Inactive Hazardous Waste Disposal Site #3-56-008
Remedial Investigation Report

Rotron, Inc.
Olive Facility
Olive, New York

THE
Ch n
COMPANIES

Prepared For:

Rotron, Inc.
Custom Division
9 Hasbrouck Lane
Woodstock, New York 12498

Job# 49531.01

Inactive Hazardous Waste Disposal Site #3-56-008
Remedial Investigation Report

Rotron, Inc.
Olive Facility
Olive, New York

Prepared by:

The Dutchess County Office:
The Chazen Companies
P.O.Box 3479, 229-B Page Park
Poughkeepsie, New York 12603

Dutchess County
(914) 454-3980

Orange County
(914) 457-1521

Capital District
(518) 371-0929

Table.of Contents

Table of Contents
(Continued)

FIGURES:

Table of Contents
(Cf!ntinued)

EXECUTIVE SUMMARY

The EG&G Rotron site is located on approximately 150 acres in northern Ulster County in an undeveloped part of the Town of Olive. The facility was formerly used to manufacture specialty air moving devices and controls, but since 1985 has been primarily used as a warehouse. Some light assembly is currently ongoing as part of another EG&G division.

The plant is located at the base of Little Tonshi Mountain which lies along the south flank of the Catskill escarpment (Figure 1). The land surface slopes gently southward across terraces and occasional steep drops resulting from the subhorizontal sedimentary rock of the Catskill formations. Swamps or wet depressions are found in the terraced areas and drainage from these wet areas drains southward via several perennial streams into an unnamed creek that feeds into the Ashokan Reservoir near the hamlet of Ashokan.

The bedrock aquifer under the Rotron site receives some recharge from a broad poorly drained terrace on the northern portion of the site. Bedrock is shallow in this area and outcrops were observed with some frequency. Sediments thicken towards the southern portion of the site where over 40 feet of dense glacial till were encountered in boring MW-12. Groundwater in the bedrock aquifer migrates southward towards the Ashokan. A shallow overburden aquifer is only supported in areas where till is thicker than approximately twenty feet and this shallow groundwater either migrates laterally toward perennial streams or infiltrates the deeper bedrock aquifer.

Between the late 1960s and 1976 the solvent Trichloroethane (TCE) was used as a parts degreaser at the plant. Between 1976 and until 1985 when the plant stopped manufacturing operations, 1,1,1-Trichloroethane (TCA) was used instead of TCE. Freon 113 was also used intermittently for ultrasonic cleaning from the late 1960s until 1985. All three compounds, as well as decomposition byproducts of TCE and TCA, were detected in soils and groundwater on the site during the 1980s.

The site was designated a Class 2 on the New York Registry of Inactive Hazardous Waste Disposal Sites and during the 1980's substantial efforts were undertaken by Rotron under NYSDEC's direction to excavate and remediate contaminated soils on the Rotron property. Between 1982 and 1984, production well PW-1 was used as a scavenger well to control bedrock groundwater COJ?. amination. Also in the 1980's, two air strippers were added to a surface and shallow groundwater drainage system to treat contaminated water before it discharged into the fire pond. A residential well sampling program was instituted in conjunction with the Ulster County Department of Health (UCDOH). An Order on Consent prepared by NYSDEC incorporating a Work Plan for a Supplemental RI wsigned by Rotron m December of 1995. The investigation has been ongoing since that time.

The RI evaluated potential sources of contamination and examined possible relationships between historic groundwater and surface water impacts. The source investigation was implemented to identify areas where residual Volatile Organic Compounds (VOCs) were present in soils at levels above NYSDEC clean-up values. The source investigation incorporated magnetometry, an active and passive soil gas survey, and test pitting in the former quarry, the loading dock and drum storage area, the former waste solvent tank area, along a line of buried perforated Orangeburg pipe, and in two formerly used drywells (Figure 2). The soil gas methods were also used to characterize the area beneath the slab.

Source regions were found near the loading dock, in the former waste solvent tank graves, along the buried Orangeburg pipe, and at the drywells. Rotron is implementing Interim Rem,edial Measures (IRMs) that will significantly reduce the levels of VOC's in these source regions. Site remediation is being completed through IRMs, which include excavation of soils where practicable and mechanical remediation systems including Soil Vapor Extraction (SVE) and dewatering systems. SVE systems are being utilized in areas where excavation is not feasible or would result in damage to buildings. The dewatering systems will substantially reduce the quantities of VOC-impacted groundwater that infiltrates into the bedrock aquifer and facilitate use of soil vapor extraction systems in dewatered soils.

More than 7,000 cubic yards of soil has been or will be excavated, screened on-site to remove large and intermediate-sized rocks and re-used or disposed off-site, if necessary. This work will be completed in the near future, prior to the start of inclement weather.

While soil sampling results from the former quarry indicate that remediation is not mandated, a stream will be diverted away from the former quarry to reduce infiltration. Treated soils taken from other Jocations on site will also be used to regrade the former quarry surface to promote surface runoff and further reduce surface water infiltration in this location.

Groundwater contamination has historically been limited to the wells around the former quarry and in production wells ;PW-1 ap.d PW-3. Recent groundwater sampling during this RI confirmed this hi toric contaminant distribution. TCE has been detected on three separate occasions at decreasing levels ranging from 15 to 1.1 ppb in perimeter well MW-9 but has not been detected since 1984. The compounds TCE and TCA were detected at 11 and 9.2 ppb, respectively, in OR-16 located at 22 Mary Lou Lane in February of 1991. No chlorinated solvents had been detected prior to the February 1991 sampling or i.n subsequent sampling roundS. No persistent chlorinated solvents are found in the perimeter wells indicating that the contamination has essentially remained on-site.

Contamination in the monitoring wells surrounding the old quarry probably resulted from precipitation infiltrating the backfill material in the quarry before entering the bedrock aquifer. The contamination in PW-1 is believed to have originated from infiltration of groundwater through soils in the quarry and loading dock regions which were then drawn toward the well head. PW-3 may be impacted for the same reason as PW-1, since it appears to be in direct hydraulic contact with PW-1 along a vertical fracture. The distribution, fate and transport of the VOCs in groundwater is linked to on-site pumping, the network of horizontal and, more importantly, vertical fractures, and the recharge/ discharge relationship between the wet depressions found throughout the site.

Potential human health impacts were evaluated for exposure to contaminated soil, groundwater, surface water, sediments and indoor air by conducting a Human Health Exposure Assessment (HHEA). The HHEA conformed to applicable Federal and State guidance and, based on observed contaminant levels, adverse human health affects are not anticipated with exposure to these media.

The ongoing interim remedial activities will lead to significant overall reductions in residual VOC impacts in soil and groundwater. Since no significant or persistent off-site impacts are observed and the VOC distribution is contained and controllable, this facility is believed to be eligible for a Class 4 status, once all remedial systems are operational.

This RI Report meets all RI reporting requirements in conformance with a recommended RI report outline published in *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (October 1988). The IRM's referred to above are ongoing and an IRM Report will be submitted in the future addressing source area remediation on. the Rotron property.

1.0 INTRODUCTION

1.1 Purpose ofthe Report

The New York State Department of Environmental Conservation (NYSDEC) has requested that Rotron, Inc. (Rotron) address groundwater and soil contamination at its Olive facility. The Rotron Olive site (NYSDEC Site Number 3-56-008) is listed as a Class 2 inactive hazardous waste site based on previous detection of TCE and 1,1,1-TCA residual in soil and groundwater.

Chazen Environmental Services (CES) was retained by Rotron in 1995 to conduct a Remedial Investigation (RI) at the site. CES prepared and submitted an RI work plan to the NYSDEC which was approved and incorporated by reference into an Order on Consent which was signed in December of 1995. The RI described herein was performed in conformance with the approved work plan. The RI adhered to the process defined in 6 NYCRR Part 375 and, by reference, to the National Contingency Plan and other documents including *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA540/G-89-004).

1.2 Site Background

1.2.1 Site Description

The Rotron Olive site is situated on Dubois Road in the Town of Olive, which is located in Ulster County, New York (Figure 1). The site consists of approximately 150 acres surrounded by vacant land to the north and west and residential dwellings to the east and south. Structures on the property consist of a single-story manufacturing facility, an attached warehouse, and a detached storage building (Figure 2).

The facility is located on the north side of an east/west trending valley occupied by the Ashokan Reservoir and the Esopus Creek. The Rotron site is confined by Little Tonshi Mountain to the north and Route 28 to the south. Little Tonshi mountain comprises one of several peaks marking the south-facing escarpment of the Catskill plateau which extends northward and westward from this location. Drainage on the Rotron site is controlled by a perennial stream originating on Little Tonshi Mountain and draining into the Ashokan Reservoi,r near the hamlet of Ashokan one mile west of the Rotron facility (Figure 1): This stream flows around the fire pond on the site and receives seasonal flows from numerous poorly drained areas on the property (EG&G, 1981).

1.2.2 _Site History

Rotron manufactured high-velocity air moving devices and associated control units at this plant until its closing in 1985. The plant manufactured many of the metal parts used in the manufacturing of the air moving devices and degreasers were used to clean the parts before assembly.

