-sided confidence interval to incorporate possible error into the equation. Error may be due to fitting a regression line to data points that do not fit perfectly on the regression line. Additionally, there may also be error due to changes in the degradation rate over time. Finally, there may also be error in the calculation of the K<sub>point</sub> because the slope of the regression line is calculated over a error in the calculation of time (5 years maximum).

Copies of the regression analyses and calculations are attached.

Benzene and vinyl chloride trends were both studied with this technique in those wells where trends were noted. Calculations were made of when both the NYSDEC and USEPA goals will be met

A variation on the above technique was used to evaluate the total chlorinated volatile organic compound (CVOC) data in well OW-5. The CVOC total was calculated by summing the PCE, 1,2-DCE and vinyl chloride levels for this well. Because the data shows an oscillating



pattern that may not be due to variations in groundwater elevations, a distinct trend could not be calculated using all of the data (see attached). Therefore, a conservative estimate of the trend was calculated using the three highest levels of CVOCs in this well and the most recent data point (see attached). A trend line was plotted using these data points, and the above methodology was then applied. This trend line results in a conservative number, because it which is the INYSDEC SVG and USEPA MCL for vinyl chloride. This is a very conservative which is the INYSDEC SVG and USEPA MCL for vinyl chloride. This is a very conservative number, because it is the lowest goal for all of the CVOCs, and also is the goal for one constituent rather than a total of the goals for all four compounds of interest.

### Results

The results of these calculations for monitoring wells MW-4, OW-10R, OW-13, OW-19, OW-21 and OW-22 showed the following time estimate:

- MW-4 benzene levels will reach 1 ug/L by 2005, and reached 5 ug/L in 2003
- OW-10R benzene levels will reach 1 ug/L by 2007, and will reach 5 ug/L in 2005; vinyl chloride levels were below 2 ug/L in 2003.
- chloride levels were below 2 ug/L by 2011, and will reach 5 ug/L by 2008; vinyl

  OW-13 benzene levels will reach 1 ug/L by 2011, and will reach 5 ug/L by 2008; vinyl
- chloride levels will reach 2 ug/L by 2008, and reached 5 ug/L in 2000

  OW-19 benzene levels will reach 1 ug/L by 2008, and reached 5 ug/L in 2000
- OW-21 benzene levels will reach 1 ug/L by 2012, and reached 5 ug/L in 2004
   OW-22 benzene levels will reach 1 ug/L by 2007, and reached 5 ug/L in 2004
- OW-52 benzene levels will reach 1 ug/L by 2001; and PCE will reach 5 ug/L by 2005
   OW-5 CVOC levels will reach 2 ug/L by 2011 and PCE will reach 5 ug/L by 2005
- In addition to the previous time calculations, USEPA recommends calculating an upper confidence interval on the slope of the regression (USEPA, 2002) to account for potential error that enters into the calculations. Therefore, assuming a 95 percent confidence interval:
- MW-4 benzene levels will reach 1 ug/L no later than 2011
- OW-10R benzene levels will reach 1 ug/L no later than 2008, and will reach 5 ug/L no later than 2007
- later than 2007

  OW-13 benzene levels will reach 1 ug/L no later than 2015, and will reach 5 ug/L no later than 2012; vinyl chloride levels will reach 2 ug/L no later than 2001;
- OW-19 benzene levels will reach 1 ug/L no later than 2015
- OW-21 benzene levels will reach 1 ug/L no later than 2024
- OW-22 benzene levels will reach 1 ug/L no later than 2010
- OW-5 CVOC levels will reach 2 ug/L no later than 2033 and PCE will reach 5 ug/L not later than 2016

These numbers mean that the length of time that will be required for the levels of these compounds to decrease to the goals are estimated to be no more than the years listed above at a 95 percent level of confidence. It should be noted that t(0.95;n-2) is very high for OW-5, because n-2 is 2. Therefore, this calculation has significant error.

### Conditions

The following should be considered concerning the calculations:

1. For the tests to be statistically significant, you need six sampling dates with sampling intervals of greater than three years (USEPA, 2002). Such data was available for wells OW-10R (benzene), OW-13, OW-19, OW-21 and OW-22. Such data was not available



for MW-4 and OW-10R (vinyl chloride). Levels of benzene in well MW-4 did not show a decreasing trend line until August 2001. Since that date, four additional rounds of sampling data have been collected. Monitoring well OW-10R did not show a decreasing vinyl chloride trend until August 2001. Since that date, four additional rounds of sampling data have been collected. Therefore, there is a wider range of error possible. Also, as stated previously, only four data points were used for the OW-5 regression analysis. This lack of data points increases the error significantly, leading to an upper confidence level of 22 years.

- 2. There is scatter when the natural log of the analytical data is plotted over time. This scatter causes some uncertainty in the regression analysis.
- It is possible that the rate of decay of these compounds may change over time, especially as levels of these compounds approach zero. The previous calculations assume a constant rate of decay.

## Calculations of Time for C&D Monitoring Wells

### Where:

 $T = -Ln [C_{goal}/C_{start}]/K_{point}$ 

T = Time (in years) to reach goal from start date
C<sub>goal</sub> = desired level of constituent

C<sub>start</sub> = level of constituent at the start date

K<sub>point</sub> = time per year (measured from trend line)

### Calculations Using NYSDEC Goals

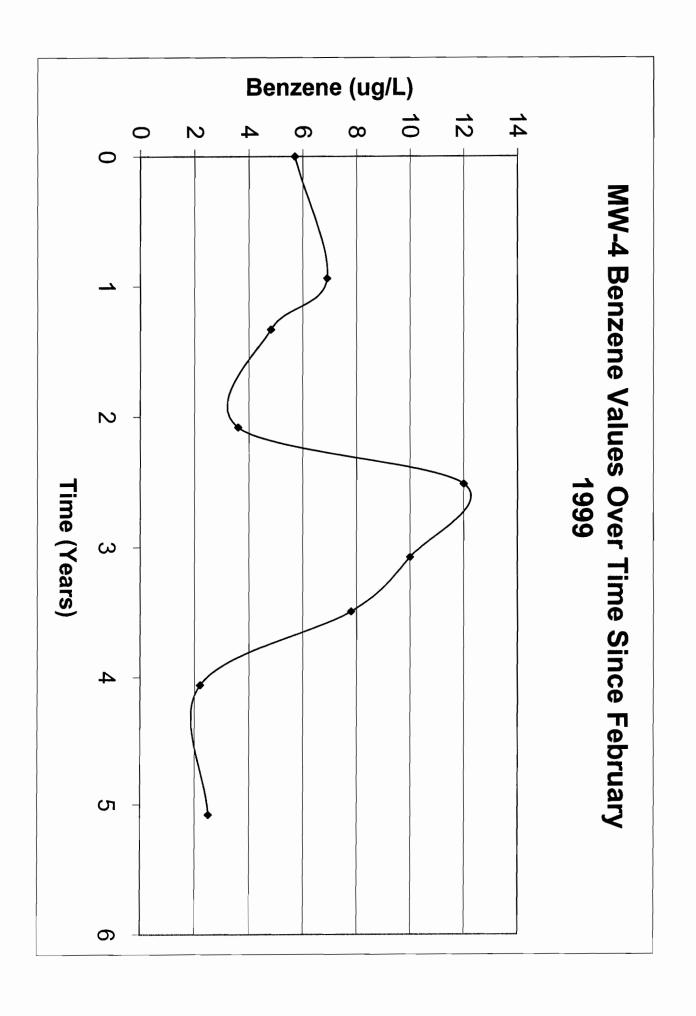
Well	Contaminant of Concern	С <sub>goal</sub> (ppb)	C <sub>goal</sub> (ppb) C <sub>start</sub> (ppb)	Kpoint	Start Year		Time (years Y from start)	Year That Goal Will Be Reached
MW-4	Benzene	_	12	0.7239		2001	3.43	2005
OW-10R	Benzene	<b>-</b>	400	0.8907		2000	6.73	2007
<b>OW-10R</b>	Vinyl Chloride	2	9.5	0.9667		2001	1.61	2003
<b>OW-10R</b>	1,2-DCE	5	3.5	0.7186		2001	-0.50	NA
OW-13	Benzene	_	490	0.5209		1999	11.89	2011
OW-13	Vinyl Chloride	2	48	0.5792		1999	5.49	2005
OW-13	1,2-DCE	თ	56	0.4832		2000	5.00	2005
OW-19	Benzene	_	5.8	0.2108		1999	8.34	2008
OW-21	Benzene	_	5.8	0.1434		1999	12.26	2012
OW-22	Benzene	_	46	0.4963		1999	7.71	2007