Groundwater and soils at the Rotron Olive site have been impacted by historic releases of the solvents TCE and Trichloroethene TCA (EG&G, 1981, 1982). TCE was used as a degreaser at the plant from the late 1960s to 1976 when TCA was used instead of TCE. Freon has also reportedly been used intermittently for ultrasonic cleaning from the 1960s until 1985. Prior to 1981, waste solvents were generally disposed of into the on-site waste solvent tank which emptied into a dry well and occasionally into the old quarry, which was used as an industrial landfill. This method of waste disposal was common practice for the time period. After 1980, most spent solvents were removed from the site by solvent recycling vendors. Based on the findings of previous investigations, solvents apparently entered soils on the site and impacted groundwater.

Between 1981 and 1985, Rotron performed numerous investigations and remedial activities to characterizes and remediate VOC impacted areas. Preliminary investigations were performed to determine the source of the solvents in Production Well 1 (PW-1) and early work focused on identifying source areas, defining regional and site geology, including the attitude of the fractures within the bedrock, and characterizing site hydrogeology and surface water drainage.

1.3 Summary of Previous Investigations

Previous investigations and remediation efforts are described in the Work Plan approved by the NYSDEC. These are reviewed below with focus on previous work performed in the source regions addressed during the recently completed RI.

<u>Former Quarry Area</u>

A former quarry is located approximately 500 feet to the northwest of the main plant builg used as a source of fill material during construction of Rotron's Olive plant in the late 1960's. The excavation is approximately 200 feet long by 130 feet wide and approximately 20 feet deep at it deepes location (Figure 2). During the 1970's, the quarry was used as a receptaqe for industrial wastes including rejected fan parts, plastic, metal and wooden pallets and drums with waste solvent. Waste disposal continued in the quarry until approximately 1980.

Substantial work was performed in the former quarry .during 1981 and 1982, including excavation and removal of 450 tons of contaminated soils, excavation of drum carcasses and removal of seven liquid-filled drums and five empty, intact drums (EG&G, 1982). Following excavation, the landfill contours were re-graded and shaped to promote drainage away from the fill material and uphill surface water flows were diverted around the abandoned quarry to limit infi.ltrati.on through the fill.

Loading Dock Area

Drums containing degreasing agents were stored on the edge of the pavement along the northern edge of the loading dock. Degreasing agents were occasionally spilled onto the loading dock pavement during transport, especially during the winter months when the drums would freeze to the pavement and rupture when moved.

Contamination in the loading dock area was addressed by removing approximately 439 cubic yards of soils contaminated with TCE and backfilHng with clean fill material (EG&G, 1982).

Drums were also stored in an area located just outside of the northeast comer of the main plant building. Some of the drums stored in this area were kept on horizontal racks to allow workers direct access to the solvent via drain spigots. Workers would take whatever quantity needed from these drums to complete their assigned tasks. Some solvents were apparently spilled during the filling process.

Waste Solvent and Process Water Tank

Waste solvent was reportedly exhausted to a 2,500-gallon spent-product tank located along the east side of the manufacturing facility (Figure 2). The 2,500-gallon spent-product tank was excavated and removed in the early 1980's.

:t;)rywell #1 and Orangeburg Pipe

When the tank was full, it was reportedly emptied by pumping or gravity drainage to a drywell connected to the tank by perforated Orangeburg pipe (Figure 2). Impacted wastewater seeped into soils from the perforated pipe enroute to the drywell. Two areas were identified along the Orangburg pipe which exhibited elevated VOCs. The impacted areas coincide with:1) a low point in the pipe, and 2) the head of the Orangeburg pipe where it nnects· to metal piping from the tank.

Dryw ll# 2

A second drywell was located on the east side of the building near the northeastern comer (Figure 2). Solvents used by degreasers in the building may have spilled and were apparently channeled to the drywell via floor drains. VOCs were encountered in soils around this drywell.

Groundwater

Groundwater and surface water remediation efforts included using PW-1 as a scavenger well between 1982 and 1984. Wastewater was discharged to an existing cooling tower for VOC removal (Figure 2). Effluent from the cooling tower was discharged into the :fire pond. Two air stripping units were later installed to provide treatment of surface water run-off and shallow groundwater emanating from the loading dock.

Groundwater contamination has historically been limited to the wells around the former quarry and in production wells PW-1 and PW-3. Recent groundwater sampling during this RI confirmed this historic contaminant distribution. TCE has been detected on three separate occasions at decreasing levels ranging from 15 to 1.1 ppb in perimeter well MW-9 but has not been detected since 1984. The compounds TCE and TCA were detected at 11 and 9.2 ppb, respectively, in OR-16 located at 22 Mary Lou Lane in February of 1991. No chlorinated solvents had been detected prior to the February 1991 sampling or in subsequent sampling rounds.

Presently, shallow and deep groundwater monitoring wells on the Rotron property continue to show levels of dissolved TCA and TCE with lesser concentrations of compounds associated with the natural decay of TCA and TCE. Low concentrations of Freon 113 have also been detected in select monitoring wells. Historic and recent sampling results indicate that no persistent chlorinated solvents are found in the perimeter wells indicating that the contamination has essentially remained on-site.

1.4 ARARs

Applicable or Relevant and Appropriate Requirements (ARARs) include the following: "T.

- Work done under the Rotron Olive Order on Consent follows regulations promulgated under 6 NYCRR Part 375, Inactive Hazardous Waste Disposal Sites, pursuant to statutory authority under Environmental Conservation Law Chapters 1-0101, 3-0301, 27-0903, 27-1315, 27-1317, and 52-0107.

- Groundwater quality standards applicable to the Rotron site are published in 6 NYCRR, Chapter X, Part 703. Water standards for TCE, 1,1,1-TCA, PCE, and DCE are 5 ppb. The standards for 1,1,1-TCA, 1,2-DCE and Vinyl Chloride are 5 ppb, 5 ppb, and 2.0 ppb respectively.

- Groundwater extracted as a result of RI or IRM activities may only be returned to groundwater in conformance with the New York State Water Quality Regulations published in 6 NYCRR, Chapter X, Parts 702.16 and Part 703.6. Part 703.6 indicates that maximum allowable groundwater effi.uent standard for TCE and Vinyl Chloride are 10 ppb and 5 ppb respectively.

- Extracted groundwater returned continuously to surface waters is subject to requirements for State Pollution Discharge Elimination System (SPDES) permits issued pursuant to 6 NYCRR, Chapter X, Parts 750-758. Effiuent standards are calculated by the NYSDEC based on effi.uent volume, receiving water body characteristics, and effi.uent contaminant concentrations.

- Remedial actions resulting in continuous atmospheric emissions of volatized compounds, particulates, or other hazardous air pollutants must acquire emissions permits in conformance with 6 NYCRR Part 201 and Part 212. Where applicable, emission control devices may be warranted.

1.5 Report Organization

The organization of the Remedial Investigation report for the groundwater operable unit follows the suggested outline for RI reports, as outlined in *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (October 1988).

2.0 FIELD INVESTIGATION

2.1 Source Investigation

The source investigation was designed to evaluate whether residual VOCs were present in soils at levels that would represent a threat to the environment. The source investigation incorporated non-invasive pre-screening techniques followed by confirmatory test pitting. Data collection and documentation were performed as outlined respectively in Chazen's Field Sampling Plan (FSP), Quality Assurance Program Plan (QAPP), and the site specific Quality Assurance Project Plan (QAPjP).

2.1.1 _Magnetometry Investigation

The purpose of the investigation in the former quarry was to determine whether substantial residual VOCs remain in this area. The magnetometry investigation was intended to locate areas where metallic debris, such as drums, may be buried and to evaluate whether previous drum removal at the former quarry was successful. Buried drums, if present, would represent a potential ongoing source of contamination. Magnetometry provides an indirect, non-invasive sensing technique well suited for located buried ferro-magnetic materials like steel drums.

The magnetometry investigation was conducted according to the methods outlined in the Rotron Olive Work Plan and Field Sampling Plan (FSP). The magnetic field data were collected at ten foot grid intervals along lines spaced ten feet apart using a Geometries G-856-AX Proton Precession Magnetometer. Total field magnetic intensity was measured at each grid station using a sensor held 60 inches above ground surface. Another Geometries G-856-AX Proton Precession Magnetometer was used as a base station to remove diurnal fluctuations from the magnetic field data. The base station magnetometer was time synchronized with the field station and data were collected at 30 second intervals for the duration of each field survey. The field and base station data are contained in Appendix A

2.1.2 Soil Gas Survey

Soil gas surveys provide broad aerial coverage of potential source regions by measuring VOC levels entrained in the soil pore space. Soil gas surveys are usually followed by focused work concentrating on "hot spots". A soil gas readings were taken around existing dry-wells, perforated pipe, and the loading dock and drum storage areas and provided a qualitative measure of the VOC vapors collecting in the vadose zone.

Both passive and active soil gas methods were utilized. Active soil gas samples were taken by preparing a 1.5 to 3.0 feet deep. penetration using a small diameter rotary percussion drill and a slide bar. A half inch diameter pre-cleaned laboratory grade glass tube was inserted in the hole which was sealed at the surface with clay or equivalent material to create a soil gas micro-well. Once inserted and sealed at the surface, the glass tube was connected to an MSA Escort precision low volume air sampling pump which evacuated the micro-well at a rate of approximately 100 ml of air per minute for one to two minutes. The· ample was obtained by inserting a contaminant-free needle through a eptum attached to the air pump and extracting a 1000 ul volume of soil gas. The soil gas sample was then injected into the field GC for analysis.