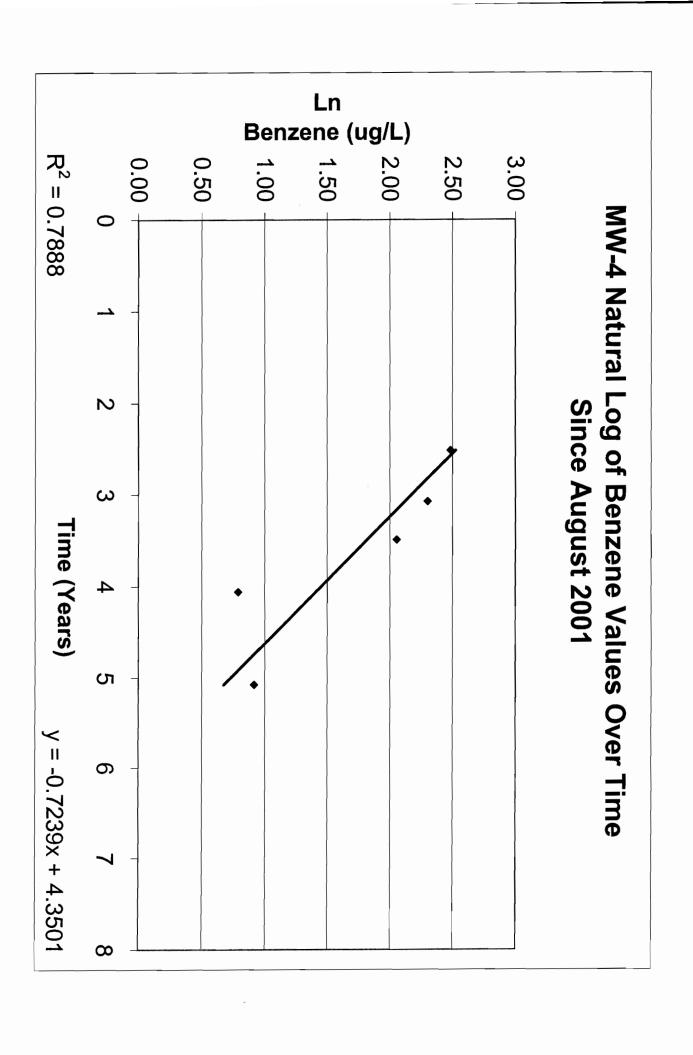
## Calculation of T using 95% confidence interval

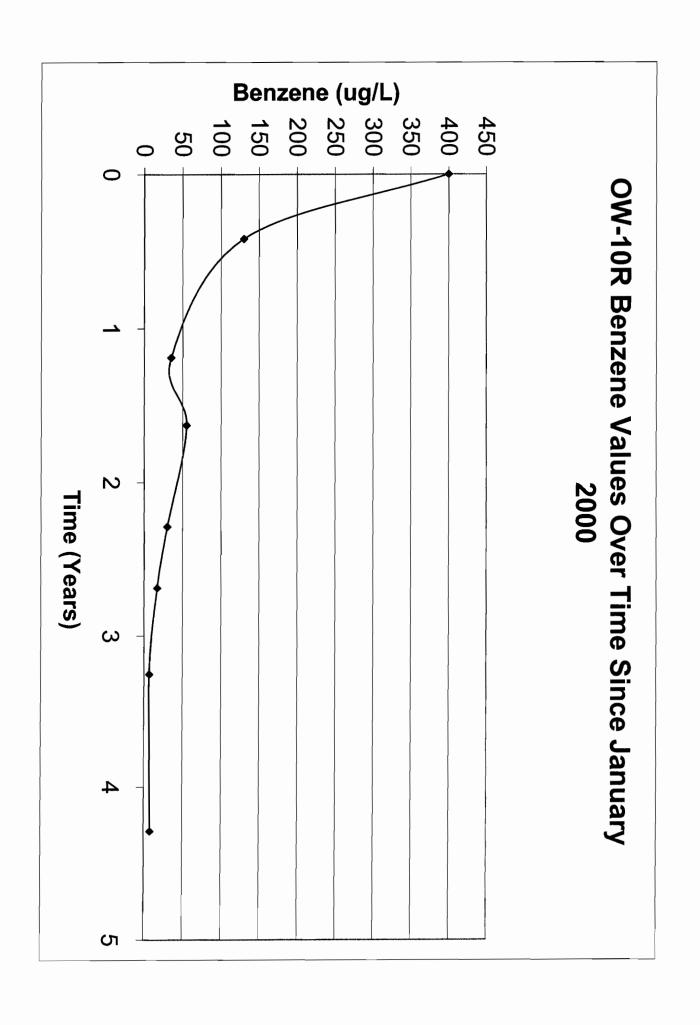
Well	Equation	5	t(0.95:n-2)	v intercept t/0	t(0.95: n-2) + intercept	inv Ln	Time (years from start)
MW-A	y = -0.7239x + 4.3501	თ	2.353	4.3501	6.70		814.93
	y = -0.8907x + 5.3379	<b>%</b>	1.943		7.28		1452.29
-	y = -0.9667x + 3.7873	5	2.353		6.14		464.19
	y = -0.5209x + 6.2879	9	1.895		8.18		3579.22
	y =5792x + 3.9385	9	1.895		5.83		341.55
OW-13	y = -0.4832x + 3.8429	œ	1.943	3.8429	5.79		325.68
	y = -0.2108x + 1.2766	9	1.895		3.17		23.85
	y = -0.1434x + 1.6502	9	1.895		3.55		34.65
	y = -0.4963x + 3.4285	9	1.895		5.32		205 10

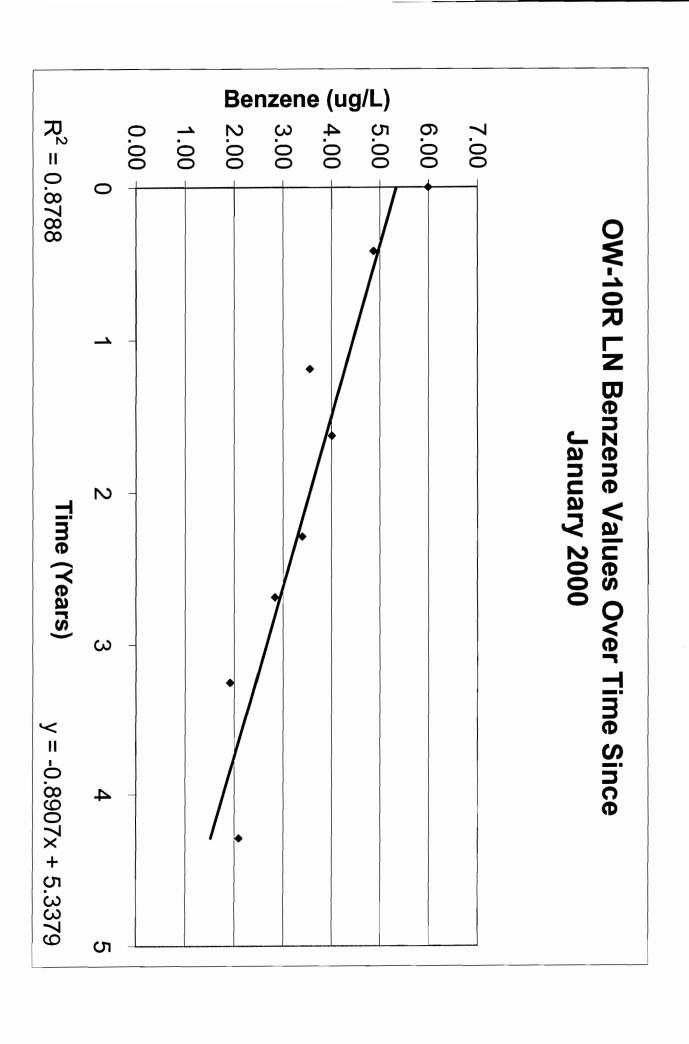
### Calculations Using USEPA MCL

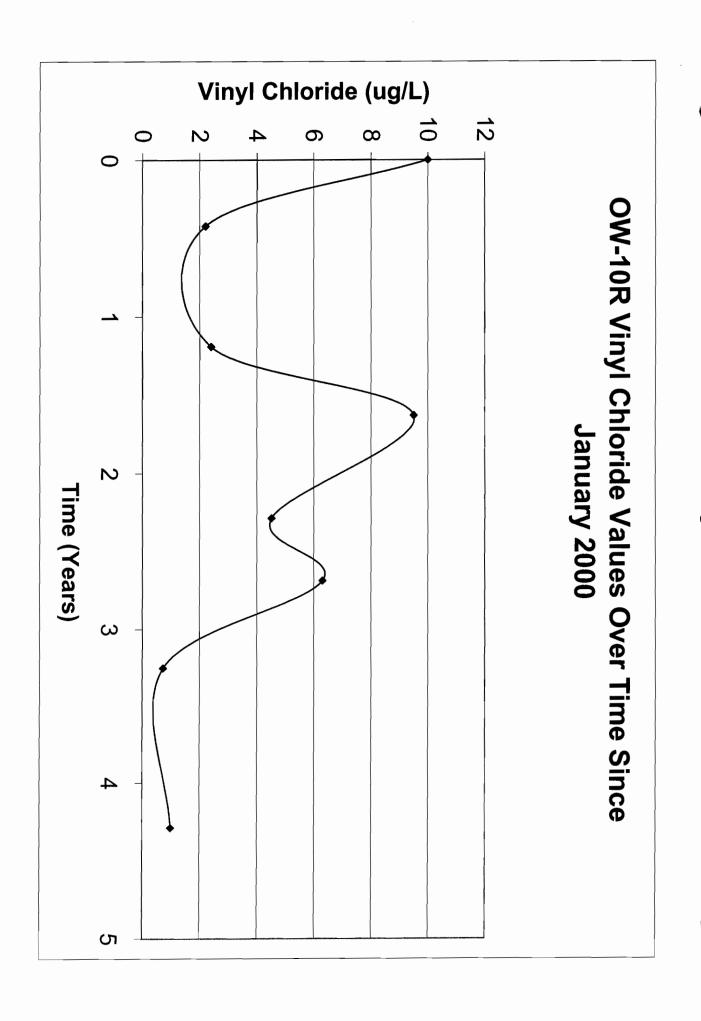
	•						!	
Well	Contaminant of Concern	C <sub>goal</sub> (ppb)	C <sub>goal</sub> (ppb) C <sub>start</sub> (ppb)	Kpoint	Start Year	Time (years Yofrom start)	Year That Goal Will Be Reached	l Historic Results for Comparison
MW-4	Benzene	σı	12	0.7239	2001	1.21	2003	2002 - 7.8 ppb; 2003 - 2.2 ppb
OW-10R	Benzene	σ	400	0.8907	2000	4.92	2005	2003 - 6.8 ppb; 2004 - 8.1 ppb
OW-10R	Vinyl Chloride	2	9.5	0.9667	2001	1.61	2003	2002 - 6.3 ppb; 2003 - 0.72 ppb
OW-10R	1,2-DCE	70	3.5	0.7186	2001	-4.17	N	:
OW-13	Benzene	Ŋ	490	0.5209	1999	8.80	2008	
OW-13	Vinyl Chloride	2	48	0.5792	1999	5.49	2005	2003 - 4.9 ppb; 2004 - 3.2 ppb
OW-13	1,2-DCE	70	56	0.4832	2000	-0.46	N	
OW-19	Benzene	თ	5.8	0.2108	1999	0.70	2000	1999 - 5.8 ppb; 2000 - 2.3 ppb
OW-21	Benzene	Ŋ	5.8	0.1434	1999	1.04	2001	2000 - 5.4 ppb; 2001 - 4.5 ppb
OW-22	Benzene	ഗ	46	0.4963	1999	4.47	2004	2003 - 8.7 ppb; 2004 - 4.2 ppb
Calculatio	Calculation of T using 95% confidence interval	ence interval						
:	<b>!</b>		; ; ;			•	Time (years	Year That Goal Will
Well	Equation	3	t(0.95;n-2)	y intercept	t(0.95;n-2) y intercept t(0.95; n-2) + intercept	lnv Ln	from start)	Be
MW-4	y = -0.7239x + 4.3501	Ŋ	2.353	4.3501	6.70	814.93	7.04	
OW-10R	y = -0.8907x + 5.3379	8	1.943	5.3379	7.28	1452.29	6.37	
OW-10R	y = -0.9667x + 3.7873	σı	2.353	3.7873	6.14	464.19	5.63	
OW-13	y = -0.5209x + 6.2879	9	1.895	6.2879	8.18	3579.22	12.62	
OW-13	y =5792x + 3.9385	9	1.895	3.9385	5.83	341.55	8.87	
OW-19	y = -0.2108x + 1.2766	9	1.895	1.2766	3.17	23.85	7.4	
OW-21	y = -0.1434x + 1.6502	9	1.895	1.6502	3.55	34.65	13.50	2013
OW-22	y = -0.4963x + 3.4285	9	1.895	3.4285	5.32	205.10	7.48	