Passie soil gas samples were collected using a method outlined in Vroblesky, et al (1996 and 1992). The passive soil gas collectors allowed substantial flexibility since they were less susceptible to wet weather conditions. The typical passive collector is shown on Figure 3 and consisted of a 40 ml glass jar covered with two permeable polyethylene membranes (food storage bags) and clipped to a metal survey stake. The outer membrane acted as a shield to protect the inner membrane and the jar from dirt and moisture. The inner membrane was left in place after removing the sample jar from the ground to ensure that the soil vapor sample remained within the jar prior to securing the top on the jar.

The soil gas collectors were placed in 1.5-inch diameter holes approximately one foot below ground surface. The hole was sealed with either native material, clay, a thin layer of quick drying cement or moist sand to limit surface infiltration. The passive collectors were generally kept in the ground for a minimum of four days before removal and upon extraction, the outer permeable membrane was immediately removed and the septum top screwed onto the bottle. This process secured the samples and preserved sample integrity.

The sample was analyzed by inserting a contaminant-free needle through the septum top and extracting 1000 ul of air for GC analysis. Sample preservation was not necessary as long as the sample was analyzed within roughly four days, however, samples could not be reliably re-analyzed once the septum tops were pierced (Vroblesky). Soil gas samples were analyzed with an SRI Model 8610 Portable Gas Chromatograph equipped with a 60 meter capillary column and PID and DELCD detectors with programmable temperature and pressure ramping. Sample chromatographs were computed using PeakSimple GC Analysis software. The portable gas chromatograph (GC) was calibrated for the specific Compounds of Concern (COCs) including TCE, Freon-113, TCA, 1,1 Dichloroethane (1,1-DCA), and 1,2-Dichloroethene (1,2-DCE).

Active soil gas samples were run at approximately 5 to 10 percent of the passive collector locations to ensure correlation between the two sampling methods. Based on the soil gas results presented in Table 1, both sampling methods were sensitive to VOC's. Passive soil gas sampling offered representative average soil gas concentrations, while the active method depicted a "snapshot" of the most permeable portion of the unit where the point was installed.

Soil gas samples were taken at regularly spa ed intervals but spacing varied between 20 and 50 feet depending upon lqcation. The grid interval was determined using readily available information and a best approximation of what data density would provide adequate coverage given the nature of the potential source region. For instance, it was presumed that the Orangeburg pipe was perforated throughout, therefore, a coarse grid spacing would provide adequate preliminary characterization. However, not much was known about.the region surrounding Dry-Well #1 so it was believed that a tighter grid spacing was needed. The location and distribution of the sampling points are shown on Figure 4.

2.2 Test Pits

Test pits, which provide a visual window of subsurface conditions and facilitate geochemical and geotechnical sampling were also used to implement Interim Remedial Measures (IRMs) by removing obviously contaminated soils at the time of discovery. Test pits were performed at the Rotron site in potential source regions to evaluate the vertical and horizontal distribution of residual VOCs in areas identified by the magnetometry and soil gas surveys.

Prior to excavating test pits, exclusion and decontamination zones were established in accordance with the site specific Health and Safety Plan (HASP) guidelines for PPE levels. Air quality was monitored with a photo-ionization detector (PID) to ensure compliance with the HASP.

Soil staging areas were also prepared adjacent to each test pit in case excavated soils could not be returned to ground. Excavated soils were securely covered overnight and during windy or rainy weather.

Test pits were excavated in areas where previous remedial. activities occurred to verify the effectiveness of past remediation efforts and in locations where screening indicated that significant VOC concentrations may be present. The test pits were excavated by Stony Hollow Equipment Co. of Kingston, New York using a CAT EL180 track mounted excavator with an excavation depth of roughly 21 feet and a reach of approximately 25 feet. The backhoe bucket and arm were decontaminated between test pits using a high temperature pressure washer to limit the possibility of cross-contamination.

Representative grab or composite soil samples were taken from the test pits for field screening with a portable GC calibrated fo;r the specific Compounds of Concem (COCs) and additional confirmatory soil samples were forwarded to lEA, Inc., Monroe, Connecticut, a NYS ELAP approved laboratory, for VOC analysis using EPA Method 8260 including Freon 113.

2.2.1 TOC Sampling

Representative soil samples were evaluated for Total Organic Carbon (TOC) content to determine the soil clean-up objectives for the site. TOC samples were taken from the former quarry, the loading dock and the solvent tank area. Samples were taken from a depth of around 2.5 feet and below the organic-rich soil horizon.

The OC values(/) were used to define recommended soil clean-up values for the COCs. The recommended soil clean-up objectives for TCE, TCA and Freon 113 are 0.7 ppm, 0.8 ppm and 6.0 ppm respectively (NYSDEC/DHWR TAGM #4046). Attainment of these clean-up objectives eliminates significant threats to human health and/or the environment posed by contaminated media. The soil clean-up objectives which are found in Table 2 were developed for soil carbon content adjusted linearly for the actual % carbon content *(/)*.

2.2.2 Soil Sampling

Geologic characteristics were recorded as exposed in each excavation and representative grab samples were taken for geologic and chemical characterization at appropriate depth increments, or at changes in geology. Saturated and/or unsaturated soil samples were collected from the track-hoe bucket for field screening and when warranted for subsequent laboratory analyses. At least one soil sample per test pit was forwarded to the lab and all pertinent observations (i.e., contamination, staining, odor, air monitoring readings, sheen) were recorded in the field log. Soils with visible solvent residuals, anthropogenic objects associated with site contamination, or soils that may have been impacted above the established soil clean-up objectives based on field screening were not to be returned to the excavation.

Soil samples were screened in the field using jar head space methods. A septum top 40 ml VOA vial was filled approximately half way with soils taken directly from the backhoe bucket. The soil sample was placed in a warm water bath to warm the sample to 70o F and a syringe extracted 1000 ul of head space air from the soil jar. The sample was injected into either a Photovac Model 10 S Plus or a SRI Model 8610 Portable Gas Chromatograph equipped with a 60 meter capillary column and PID and DELCD detectors with programmable temperature and pressure ramping. Sample chromatographs were computed using PeakSimple GC Analysis software.

Grab soil samples were also analyzed for VOCs following EPA Method 8260 plus Freon 113 at lEA, Inc. of Monroe, Connecticut. Soil samples collected from laboratory analysis were kept chilled to approximately 4° C prior to shipping to the laboratory. Field blanks, trip blanks, equipment blanks, and matrix spike/matrix spike duplicates were taken as outlined in Section 9.1ofChazen's QAPP.

2.3 Test Pit Locations

Based on extensive subsurface testing and interviews with past and present employees, all potential source areas were investigated during this RI. No other source regions have been identified or are likely to exist on-site.

2.3.1 _Former Quarry Area

Twelve test pits were excavated in the former quarry area. Test pits locations were selected based on magnetic field anomalies as identified by the magnetometry investigation and based on areas of the quarry that were previously remediated. The locations of these test pits are shown on Figure 5.

2.3.2 Loading Dock and Drum Storage Area

Twelve test pits were excavated in the loading dock area. These pit locations were selected based on previous remediation work, observed surface water infiltration zones and field screening using passive and active soil gas methods. The location of these test pits are shown on Figure 6.

2.3.3 Solvent Tank, Orangeburg Pipe and Drywell #1, and Drywell #2

Initially, four test pits were excavated in the area of the old solvent tank and one test pit was excavated adjacent to Drywell #2. An additional test pit was excavated between the solvent tank and Drywell #2 to determine the extent of the impacts adjacent to the solvent tank area (Figure 6).

Subsequently, informal interviews with past and present Rotron employees indicated that the former waste solvent tank was connected to an Orangeburg pipe that emptied to a drywell (Drywell # 1 on Figure 2). Also, information was provided indicating that the floor drains in the main plant building were connected to a second dry well (Dry Well #2). Four test pits were then excavated to characterize these areas. The locations of these additional pits are shown on Figures 6 and 7, respectively. No floor drains were located in the war-ehouse addition, however, the roof leaders from the warehouse drained to a swale located near the southwest corner of the building. The swale emptied to the stream that flows from the fire pond.

Soil gas screening results (Table 1) indicated,that the area surrounding Drywell #1 was relatively free from VOC impacts so only one test pit was excavated in this area (Figure 7). Some soils were excavated and confirmatory soil samples were taken from the drywell pit to verify that soil clean-up guidance values had been met.

Three test pits were excavated along the Orangeh\:1rg pipe connecting Drywell #1 to the solvent tank (Figure 7). These test pt locations were selected to coincide with the highest soil gas readings observed along the pipeline (Table 1). Soil samples were taken for field GC screening and confirmatory laboratory analysis.

The r sults of the field screening are posted in Table 1 and the chromatograms are contained in Appendix B. Confirmatory laboratory data are summarized in Table 3 and the laboratory results are contained in Appendix C.

2.4 Groundwater Monitoring Wells

2.4.1 Modification of Existing Monitoring Wells

Bedrock monitoring wells previously installed at the Olive site were cut at grade and completed with pitcher pumps for groundwater sampling. These pumps proved physically awkward to use, required significant time and effort to purge, and provided difficult access for measuring water elevations. The pitcher pumps have been replaced with new drive casing, protective casings and well caps meeting current NYSDEC and EPA monitoring well standards. Replacements were made on wells MW-4, MW-5, MW-6, MW-9, MW-10, andMW-11.

To replace the pitcher pumps, a track-mounted drill rig was used to loosen and remove each pitcher pump from its existing concrete platforms. After the pump was removed, the internal iron pipe and foot valve assemblies were pulled from the well annulus using the mast assembly of the drill rig. The lengths of internal pipe removed from each well ranged between 50 and 140 feet based on the depth of the well and the depth to the static water level.