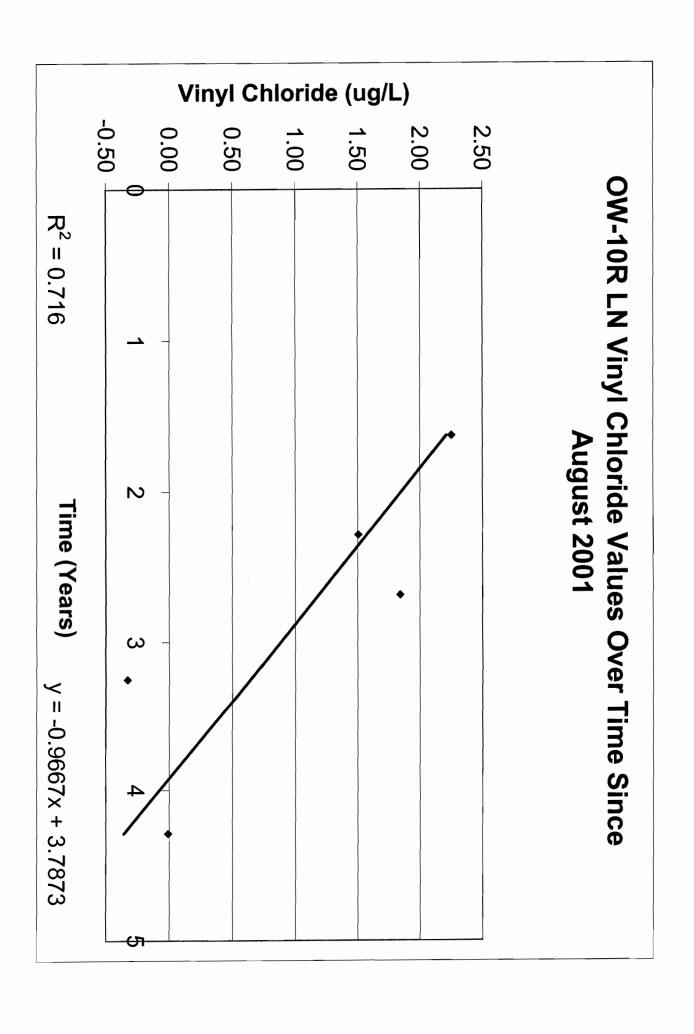


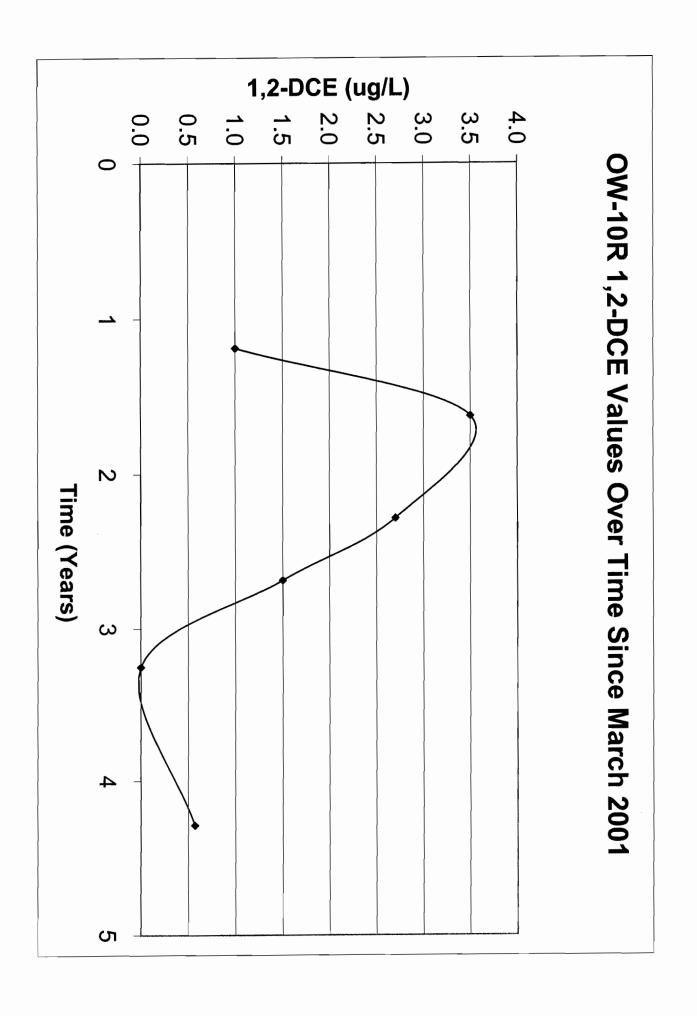


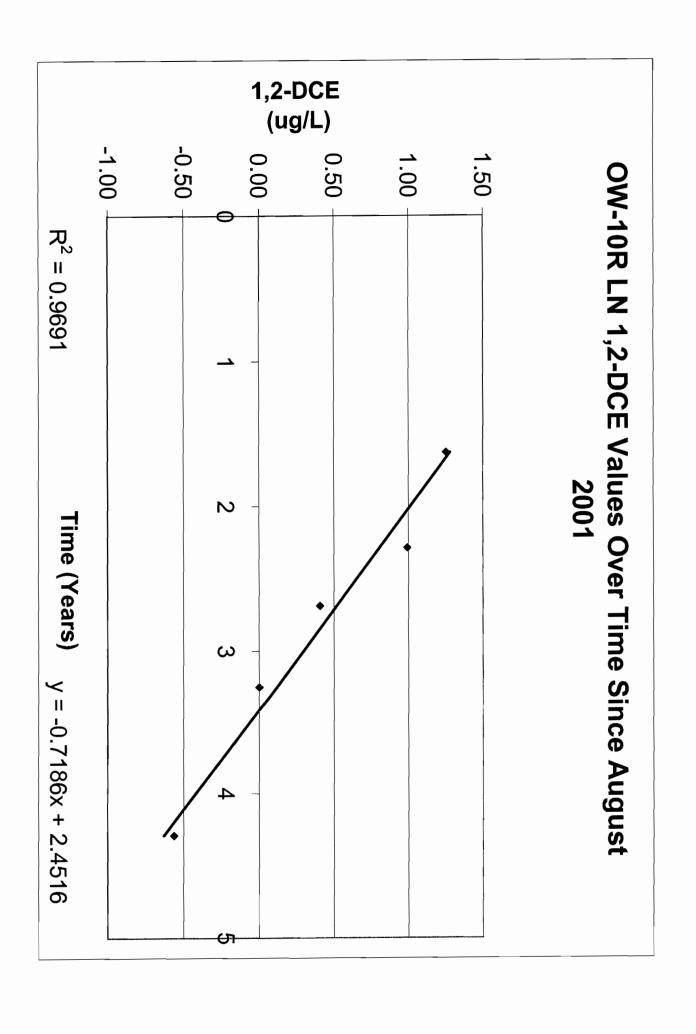


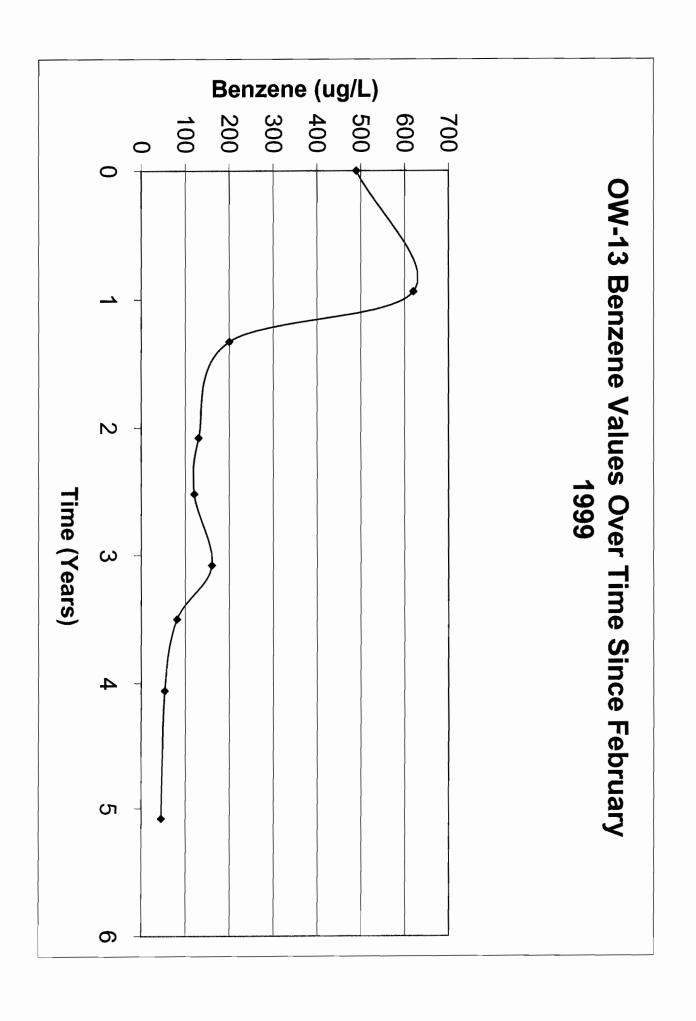


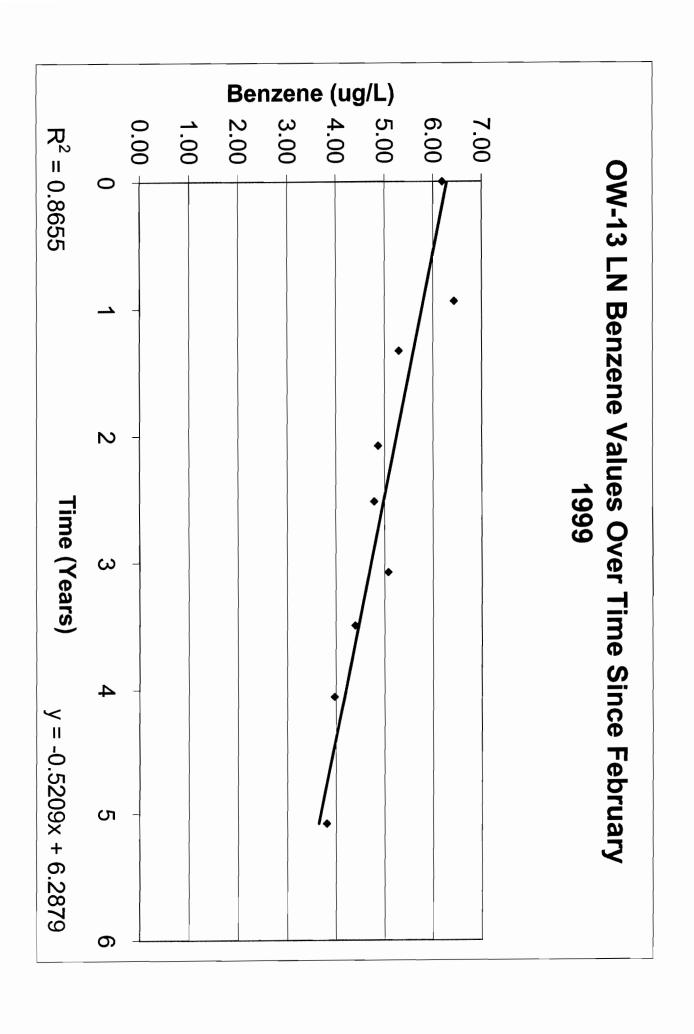


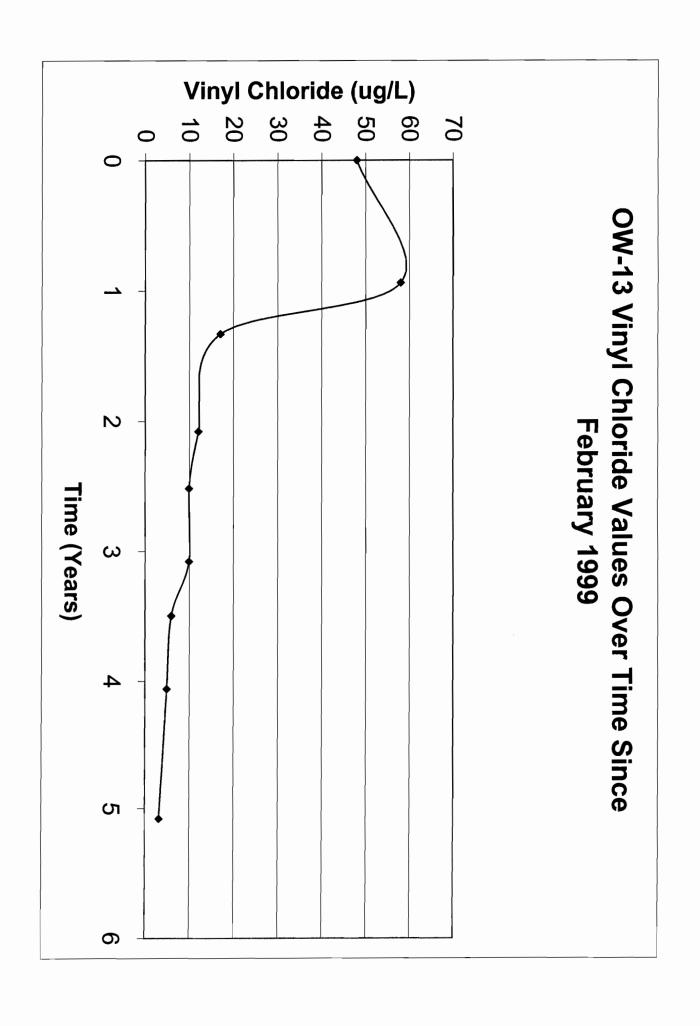


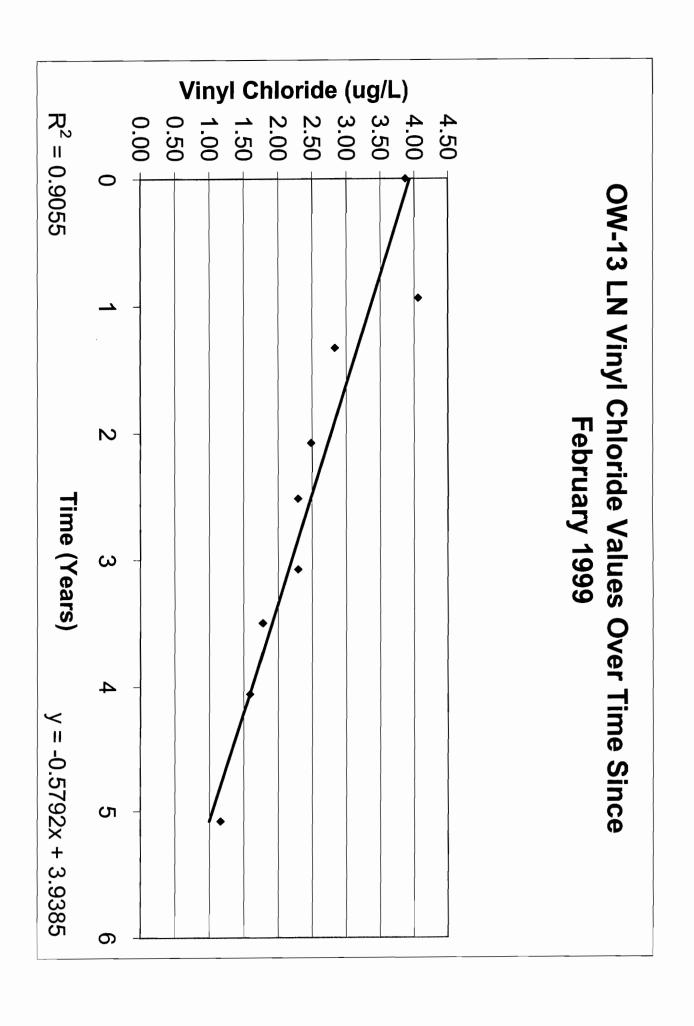


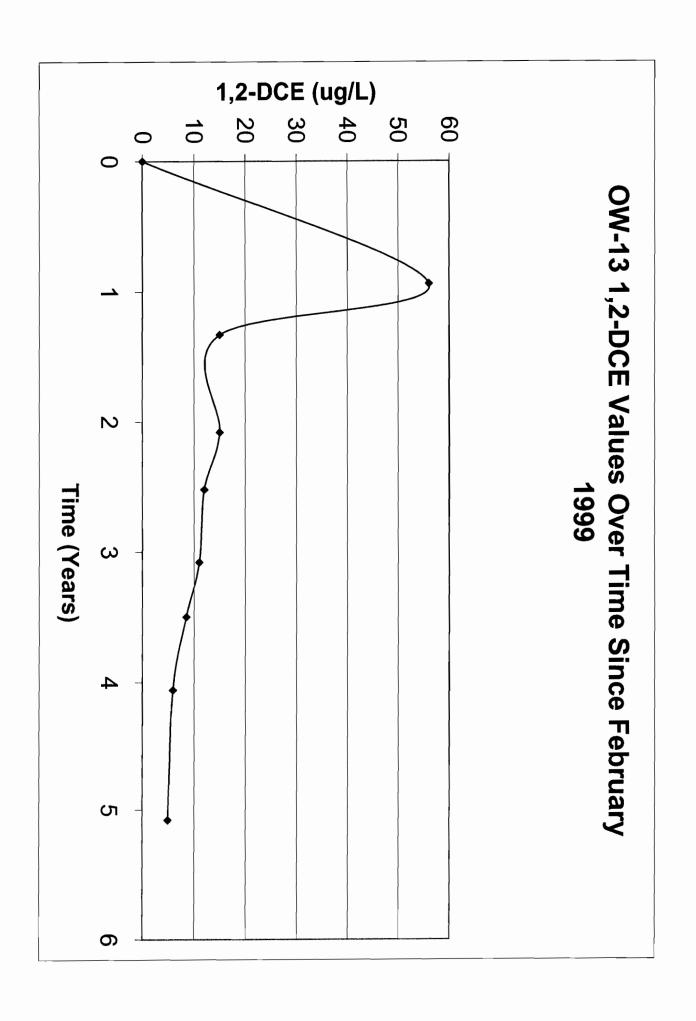


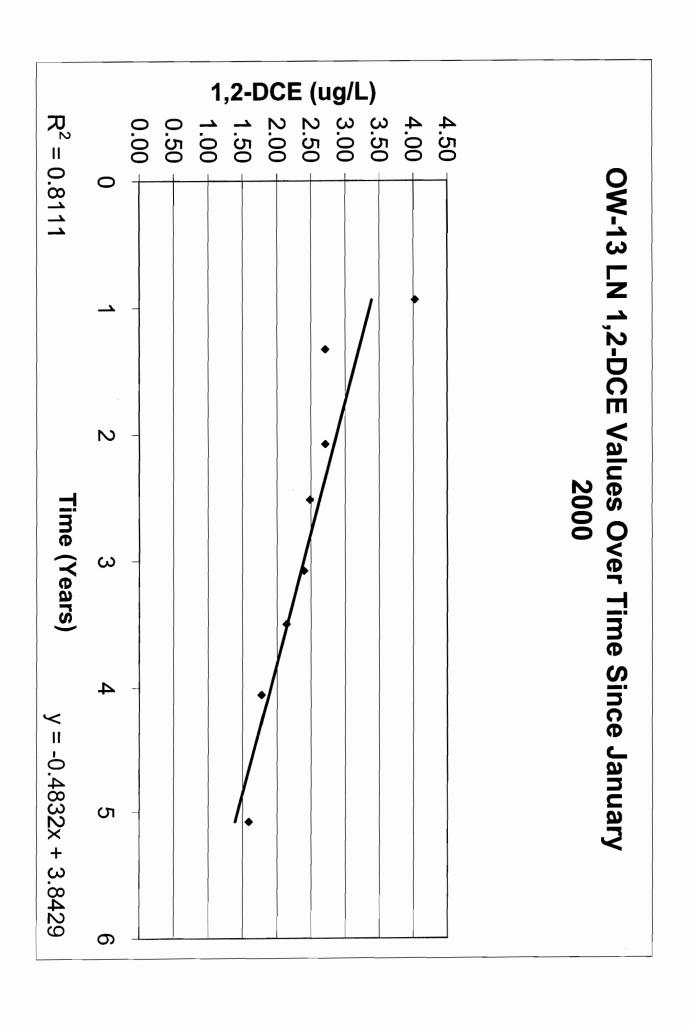


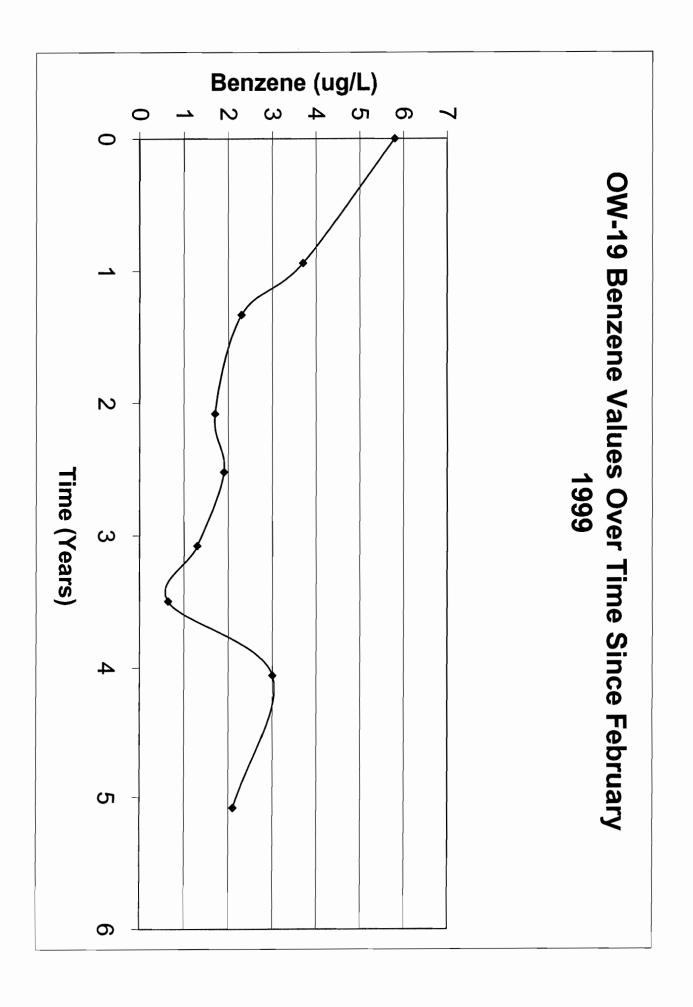


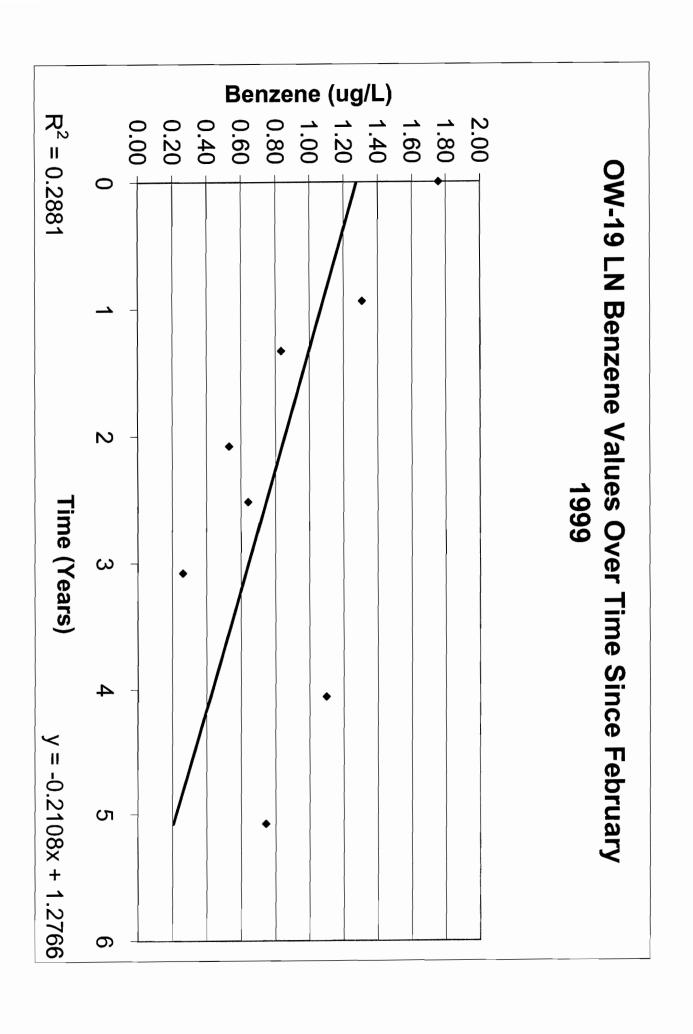


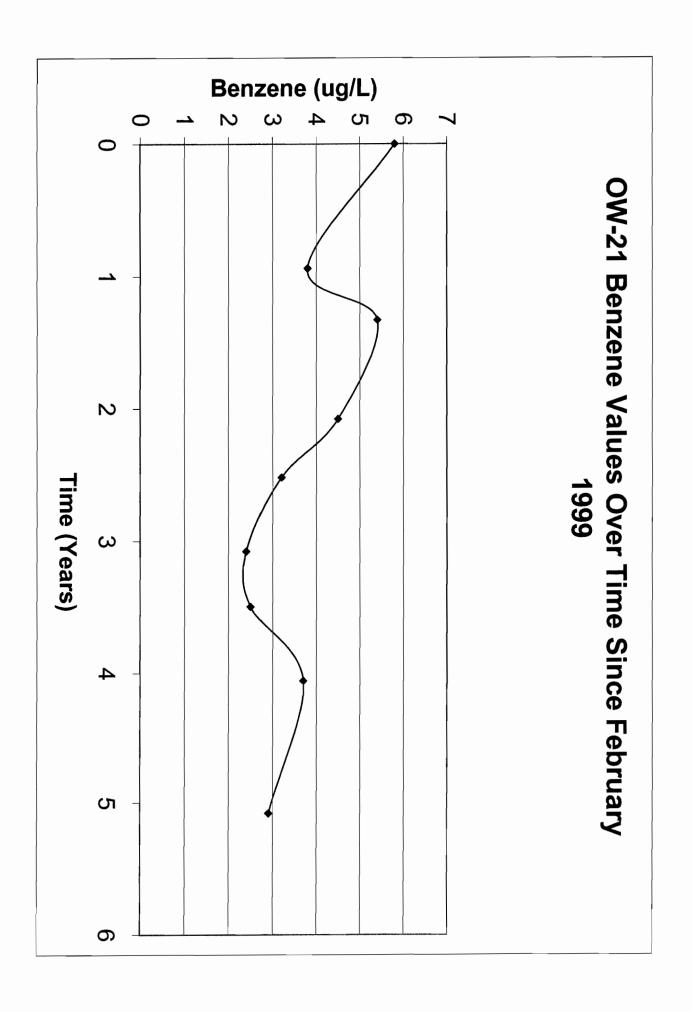


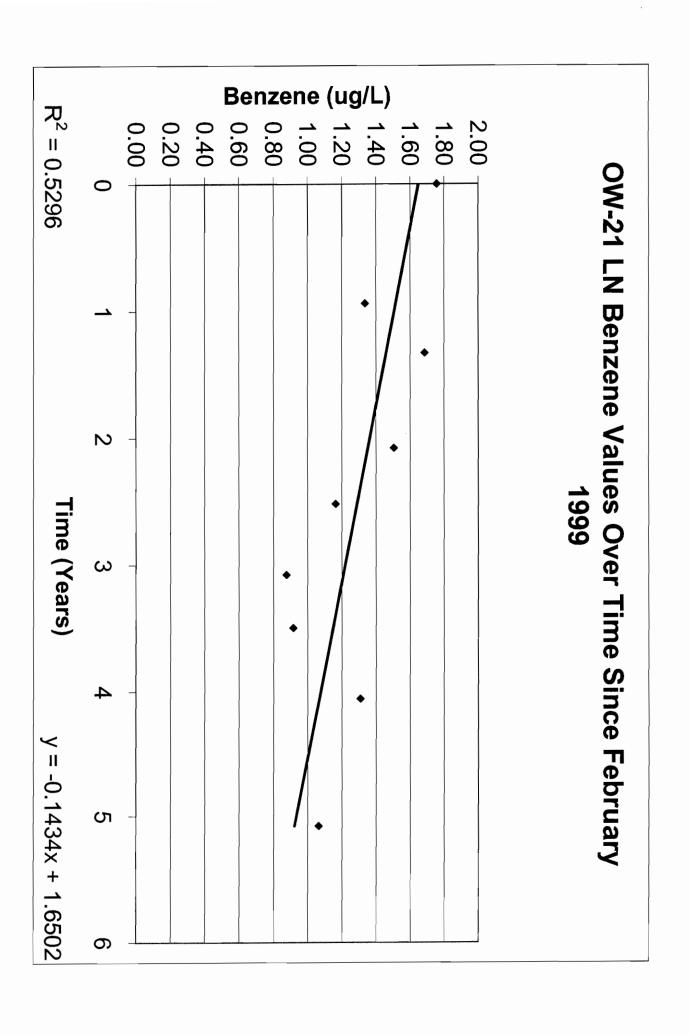


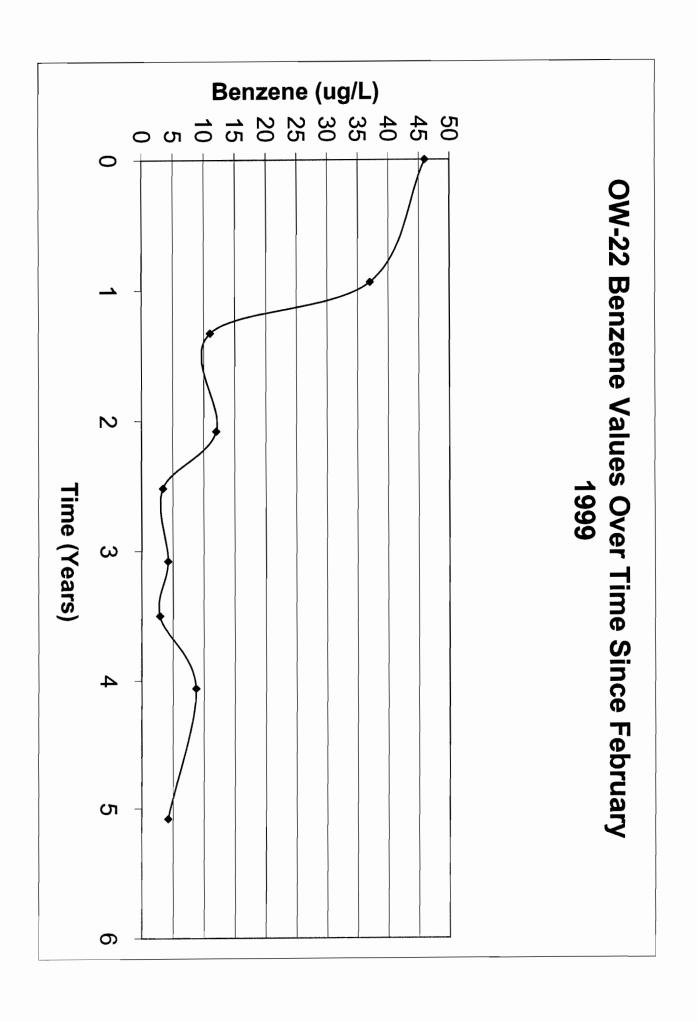


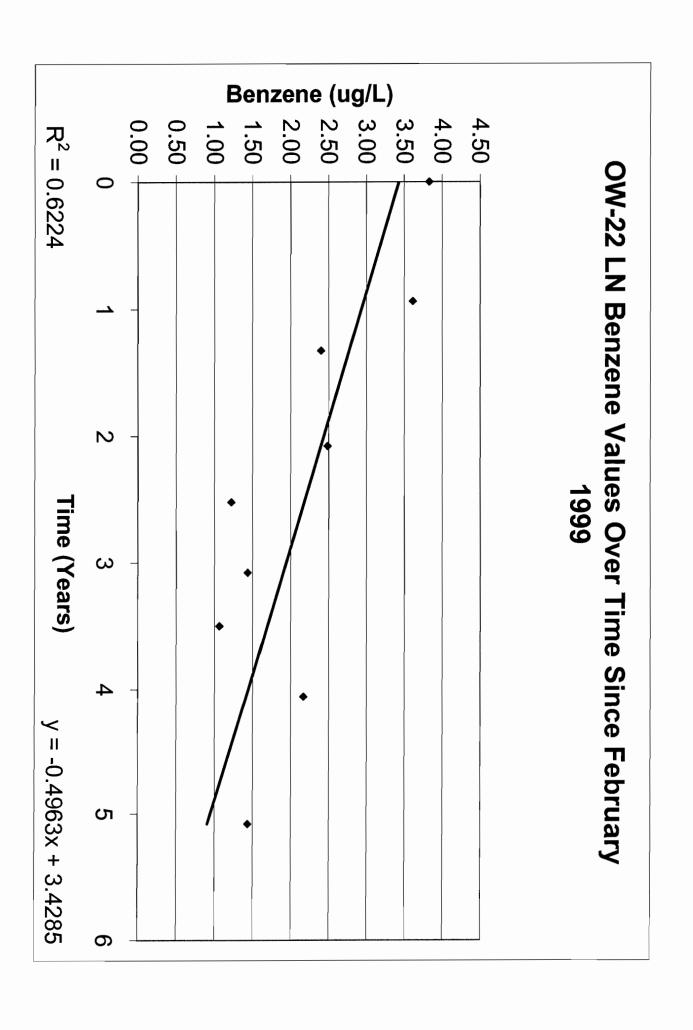








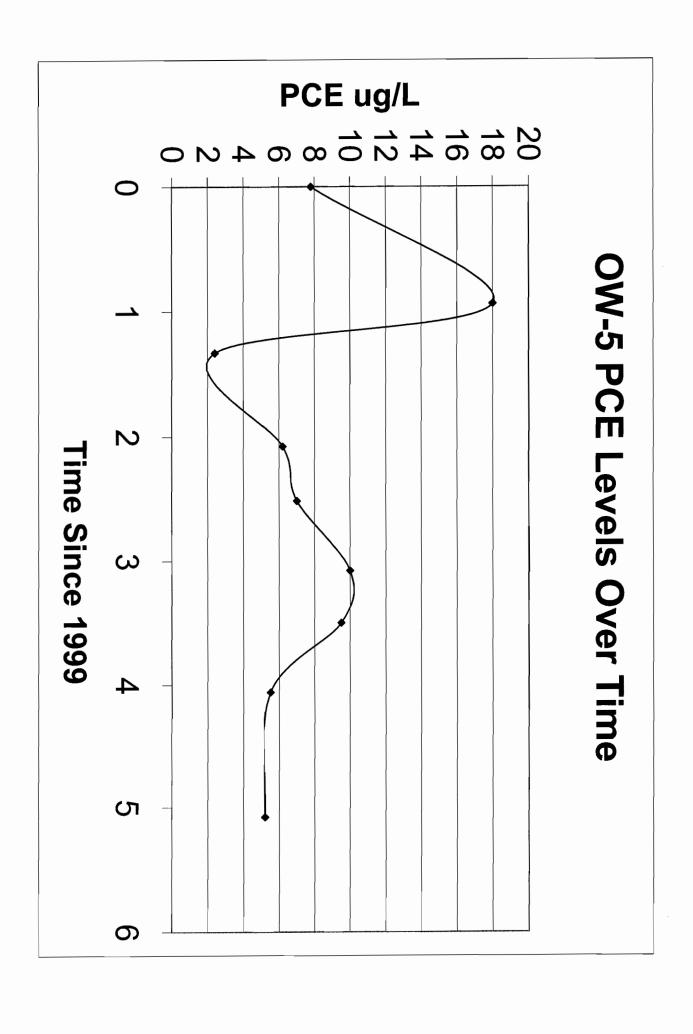


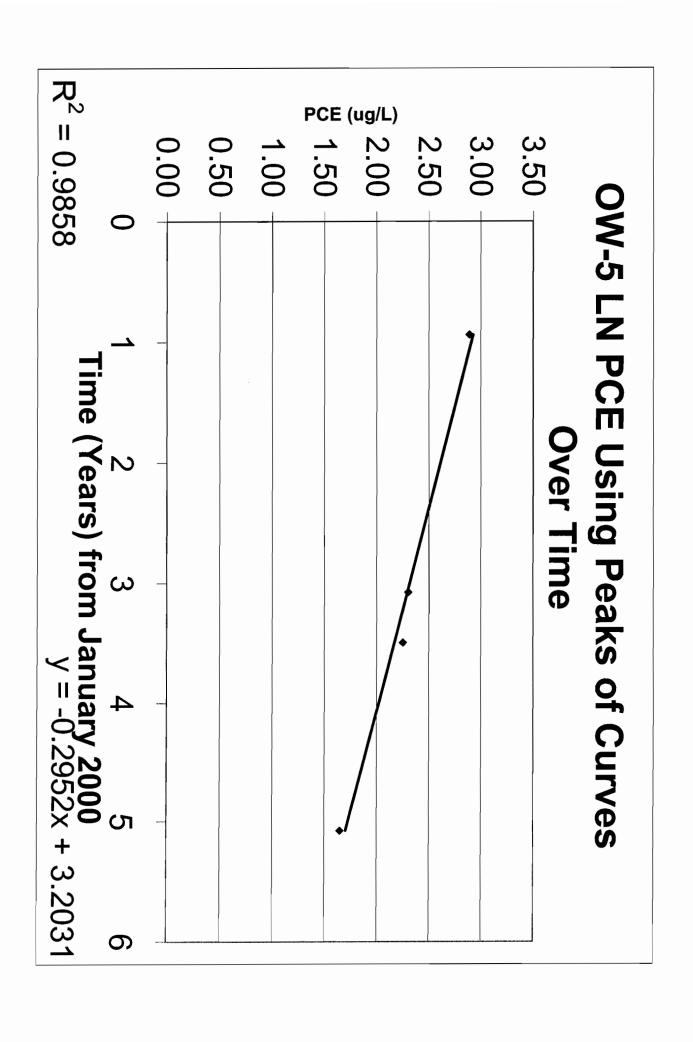


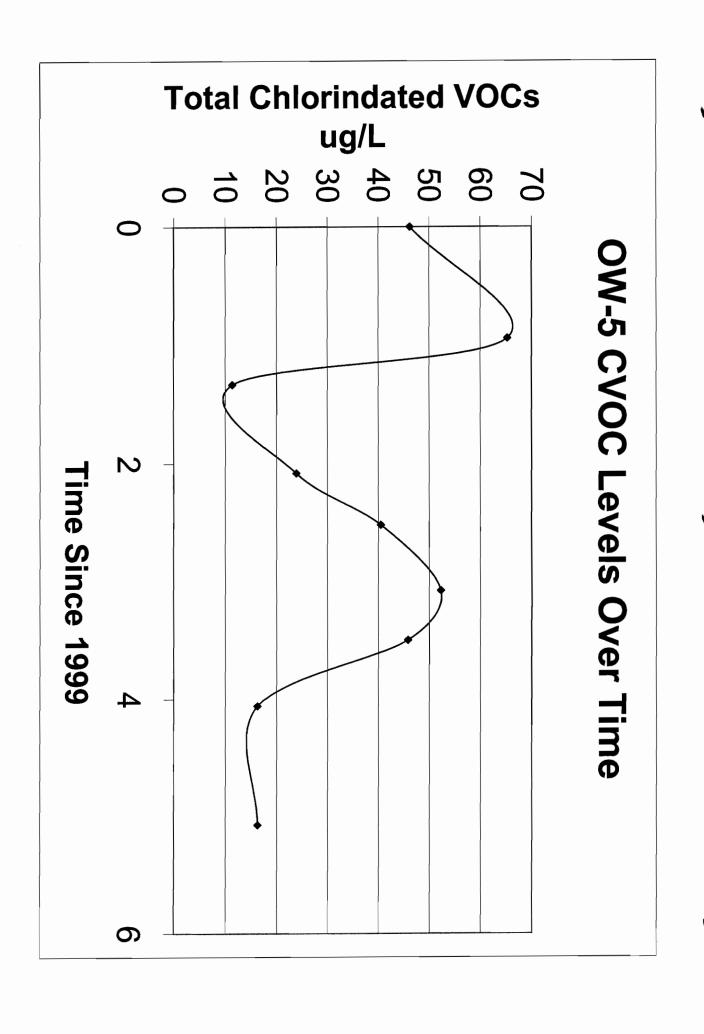