The cleared and exposed drive casing was then temporarily sealed with an expansion cap to keep the annulus clean and the concrete pad was removed using a rubber-tired backhoe. The backhoe was also used to excavate around the drive casing to allow adequate footing for a new protective casing. The drive casing was subsequently lengthened by welding a coupling and additional casing to the original drive casing and new protective casing was installed in a poured concrete base (Figure 8). Once the monitoring well modifications were completed, the elevations of the modified wells were re-surveyed to facilitate evaluations of groundwater elevation within the wells.

2.4.2 Installation of Piezometers and a New Monitoring Wells

Six shallow overburden piezometers and one new bedrock monitoring well were installed on the Rotron Olive property. A summary of the monitoring well construction is included in Table 4 and loCations of the wells are shown on Figure 2. Well logs with completion details are foun_d in Appendix D.

Overburden drilling was accomplished using rotary drilling methods. Split spoon samples were taken continuously and evaluated by a geologist during drilling for VOCs by measuring headspace concentrations using a hand-held photoionization detectpr (PID). Split spoon samples were decontaminated b.etween samples, and all drilling tools were decontaminated between drilling locations by a high temperature pressure washer. All wells were installed in accordance with the approved Work Plan.

Overburden Borings and/or Piezometers PZ-20 through PZ-27

Eight overburden borings were installed in the loading dock area. Six of them were finished as piezometers to characterize vectors of shallow groundwater flow since it was suspected that shallow groundwater flow was acting as a conduit for VOC transport in this region. Refusal was encountered at .shallow depth in B-24 and B-25 so they were not completed as piezometers.

The six overburden piezometers (PZ-20, PZ-21, PZ-22, PZ-23, PZ-26 and PZ-27) were installed in the fill material and native soils beneath the paved parking area (Figure 2). The piezometers were finished with a ten foot or less, 10-slot well screen bracketing the water table surface, if possible, and finished with flush mounted protective casings. Boring logs and well construction diagrams are contained in Appendix D.

Monitoring Well MW-12

The bedrock well was installed through an overburden boring to the bedrock surface. Once bedrock was reached, permanent steel casing was grouted into place and allowed to sit for a 24-hour period. A diamond tip, NX core barrel was then used to obtain core samples of the bedrock. The cores were inspected by a geologist with specific attention to fracture and joint patterns as well as to the graywacke and shale stratigraphy. MW-12 was drilled to a depth of 100 feet with approximately 50 feet of rock core obtained. The bedrock monitoring well was completed with 3" steel casing extending into bedrock approximately 10 feet and leaving the cored bedrock hole open through its entire vertical extent.

2.4.3 Well Development

New and existing monitoring wells were developed to improve hydraulic contact with the aquifer. Water was purged from the wells using either a bladder pump or an inertial lift pump. Where extensive silt or iron bacteria from the former pitcher pump mechanisms was encountered in the well,-cQmpressed air was used to agitate the well and remove detritus from the bottom and 'sidewalls of the well. Sufficient water was removed to bring the wells to within 50 nephelometric turbidity units (NTUs) or better, wherever possible. Temperature, pH, and specific conductivity measurements were monitored during development to assess when groundwater conditions had stabilized.

2.5 Water Levels

Water level data were collected at approximately monthly intervals during the Remedial Investigation. These data are summarized in Table 5. Water level data were collected using an electronic water level meter. Depth to water was recorded from a fixed measuring point and converted to elevation based on the ·surveyed elevation of the well casings. To prevent groundwater cross contamination, the water level meter was decontaminated between measurements using an AlconoxR solution.

2.6 Focused Bedrock Aquifer Pumping Test

A Focused Aquifer Test was performed to assess the impacts of pumping production well PW-1. A previous aquifer test had indicated that the cone of depression created by pumping PW-1 exhibited significant anisotropy and may have extended beneath suspect source regions. The objective of the pumping test was to evaluate whether PW-1could be used to limit migration of VOCs.

The aquifer test was started on February 20, 1996 and pumping was ended on February 22, 1996. Drawdown data were manually obtained in the on-site monitoring well network at regular intervals throughout the test duration and recovery data were collected over the following days.

PW-1 was pumped at approximately 20 gallons per minute (GPM) for the duration of the test. Pumped water was discharged to the existing air stripping unit for treatment and groundwater samples were collected during the test ·so that the VOC discharge levels could be evaluated. The groundwater samples were collected from the end of the discharge line prior to entering the air stripper and from the drainage pipe discharging into the fire pond.

Heavy rain and snow melt during the pumping test had a recharging impact on water levels. When the pumping test began, there was approximately 8-10 inches of snow on the ground, however, as a result of rainfall and mild temperatures the majority of this snow had melted by the end of the day. Significant upward fluctuations were observed in wells located near the former quarry. These results are reflected in the pumping test data which are contained in Appendix E.

2.7 Groundwater Sampling

2.7.1 MonitoringWells

Two complete water quality sampling events were conducted at the Rotron Olive site as part of the RI investigation, during winter and summer conditions. The first sampllng event took place in February of 1996 and the. second sampling event occurred in June of 1996. AU samples were analyzed by lEA, based in Connecticut. Independent data validation was provided by Dataval, Inc., based in Endwell, N.Y. The validated data are found in Appendix C and the results are summarized in Table 6.

Additional historical water quality data collected prior to the current RI investigation, which date to the early 1980s, have been tabulated and are also included in Appendix F for interpretive purposes.

During the sampling events, the bedrock monitoring wells were purged prior to sampling by removing three or more well volumes in accordance with the approved Sampling and Analysis Plan. Dedicated submersible pumps were used to purge bedrock wells. In instances where wells proved to recharge extremely slowly, purging was accomplished by fully evacuating the well and waiting for recovery. In all other wells, groundwater was purged until water quality parameters stabilized. These methods ensured that standing water in the borehole had been fully replaced by groundwater flowing into the well from the surrounding aquifer. Samples were collected once static water levels recovered to not less than ninety percent of the pre-purging levels.

Bedrock monitoring wells were sampled using the dedicated two-inch submersible pumps installed in all nominal 3-inch bedrock monitoring wells. Production well PW-2 was sampled using a portable four-inch submersible pump, and PW-1 and PW-3 were sampled from sample ports on their respective distribution lin s.

Groundwater samples were analyzed at lEA, Inc. by EPA method 8260 plus Freon 113 using the NYS-certified laboratory assuming Level 4 QA/QC data requirements. Temperature, pH, specific conductance, turbidity and dissolved oxygen were also measured in the field, where possible. Duplicate samples, field blanks, trip blanks and equipment blanks were obtained during each round of quarterly samples. Samples were transported to the laboratory on i.ce, in secure coolers.

2.7.2 Private Well Water Quality Sampling

Since the mid-1980s, well water samples have been collected from various private wells on properties surrounding the Rotron property by the Ulster County Department of Health. Rotron has collect.ed water samples at two homes that were included for a time as part of the monitoring well network. These private homeowner well data have been reviewed and tabulated, and are presented in Appendix F. No sampling of off-site wells was conducted as part of this investigation, however, the Ulster County Department of Health has conducted local _homeowner sampling within the last year, the .results of which were non-detect for the COCs. Those results are also suiJlmari.zed in Appendix F.

Review of the historical sampling record indicates that there have been low level detection of TCE in downgradient monitoring well MW-9 and the residential well OR-16 located at 22 Mary Lou Lane. The compounds TCE and 1,1,1 TCA were reported to be present in OR-16 at 11 and 9.2 parts per billion (ppb}, respectively in February of 1991. These compounds were not detected in any previous or subsequent samples taken from this well. TCE has been detected in MW-9 on three occasions at values ranging between 15 and 1.1 ppb. TCE has essentially been non-detect in MW-9 since 1984.

Some confusion may have resulted from mis-interpreting a poorly labeled sample Water #9, Sample Number 7695 as a sample from MW-9. The sample record, which is included in Appendix F, was included with the MW-9 sample results solely based on the #9 in the sample header. A thorough search of the historical data indicates that this sample was actually taken from PW-1 (The supporting documentation are included in Appendix F). This data has been removed from the MW-9 records in AppendixF

2.8 Surface Water Sampling

Surface water samples were collected at several locations throughout the site. The locations of these sampling points are shown on Figure 2 and these data are compiled in Appendix C.

Surface water quality samples were collected by manually lowering 40 ml VOA vials under the water surface with the opening downward. When the VOA was fully underwater, the VOA vial was rotated toward the upright position with the opening oriented downstream. The VOA was then closed underwater and lifted from the water and checked for air bubbles before shipping on ice to the laboratory.

All soils and groundwater quality analytical .samples were analyzed independently by Dataval, Inc., in accordance with EPA SW-846 procedures and protocols. Data validation was performed in accordance with the recommendations outlined in "Laboratory Data Validation" Functional Guidelines for Evaluating Organic and Inorganic Analysis (USEPA, 1988) and other applicable guidelines. The analytical data were validated to ensure that holding times, instrument acceptance tests, calibration, instrument tuning, method blanks, lab control procedures, field blank frequency and analysis, surrogate recovery, target compound identification, duplicate sample analysis, matrix spike and matrix spike duplicates, internal QA/QC, compound quantification and reported detection limits, sample custody and miscellaneous observations were within acceptable limits of the approved sampling method.

Data validation materials are bound in the respective laboratory results Appendices C and F. Where data validation identified necessary modifications to the laboratory data, the Appendices data have been modified to reflect the data validation values. Where changes have been made, the data qualifier includes a "V".