### **OW-5 Calculations**

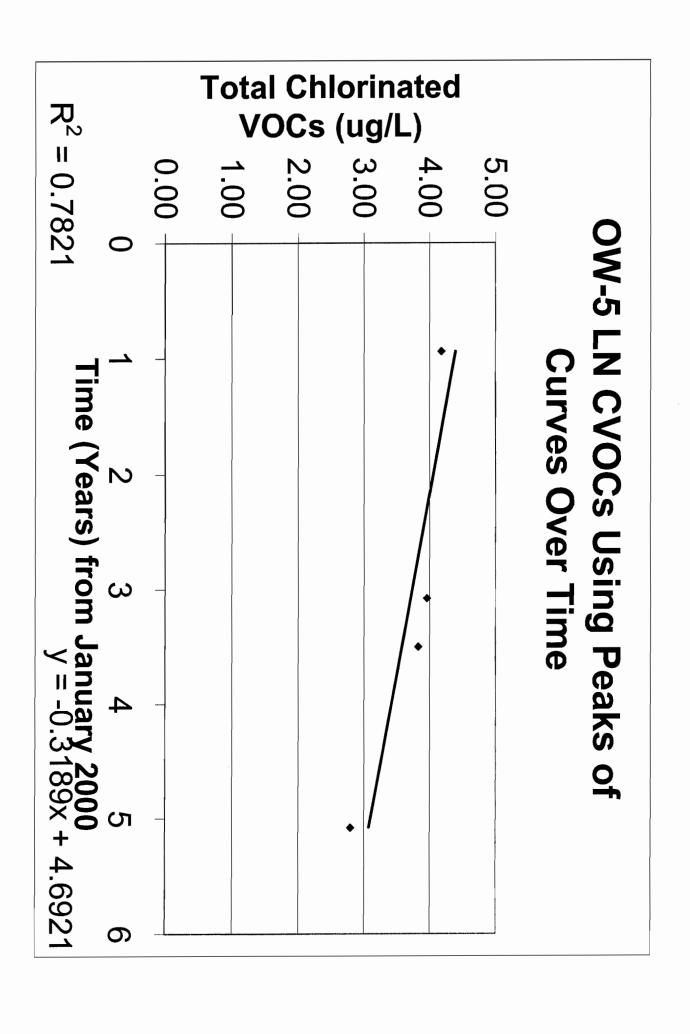
<b>Well Equation</b> OW-5 y = -0.3189x + 4.6921 OW-5 (PCE) y + -0.2952x + 3.2031	Calculation of T using 95% confidence interval	OW-5 PCE		Well
Equation y = -0.3189x + 4.6921 E) v + -0.2952x + 3.2031	95% confidence inte		Total Chlorinated VOCs <sup>(1)</sup>	Contaminant of Concern C
C 4 4	rval	თ	2	goal (ppb)
t(0.95;n-2) y intercept t(0.95; n-2) 4 2.92 4.6921 7.61 2.92 3.2031 6.12		18	65.3	C <sub>goal</sub> (ppb) C <sub>start</sub> (ppb)
y intercept 4.6921 3.2031		0.2952	0.3189	Kpoint
<b>t(0.95; n-2) -</b> 7.61 6.12		2000	2000	Start Year
inv Ln 2022.52 456.28		4.34	10.93	Time (years from start)
i ime (years from start) 21.70	!	2005	2011	Year That Goal Will Be Reached
Year Inat Goal Will Be Reached 2033 2016	: ! :			=

 $<sup>{}^{\</sup>rm (1)}C_{\rm goal}$  is the goal for vinyl chloride to be conservative









### Carroll and Dubies Sewage Disposal Superfund Site Five-Year Review Meeting May 19, 2005 New York, New York

Name	Affiliation	Phone Number	E-Mail address
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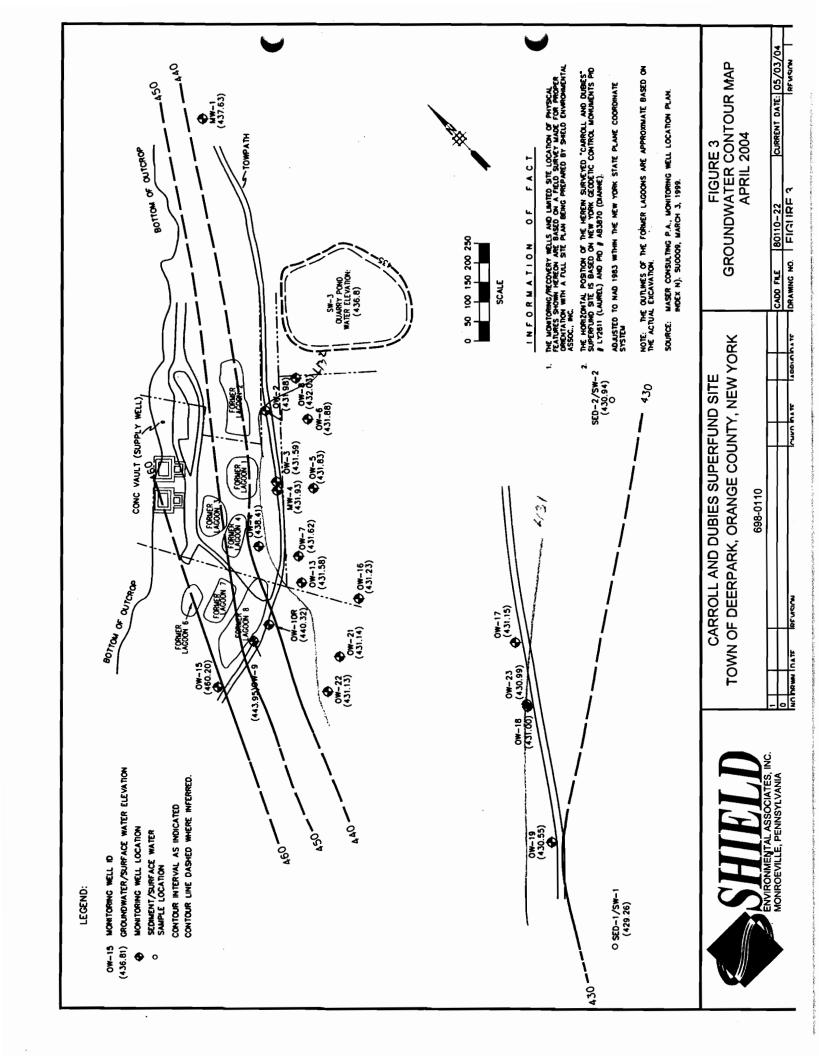


Table 2 Groundwater and Surface Water Elevation Data<sup>(1)</sup> **April 20, 2004** 

### **Carroll and Dubies Superfund Site** Town of Deerpark, Orange County, New York

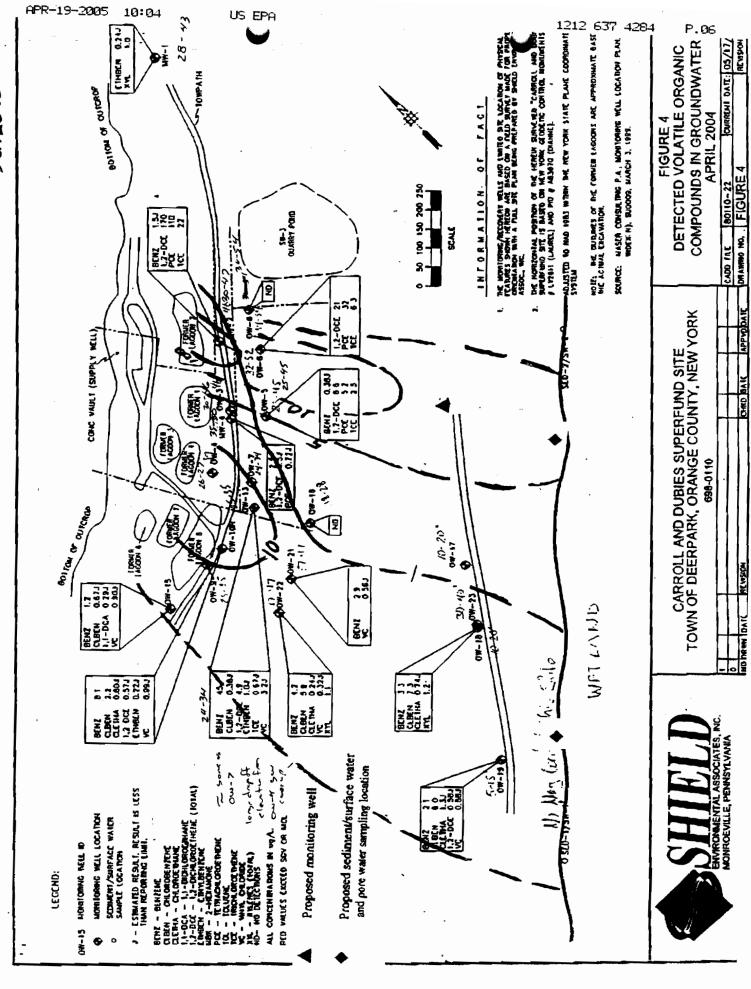
Well No.	Top of Casing Elevation or Staff Gauge <sup>(2)</sup>	Screened Interval	Depth to Groundwater or Surface Water	Groundwater or Surface Water Elevation	e e
MW-1	469.39	28.5 - 43.5	31.76	437.63	wT
MW-4	470.13	35.3 - 50.3	38.20	431.93	wT
OW-2	472.33	30.0 - 47.0	40.35	431.98	ωτ
OW-3	472.70	30.0 - 46.5	41.11	431.59	ωT
OW-4	473.33	26.5 - 27.5	34.92	438.41	-diy??
OW-5	459.85	25.5 - 45.5	28.02	431.83	ωT <sup>'</sup>
OW-6	464.40	31.4 - 51.4	32.52	431.88	wT
OW-7	459.31	24.5 - 34.5	27.69	431.62	ωτ
OW-8	464.63	34.6 - 54.6	32.60	432.03	just helm when telle
OW-9	472.91	25.3 - 35.3	28.96	443.95	<b>ω</b> Τ
OW-10R	469.27	29.0 - 39.0	28.95	440.32	wT
OW-13	458.00	24.8 - 34.8	26.42	431.58	just hale weter tells
OW-15	472.05	22.0 - 32.0	11.85	460.20	below water table
OW-16	453.90	18.0 - 28.0	22.67	431.23	<b>~</b> ₹
OW-17	447.18	11.0 - 21.0	16.03	431.15	below to bly w+
OW-18	444.57	11.0 - 21.0	13.57	431.00	between the war
OW-19	438.69	5.0 - 15.0	8.14	430.55	wT
OW-21	467.46	37.1 - 47.1	36.32	431.14	just he land
OW-22	467.10	38.0 - 48.0	35.97	431.13	he law when tells
OW-23	444.73	29.0 - 39.0	13.74	430.99	here water 11/10
SW-1 <sup>(3)</sup>	432.06	-	-	429.26	
SW-2 <sup>(3)</sup>	432.03	-		430.94	
SW-3 <sup>(3)</sup>	440.10	-		436.80	

Are we som you not moving post so I creek??

<sup>(1)</sup>Data reported in feet; elevations relative - mean sea level; 1988 National Geodetic Vertical Datum.

<sup>&</sup>lt;sup>(2)</sup>Top of casing and gauge staff elevations surveyed by Maser Consulting P.A.

<sup>(3)</sup>Water elevation measured using surveying transit.



21-13

TOTAL P.06