2.10 Geologic Field Reconnaissance

Rock outcrops on and near the Rotron property were examined in the field to evaluate the geologic characteristics of the graywacke and shale bedrock exposures and to evaluate orientations of fractures and bedding surfaces. Study locations included outcrops on the Rotron property near the former quarry and to the east of the former quarry. Previous investigations also included an assessment of outcrops north, east, and south of the Rotron site (EG&G, 1982).

Field evaluation of geologic formations included inspection of fracture characteristics in the shale and graywacke beds, observation of sediment grain-size variations within the graywacke beds, estimates of bed thickness', and summary evaluations of the geologic formation.

The orientation of fractures and bedding planes observed in the field were measured using a Brunton compass. The instrument is used to record the orientation, or bearing, of a fracture surface with respect to the magnetic north pole and to record how steeply the fracture surface is dipping toward the ground. Poles, or lines perpendicular, to the fracture were plotted on an equal-area Schmidt stereoplot for structural geologic analysis (Figure 9).

2.11 Fracture Trace Evaluation

2.11.1 Air Photo Analysis

Air photos available from various time periods (1967, 1980, 1994) and at various scales were evaluated as single sheets to identify bedrock lineaments. Lineaments observed on more than one air photo were plotted on the site base map (Figure 10) and physically field checked.

2.11.2 Geophysical Evaluations

A Very Low-Frequency (VLF) geophysical survey was conducted to identify dominant vertical fractures which might provide preferential :flowpaths for groundwater migration. The method involved use of a portable VLF geophysical receptor sensitive to low-frequency radio waves transmitted from naval bases located along the Atlantic coast and in the Great Lakes. The Navy propagates the VLF signals as navigation and communication beacons for submarines and other vessels and the signals can also be used on land for various geophysical applications. During groundwater investigation, geophysical instrument reception is improved by the presence of vertical thickness' of water which act like an antenna to amplify the signal. Where vertical fractures are filled with groundwater and are separated by zones of un-fractured rock virtually devoid of groundwater, the VLF signal improves.

VLF data collection was accomplished by transporting the VLF tuner along transects oriented roughly perpendicular to the transmitter location, recording signal strength data at approximately 20 foot intervals along each transect. The data were then filtered and processed to identify zones of enhanced low-frequency transmission. The traverses are shown on Figure 10. The VLF raw and filtered data are included in Appendix G.

To the degree possible, the locations for these fracture traces were physically field checked, compared to the results of the air photo analysis and compared to published fracture trace literature.

2.12 Down-hole Multi-Parameter Evaluations

Since well completion logs were not available for most bedrock monitoring wells on the Rotron property, a multi-parameter water quality down-hole probe was used to profile water quality at depth. A Hydrolab Corp. H20R multi-probe sampler was used to monitor dissolved oxygen, specific conductance, redox, temperature, and pH at five foot intervals through the water column. Vertical profiles plotting the multi-probe parameters from each well are shown in Appendix H. Water-bearing zones are tentatively identified where water quality indicators shift markedly, indicating boundaries between static well water and active water proximal to water-bearing fractures. Where possible, the water-bearing fractures are shown on the multi-probe records in Appendix H.

3.0 SITE GEOLOGY AND HYDROGEOLOGY

3.1 Site Geology

3.1.1 Overburden Stratigraphy and Hydroge'Ology

The Rotron Olive facility is situated at the base of Little Tonshi Mountain on the north side of an east-west trending valley that confines the Ashokan Reservoir (Figure 1). Based on available well records from previously drilled wells, on new borings, and test pit records, the overburden soil is composed almost entirely of a dense brown silty glacial till. The till is thin in the northern portion of the site where bedrock outcrops are common and where till varies in thickness from non-existent to around 15 feet thick near the former quarry. The till thickens near the fire pond and is around 40 feet thick or more near monitoring well MW-12 on the south side of the Rotron site.

Test pit excavations and split spoon samples collected during installation of the new monitoring well and piezometers provided vertical record of the overburden stratigraphy on the Rotron property. The silty till underlying much of the southern portion of the site is extremely dense, resulting in severely limited groundwater permeability in the overburden. Bedrock recharge is limited in these areas due to the dense till layer.

The till is significantly thinner in the northern portion of the site. Significant bedrock aquifer recharge is suspected in this area, supported by static water levels in bedrock wells MW-5 and MW-6 which responded nearly instantaneously to precipitation that occurred during the focused aquifer test. Numerous wet depressions exist in the northern portion of the property, probably resulting in substantial aquifer bedrock recharge in this region.

3.1.2 Bedrock Geology and Hydrogeology

The interbedded shales and sandstones or graywackes underlying the Rotron facility have been identified as belonging to the mid-Devonian Moscow Formation, a unit within the Hamilton Group of sedimentary rocks (Fisher, 1970) which are part of the Catskill Delta sequence. The sediments contributing to the formation of these sedimentary rocks were deposited in an intermittently sub-aerial and near-shore marine or sub-tidal shelf environment during rapid sediment shedding resulting from mountain building events during the Acadian Orogeny (Faill, 1985; Sevon, 1985; Isachsen, 1991; Rickard, 1975). The alternating sub-units of shale and graywacke resulted from different depositional environments (Bridge & Gordon, 1985).

During deposition of these sediments, either proximity to the sediment source area, rapidly changing depositional conditions, or shallow-marine turbidity flows led to poor size sorting in the sandstone beds. These beds are therefore best characterized as graywacke rather than sandstone since sandstones are typically well sorted. The graywacke beneath the site is massive and tends 'to fracture either conchoidally or along secondary joint surfaces. Groundwater storage and flow is believed to be highly dependent on the presence and orientation of these secondary joints and fractures.

The aywacke beds near the Rotron site are more competent in outcrops and in core logs than are the interbedded shales. Graywacke scarps up to 10 feet high are found in the vicinity of the former ·quarry. Core logs, outcrops, and regional investigations by others (EG&G, 1981, 1982; Sevon, i985) suggest that there is significant horizontal variation in the thickness of both the graywacke and shale beds and that some beds are laterally discontinuous.

Shale beds range in thickness from less than two feet within graywacke beds at MW-12 to massive sections more than 50 feet thick, as reportedly found in MW-4, MW-5 and MW-6. The shale ranges in color from black to green and/or green-grey. The green beds constitute the earliest of the sub-areal sediments deposited in the Catskill facies (Faill, 1985; Rickard, 1975) and the black shales are likely to be associated with near-shore or sub-tidal shelf deposits (lsachsen, 1991). The shale reportedly contains occasional laminar partings and chemically weathered zones. As reported in previous logs, the shale exhibited both massive and un-fractured zones, as well as highly fractured and chemically weathered bedsets.

Field measurement of the regional dip of the overall formation were difficult because upper bedding planes were generally weathered, splintered along cross-bedding planes, or modified by glacial scour. Previous reports have indicated that the formation dips approximately 4 to 12 degrees to the west (EG&G, 1981, 1982), attributable to the regional uplift of the lithified Catskill sediments. This upward movement is also believed to be responsible for the extension, or slight opening, of the existing fractures, enhancing the secondary storage capacity and permeability of the bedrock aquifer.

Two sets of near-vertical fracture orientations were mapped in the outcrops found on and near the Rotron site (EG&G WASC, 1982). The two fracture clusters are nearly perpendicular to each other, giving most outcrops a sawtooth appearance where slope failure has occurred along one or the other of the two fracture orientations. The most pronounced vertical fracture set is oriented between N1W and N51E with a concentration of orientations at around. N25E. The less pronounced fracture set is oriented nearly perpendicular to the first set at approximately N79W with values ranging from N67E to N55W. Figure 9 displays the orientation of 91 vertical fractures measured in the field. The data are plotted on a *pi* diagram showing poles, or lines perpendicular, to the orientation and dip of each fracture. The data were then contoured on the Schmidt equal-area stereo-net to visually indicate the predominant frachtre orientations.

Precipitation infiltrating the bedrock aquifer is believed to recharge the bedrock aquifer using the vertical fractures and to a lesser extent, horizontal openings as conduits into the subsurface. Infiltration occurs directly from the surface wherever the bedrock is exposed at or near grade; otherwise, infiltration of the bedrock aquife_r occurs gradually where precipitation penetrates the overburden soils and reaches the buried bedrock surface.

Once surface water enters the bedrock aquifer, continued downward infiltration is believed to occur along the vertical fractures and along northwestward to westward-dipping fractured bedding planes. Horizontal groundwater movement in the bedrock is likely to occur primarily in the shale in which bedding plane partings are common. The shale is also more fractured than the graywacke.

3.2 Focused Aquifer Pumping Test Results

A focused aquifer pumping test was conducted to evaluate whether PW-1 could be used to contain and control VOC migration. A previously conducted evaluation of PW-1lead to its use as a scavenger well between 1982 and 1984. The pumping test verified that PW-1 had a large radius of influence and that it could be used as a scavenger well, if necessary. It also confirmed that vertical fractures play a major role in groundwater transmission since the instantaneous yield was observed in those wells that appear to intercept vertical lineations on site or appear to be highly fractured in the upper reaches. Delayed yield conditions were observed in other wells which were apparently not highly fractured.

The radius of influence established during the pumping test reached near-steady state conditions after approximately 48 hours of pumping at an average rate of 20 gallons per minute (Figure 11). In general, the zone of influence was not particularly anisotropic, however, anisotropic aquifer response was noted with immediate impacts pronounced in PW-3, MW-4 and MW-12, and delayed yield responses in wells PW-2, MW-9, MW-10 and MW-11. Wells PW-1, PW-3, MW-4 and MW-12 appear to coincide with suspected vertical fracture trends (Figure 10), suggesting that the vertical fractures yield water quickly and that the horizontal fractures drain at a slower rate.

3.3 Bedrock Aquifer Flow

Under non-stressed bedrock aquifer conditions, without residential, remedial, or industrial groundwater extraction or returns, the predominant groundwater flow direction within the bedrock aquifer is oriented towards the south or southeast, off the Little Tonshi Mountain toward the Ashokan Reservoir drainage basin. Due to the thin soils in the northern part of the Rotron property, significant bedrock aquifer recharge occurs.

Figure 12 presents bedrock static water elevations measured at the monitoring wells. The data have not been contoured since all monitoring wells are open over more than 50 feet of water column and represent vertical composite static elevations. The significance of this vertical integration becomes clear when comparing static water elevations measured in monitoring wells MW-9 and MW-12. These two monitoring wells are nearly identical in depth yet consistently showed greater than 20 feet difference in static water level (Table 5). Similar differences in static water levels can be seen in wells MW-4 and MW-5. The data suggest that there is a groundwater trough near PW-1 maintained by the continuous but low volume groundwater extraction from the site production wells. Since PW-1 is currently not in service, this scenario is unlikely. It is more realistic to assume that the differing static levels relate to the variations in depth at which the major water bearing fractures are intersected in each bedrock well (see the Multi-Probe well logs in Appendix H). The water level data suggests that a significant vertical hydraulic gradient exists.

Inspection of the water levels on Figures 11 indicates that water elevations are higher in bedrock in the northern portion of the site and lower south and east. This is consistent with regional groundwater drainage towards the Ashokan Reservoir.

Groundwater extraction by the Rotron production wells distorts the natural groundwater :flowpaths in the bedrock aquifer near the Rotron site. The extraction form .groundwater depressions around the production wells (Currently, only PW-3 is used to supply water for the site). Groundwater is drawn preferentially towards the extraction point along vertical to sub-vertical linear fractures, horizontal bedding plane partings, and other secondary permeability conduits. The shape of the groundwater depression around the production wells may be irregular due to the irregularities of the aquifer, but evidence obtained by pumping PW-1 (Section 3.2) suggests a relatively uniformly distributed drawdown altered appropriately by the delayed yield effects of the aquifer. Where groundwater extraction do influence the bedrock aquifer, groundwater elevations are lowered and flow may be locally reversed.

4.0 NATURE AND EXTENT OF CONTAMINATION

4.1 Source Areas

Historic records indicate that unknown quantities of the solvents TCE, TCA, and Freon 113 have been released on the Rotron site. The recent source investigation results confirm that releases of these ompounds has occurred. The areas of concern are addressed below: "'r.

4.1.1_Former Quarry

Test pits were excavated where magnetic anomalies were found (Figure 13) and where previous remedial activities occurred. VOCs were encountered at varying levels in the former quarry.

Figure 14 graphically depicts some of the results of the portable GC field screening analysis. Varying levels of the COCs were encountered throughout the former quarry. Confirmatory soil samples were taken from the test pit intervals exhibiting the highest GC screening result. Figure 15 shows the laboratory results of the. soil. Comparison of Figures 14 and 15 indicates that the portable GC screening provided a very sensitive and very conservative means of estimag presence or absence of the COCs. In almost every instance, COCs detected by field screening at high levels were present in the lab data but at significantly lower levels. The confirmatory lab samples (Figure 15) indicate that the VOC levels at the old quarry do not exceed the site specific clean-up goals listed in Table 2.

4.1.2 Loading Dock and Drum Storage Area

Figure 16 depicts the result of the preliminary field GC screening in the loading dock area. Elevated levels of the COCs were encountered in saturated samples collected beneath the paved parking area behind the loading dock. Very shallow groundwater was encountered in most of the excavations in the loading dock area so it is possible that the results are indicative of contaminant transport via groundwater and not residual soil impacts. Whenever possible, unsaturated soils were taken for analysis, but in many cases water was so shallow (less than one to two feet below ground surface) that it was not possible to obtain representative unsaturated samples.

Figure 17 shows the results of confirmatory samples evaluated in the laboratory. Only one sample from TP-027 came back above the site specific soil clean-up objectives. . Mter preliminary excavation, it was evident that an IRM could be implemented near TP-027 so a second phase soil gas survey utilizing passive and active methods was performed in and around TP-027 to determine the extent of the impacts. The soil gas survey was also expanded to include the region around the former solvent drum storage area located in the northeast comer of the building. The soil gas results indicated that the problem areas were confined to the region in the immediate vicinity of TP-027 and beneath the former drum storage area. Six new test pits were excavated in these two areas to further delineate the extent of the VOC impacts. The locations of these six test pits are shown on Figure 18.

Test pits TP-103 and TP-104 were installed in or adjacent to a footing or perimeter drain that parallels the north side of the building. Field screening with the portable gas chromatograph indicated that the footing drain was acting as either a source or conduit for VOC contamination in the area between the former drum storage area and TP-027. Some residual globules of product were observed in the perimeter drain's bedding material. Using the information obtained from TP-027, TP-028, TP-029 and TP-101 through TP-106 and the soil gas survey, the approximate limits of the VOC impacts were determined (Figure 19).

Contaminated soils in the impacted areas have been excavated as part of the IRM and the perimeter drain has been replaced.

4.1.3 Solvent Tank

Five test pits were excavated near the former solvent tank region. The test pit locations are shown on Figure 6. Both soil screening (Figure 16) and laboratory samples (Figure 17) were obtained from each of the test pits and the results indicated that the soils surrounding the former solvent tank were impacted by VOCs. Soils surrounding the former solvent tank area are being excavated to the extent possible as part of the IRM (Figure 19). An SVE system will be employed to treat those soils that cannot be excavated.

4.1.4 Drywell #1 and Orangeburg Pipe

Information provided during informal interviews with former Rotron employees indicated that the solvent tank was periodically drained to a drywell along an Orangeburg pipe when full. The Orangeburg pipe was perforated allowing VOC-impacted fluids to seep into the ground along the pipeline. Soil gas data were collected around the drywell and the pipeline to define the limits of impacts. The results, summarized in Table 2, suggested that impacts were limited primarily to three areas along the pipe. Test pits were excavated at the three hot spots along the pipeline (Stations SG-200, SG-203 and SG-209, respectively) and at the drywell. The laboratory sample results from these test pits, summarized in Table 3, indicated that remediation was warranted near TP-OB200, TP-OB203 and TP--OB209.

Drywell #1, which was located at the discharge end of the Orangeburg pipe, was removed to provide access to the soil beneath the bottom and sidewalls of the concrete structure. Field screening indicated that some contaminated soil were present which required removal. These s'oils werexcavated and stockpiled in the parking area. A laboratory sample obtained from the base of the excavation indicated that no further remediation was necessary at this location (Table 3).

4.1.5 Drywell #2

Preliminary field screening results suggested that soils around Drywell #2 were highly impacted with VOCs. Visual evidence indicated that globules of free product remained adjacent to the drywell. Although laboratory analysis of a soil sample from TP-040 was relatively free of contaminants, the presence of free product globules suggested that a cautious approach regarding the preliminary lab results was necessary and prompted installation of a series of passive soil gas collectors in the vicinity of Drywell #2, the results of which indicated that VOCs were present at high levels. Another test pit, TP-R40, was excavated adjacent to the drywell to further explore the findings. Sample results from TP-R40 are summarized on Figure 17, indicated that the soils around Drywell #2 were highly impacted with VOCs warranting additional remedial measures through IRMs. The approximate boundaries of the impacted areas are shown on Figure 19.

4.1.6 Other Areas of Concern

Soil gas data were collected beneath the slab of the building to determine whether any source areas existed beneath the slab. The location of the sampling points are shown on Figure 4 and results of the sub-slab soil gas investigation are summarized in Table 1.

While VOCs were detected beneath the slab, ·it is interesting to note that the soil gas values were fairly uniformly distributed, except near the previously identified source areas. Elevated soil gas readings were observed at SG-116 which is located in the building but adjacent to the solvent tank source area and at SG-111 which is located adjacent to the drum storage source area. The proximity of these two soil .gas points with elevated VOC levels to identified source regions suggests that VOC vapors are migrating in the permeable fill material beneath the slab from ·the adjacent source areas.

Historical site plans and informal discussions with employees indicate that there are no potential sub-slab sources for the VQC vapors observed beneath building other than those previously identified. There is no evidence or indications that buried storage tanks beneath the :floor existed and chemical storage occurred outside the building in the drum storage area. It is possible that minor spills may have occurred during transport between the drum storage areas and the work stations, or while using solvents as part of the mm:t.ufacturing process. Spills of this nature were reportedly contained using an absorbent material, if warranted; however, some solvents may have occasionally been rinsed into the :floor drain system which emptied into Drywell #2 and eventually into the soils surrounding the drywell or into the storm drain. Soil gas readings taken near the floor drains in the manufacturing area (SG-105 and SG-106) detected low levels of VOC vapors.

Based on comparative results taken from the solvent tank and drum storage source regions (See Table 2), VOC detects at these levels are not indicative of a significant source areas. It is highly unlikely that the unsaturated soils beneath the sub-slab contain sufficient residual source to warrant remediation. The detected VOC vapors probably resulted from gas diffusion through the permeable fill material from the source areas located outside of the building and, to a lesser extent, from shallow groundwater migrating beneath the building. The relatively impervious nature of the building floor acts as cap, trapping VOC vapors beneath it.

Sub-slab vapor migration control will be concentrated in those sub-slab areas that are adjacent to the known source regions outside of the footprint of the building. The SVE system is described in Section 6.0.

4.2 Concentrations and Extent ofthe Compounds of Concern

Groundwater impacted by dissolved concentrations of TCE has been identified in bedrock wells on the Rotron property. For ease of interpretation, only the most recent water quality data are shown on Figure 20. The most commonly detected chlorinated hydrocarbon on the site is TCE. During the July 1996 groundwater sampling event, the highest TCE concentrations in the bedrock aquifer were found in well PW-1 and MW-6. The highest VOC levels appear to historically be focused in PW-1. Infiltration percolating through the source regions located in the old quarry and loading dock migrate through the vertical and horizontal fractures into the bedrock aquifer and previous pumping may have induced contaminant infiltration.

Decomposition by-products ofTCE are 1,1-DCE and 1,2-DCE; both compounds have also been found in low concentrations on the property. 1,1-DCA, which is a decomposition by-product of 1,1,1-TCA, has been found on site. A secondary decomposition by-product commonly associated with 1,1-DCE, 1,2-DCE, and 1,1-DCA is Vinyl Chloride (VC); however, VC is extremely volatile, meaning that it is highly prone to evaporating from both soils and water. VC has never been found in samples collected either on or adjacent to the Rotron property.

<u>Groundwater Impacts</u>

Groundwater impacts are observed in bedrock wells surrounding the old quarry and loading dock areas and in shallow perched oundwater emanating from the loading dock area. Groundwater impa<;ts were·observed in bedrock monitoring wells MW-4, MW-5 and MW-6 which surround the quarry and in· production wells PW-1 and PW-3. The detected compounds were primarily chlorinated solvents and include TCE, 1,1,1-TCA, 1,2-DCE, 1,1-DCA, Carbon Disulfide and Freon 113. Also, and anomalously, Toluene was found in MW-12 at a concentration of 1 ppb. The historic record does not include Toluene hits in any previous monitoring well data. Toluene is an aromatic hydrocarbon not associated with solvent processes known to be used historically on the Rotron facility and may have resulted from laboratory or sample cross-contamination.

Shallow groundwater emanating from the loading dock area drains into a storm drain that runs through the parking lot and along the eastern side of the building before discharging to the fire pond. Field screening results indicated that shallow groundwater in the loading dock area was contaminated. Surface water samples taken from the catchbasin near TP-027 (CB-1 on Figure 2) and at the discharge point into the pond were also observed to be impacted with low levels of VOCs. However, SPDES sampling requires monitoring at the output end of the fire pond monthly and the results indicate that VOCs have not exceeded discharge requirements at that point. Aeration in the fire pond was also employed during remediation to ensure compliance with discharge limitations.

The extent of the shallow groundwater plume near the loading dock is believed to be confined to the south by the storm drain system. During test pitting operations, it was noted that test pits done to the south of the French drain were essentially dry to a depth of 8 to 12 feet below ground surface, whereas test pits done in the parking lot were saturated at shallow depth. It is apparent that the footing drain is an effective barrier to flow. The loading dock piezometers indicate that shallow groundwater generally flows to the northeast, east or southeast towards the storm drain system and catch basin CB-1, which is the drainage point for the perimeter drain in the loading dock area. It is possible that shallow groundwater has contributed to the VOCs detected beneath the slab, but it is likely to be a relatively minor component based on observed groundwater conditions in the loading dock area.

<u>Surface Water Impacts</u>

Surface water samples were collected at the locations shown on Figure 2. The data are presented in Table 6 and compiled in Appendix C. Samples were taken from a small stream just above the former quarry area (SW-QUA), from a small wetlands located just south of MW-4 (SW-MW4), from the small stream adjacent to PW-2 (SW-PW2), from a catch basin in the loading dock area (SW-CB1) and from the point where the storm drain pipe discharges into the fire pond (SW-02A). Sampling point SW-02A corresponds to SPDES sampling pot 002a.

Volatile organic compounds were generally not ·detected in the surface water samples with a couple of exceptions listed in Table 6. TCE, Freon-113, 1,1,1-TCA and 1,2-DCE were present at 78, 6, 3 and 15 ppb respectively at SW-02A in

February of 1996; TCE was also detected at 2 ppb at SW-02A in June of 1996. TCE and Freon-113 were found at 1 and 3 ppb respectively, at SW-MW4 in June of 1996.

Review of the SPDES sampling results indicates that VOC's have been detected at 002a which is located at the end of the storm drain system (Appendix F). The sample results obtained from SW-02A are consistent with the historical SPDES monitoring results. The storm drain system is the conduit for treatment of VOC impacted water. Contaminated shallow groundwater from both the loading dock area and Dry Well #2 drains into the storm. Contaminated groundwater originating in the vicinity of the former solvent tank area also seeps into the storm drain systeni. This VOC impacted water is treated by the air stripping towers before it discharges to the fire pond but it is possible that under high flow conditions untreated water is discharged directly to the fire pond. Discharge measured at SW-02A has been impacted with low levels of VOCs above the discharge limitations; however, past and recent SPDES sampling at the fire pond outlet (SPDES point 002b) indicates that the discharge limitations have not been exceeded (Appendix F).

5.0 CONTAMINANT FATE AND TRANSPORT

The natural regional groundwater trend within the bedrock aquifer is southward, based on the general decrease in measured water elevations in bedrock wells between the former quarry road and the southern portion of the Rotron Olive site, although there may be a component of flow to the east based on observed water levels in the eastern portion of the site. Flow to the east may be an illusion created by the open-bore characteristic of the monitoring wells which provide only vertically integrated static piezometric pressures within the aquifer. Water elevations may be strongly dependent upon the depth at which water bearing fractures are intercepted. As such, no bedrock water table map can be constructed for this site but flow can be discussed conceptually (Figure 12).

VOCs in the bedrock aquifer would be expected to migrate southward and possible southeastward, under non-pumping conditions, based on regional flow direction. Chlorinated VOCs have been detected only sporadically at the perimeter wells, so dilution and dispersion may be impacting the plume. Historically, VOCs have been detected in MW-9 which is due south of the source regions and at OR-16 which is located south and east of the site (Figure 2). TCE was detected in MW-9 at 15 ppb in September of 1981, at 1.3 ppb in Augu;st of 192 and at 1.1 ppb in May of 1984. VOCs were also detected at 22 Mary Lou _Lane (OR-16 on Figure 2) in November of 1981 (TCE at 1.4 ppb) and in February of 1991 (TCE at 11ppb and TCA at 9.2 ppb). These are the only verifiable hits at perimeter monitoring points and they cannot be correlated to an observable trend. Recent monitoring results indicate that the perimeter wells are free of impacts and MW-11, which was installed to fill a monit ring gap in the southeast portion of the site, bas been clean. Also, groundwater in the bedrock aquifer is coming under periodic influence of pumping by on-site production wells which may·be limiting migration.

Dissolved VOCs may be present in shallow groundwater in the loading dock area in concentrations likely to represent the dominant point of contaminant dissemination into the bedrock aquifer system below. Field screening gas chromatograph readings indicated that shallow groundwater was impacted in the ppm range. Overburden thickness in the loading dock area is only between 7 and 10 feet, and full saturation is maintained by the natural configuration and poor drainage of the site in this area.

6.0 INTERIM REMEDIAL MEASURES

The source investigation results indicated that VOC-impacted soils remained in the locations shown on Figure 19. Consequently, an Interim Remedial Measures (IRM) Work Plan (Appendix I) was submitted and conditionally approved by the NYSDEC. The IRM Work Plan focused on soil excavation, soil treatment and off-site disposal, where warranted and PW-1 will also be operated as a scavenger well.. The tentative soil excavation boundaries are shown on Figure 19. The IRMs are ongoing and will be completed in the near future and prior to the start of inclement weather. A brief synopsis follows:

<u>Former Quan:y</u>

Seven rusted, crushed, metal drum carcasses have been removed from various locations in the quarry. None of the drums contained fluids. To limit infiltration into the former quarry, the stream that empties into the quarry will be diverted and soils will be shaped and graded to promote runoff. The soils will be seeded with an appropriate vegetative cover material to limit infiltration, prevent erosion and enhance evapo-transpiration.

<u>Loading Dock and Drum Storage Area</u>

Approximately 500-1,500 cubic yards of soil has been excavated in the southeast comer of the loading dock area and from beneath the former drum storage area located at the northeast comer of the building.

Since groundwater is so shallow beneath_the loading dock, a system of dewatering trenches have been installed to facilitate excavation. The purge water is pumped to the air stripper located adjacent to the northeast comer of the building where it is treated before discharging into the storm drain system. This storm drain empties into a second air stripping tower before being discharged to the fire pond.

Not al) of the impacted soils in the drum storage area could be excavated based on proximity to the building foundations. A Soil Vapor Extraction (SVE) system has been located immediately adjacent to the building foundation wall beneath the drum storage area to remove VOCs. The SVE system was necessary since excavation of contaminated soils at this location might have damaged the building foundation.

Drywell #2 and the Storm Drain System

Approximately 2,000 cubic yards of soil and the drywell have been excavated around Drywell #2. Roof drains remain diverted to the storm drain system. The floor drain system in the building was previously abandoned so these lines were sealed and abandoned in place.

Bedding material surrounding the storm drain system on the east side of the building was also impacted by VOCs so it was replaced between Drywell #2 and the former solvent tank area. The old concrete storm drain pipe was replaced with an equal diameter impermeable PVC drain pipe.

Former Solvent Tank Area

Approximately 1,500 cubic yards of soils were excavated in the former solvent tank area until soil clean-up guidance values were met to the north and east. Due to structural conditions, clean-up values could not be met to the south and west. Any further excavation in these areas would have resulted in damage to the fire protection line and building foundation, respectively. A second SVE system was installed to address remnant VOCs in the southern and western portions of the solvent tank area.

During placement of the SVE system, it was noted that the former solvent tank excavation had filled with water, probably as a result of placement of permeable fill in the excavation. Accumulating water is removed by a dewatering well placed at the base of the excavation. Pumped water is .directed from the sump to the first air stripper for treatment before discharge into the storm drain system.

"'(.

<u>Oran eburg Pipe</u>

Approximately 2,500 cubic yards of ·soil as well as the Orangeburg pipe were removed along the Orangeburg pipe. Most of the soils were excavated from one area near SG-209 where there was an apparent blockage in flow along the pipe.

Drywell#1

The Orangeburg pipe formerly emptied into a drywelllocated on the eastern edge of the parking area. The drywell was excavated and removed, steam cleaned and re-used in the loading dock dewatering system. Soils were not significantly impacted around this drywell. Approximately 50 cubic yards of soils were removed.

<u>Soil Screening</u>

Soils encountered during excavation consisted either of fill material made up of crushed stone from the quarry or a native, reworked gravelly till containing up to approximately 30% boulders and cobbles by volume. Since acceptable off-site disposal options will not accept large stones in the soils matrix, it was necessary to screen the soils to remove the gravel and cobbles. Screening led to volatilization of residual VOCs adsorbed onto the soils; therefore, the soil will be re-sampled prior to off-site disposal in case some soils now meet the site specific clean-up objectives and may be re-used wherever possible on site.

The IRM results will be detailed in a separate document upon completion of the IRMs.

<u>PW-1 Scavenger Well</u>

Recent samples obtained from PW-1 indicated that groundwater in the vicinity of the well is impacted with VOCs at levels significantly above groundwater standards. Potential bene ts may be available if contaminated groundwater were captured from PW-1 and treated.

The focused aquifer test suggested that pumping PW-1 at a rate of between around 20 gallons per minute (gpm} would create a cone of influence that may extend beyond the boundaries of the property. Pumping at this rate creates a substantial capture zone which should substantially reduce,.if not completely eliminate, the potential for off-site migration. The cone 9f influence is large enough to incorporate the former quarry, the loading dock and drum storage areas and possibly the solvent tank area. Groundwater infiltrating into the bedrock aquifer from these regions is likely to be captured by pumping PW-1 at the proposed rate. It should be noted that PW-1 has not been operated continuously in the past and was only pumped for a limited duration during the aquifer test (approximately 48 hours). the actual pumping rate will vary based on available drawdown and treatment system capacity and efficiency.

Observed chemistry levels make it necessary to route water extracted from PW-1 to a separate stripping tower to meet SPDES effiuent discharge limits. Plans are to install a separate tower capable of treating up to 25 gpm at a 95% or greater efficiency rating. Discharge from the new PW-1 stripping tower will be directed to the existing primary tower for polishing. Also, modifications to the existing treatment system are planned for July and August of 1997 which will eliminate surface water runoff from the treatment stream.

7.0 BASELINE HUMAN HEALTH EXPOSURE ASSESSMENT

A human health exposure assessment was conducted to evaluate potential exposure pathways and associated potential health risks to humans at and near the Olive facility. The Human Health Exposure Assessment (HHEA) and a focused quantitative health risk assessment are found in Appendix J of this report. The exposure assessment considered volatile COCs found at the site including TCE, cis 1,2-DCE, TCA, 1,1-DCA, PCE and Freon 113.

The potential for human exposure to these chemicals was assessed assuming present-use and anticipated future land use conditions in the Olive site area. Groundwater contamination was identified around 1982 or earlier in production wells and the groundwater used at the facility is currently treated. It is assumed that future industrial occupants of this site will continue to utilize treatment systems to remove any COCs. Water quality in private wells near the Rotron facility has been monitored by the illster County Department of Health and no verifiable impacts to these wells have been identified. Based on these on-site and off-site groundwater conditions, no human exposure pathways for direct groundwater ingestion were identified under current and anticipated future site uses.

Trace level COCs have been identified in water in the fire pond located on the property. Since the pond is not used in a recreational capacity, exposure to humans are not expected under the present-use or anticipated future use scenarios. Overflow from the pond regularly meets approved SPDES conditions so no downstream health impacts are anticipated.

Since the COCs identified at the Olive site are volatile, gaseous VOCs might migrate into temporary on-site excavations installed in the areas adjacent to the north and east sides of the main plant in the identified source regions or in the former quarry. Average COC soil gas headspace concentrations from soils in these areas.were compared to the National Institute of Safety and Health (NIOSH) Permissible Exposure Levels (PELs) and were found to be lower than the approved exposure levels for an 8 hour work day. Where levels are below the PELs, health effects to site excavation laborers by inhalation are not anticipated.

Air quality sampling indicates the presence of trace levels of VOCs in the indoor air inside Rotron's main plant. Inhalation of these COCs was identified as an exposure pathway to employees inside the building and this exposure pathway was subjected to quantitative carcinogenic and non-carcinogenic risk analysis to calculate potential human health risks associated with this exposure. Total carcinogenic risks were determined to be 1.29 x 10^{-5} which is within the USEPA's target range for acceptable carcinogenic risk of 10^{-4} to 10^{-6}. The non-carcinogenic hazard index (HI) was calculated to be 0.825 which is less than the USEPA's HI threshold of 1.007 for TCE. When the HI is less than 1.000, no human health effects are indicated.

8.0 SUMMARY AND CONCLUSIONS

8.1 Summary

Pursuant to an approved Work Plan for a Supplemental Remedial Investigation, Rotron has conducted source investigations incorporating magnetometry and test pit investigations in the former quarry; soil gas, test pitting and installation of shallow piezometers in the loading dock area; and soil gas and test pitting in the dry wells, Orangeburg pipe and former solvent tank areas. Rotron has also installed an additional deep bedrock monitoring well near the southern perimeter of the site to provide complete downgradient coverage. An HHEA was also completed in which the findings determined that current site conditions pose no potential health risks through the identified exposure pathways.

8.2 Nature and Extent of Contamination

Between the late 1960's and 1976, TCE was used to. degrease parts. Between 1976 and 1985 when the plant closed, TCA was used instead of TCE. Freon 113 was used in ultrasonic parts cleaning machines during the same time frame. All three of these compounds have been detected in soils and groundwater on site.

Several source regions were identified. They 4lclude an area in the southeast comer of the loading dock, an area ben ath a former drum storage bay, the area surrounding Drywell #2, the soils surrounding the storm drain between Drywell #2 and the solvent tank, the soils surrounding the former solvent tank location, soils around the Orangeburg pipe and a small amount of soil surrounding Drywell #1.

The p_ossible extent of the contamination is shown on Figures 19 and 20. High levels of TCE, TCA and lower concentrations of Freon 113 were found in the soils in those areas discussed above. Relatively lower levels of these compounds were found in groundwater beneath the site.

8.3 Fate and Transport

Historic spills resulted in VOC source areas on the site. The source of the dissolved VOCs in bedrock groundwater is probably infiltration through shallow soils in the loading dock soils and to a lesser extent, residual contamination in soils in the former quarry area.

The bedrock aquifer contamination remains localized in the northern portion of the site near the former quarry and around PW-1. Trace VOC levels are found in PW-3, probably as a result of induced VOC transport by pumping.

Under natural gradients, groundwater flows from north to south at the site yet :ae contamination has been encountered only sporadically at trace levels in the downgradient perimeter wells, nor have there been significant VOC hits in the homeowner wells adjacent to the site (Appendix F). Either the plume is sufficiently diluted, dispersed or redirected, or the active on-site pumping restricts contaminant migration. It should be noted, however, that fractured rock flow is complex and somewhat unpredictable. However, because of the work performed under the Supplemental RI, it is unlikely that there are any undetected pathways. Neither the network of existing monitoring wells nor the periodic sampling performed at off-site private wells give any indication of off-site plume development.

8.4 Human Health Exposure Assessment

The human health exposure assessment (Appendix J) indicates that there are only limited opportunities for VOC exposure to humans near the Olive facility. Direct ingestion of impacted groundwater does not occur because all recognized wells containing dissolved VOCs are treated prior to use. Inhalation of COCs inside the main plant and in temporary excavations near the plant were therefore the only exposure pathways which could reasonably be evaluated under present and anticipated future land uses. A quantitative risk assessment conducted for facility worker's exposure to indoor air did not indicate the potential for human health effects. Day laborers might also be exposed to cc;>ncentrations of gaseous VOCs if working in subsurface excavations, but .health risks are not expected since the average gaseous VOC concentrations detected in the subsurface soils were lower than the permissible exposure limits established by OSHA's occupational exposure program.

Total carcinogenic risks were determined to be 1.29 x 10^{-5} which is within the USEPA's target range for acceptable carcinogenic risk of 10^{-4} to 10^{-6}. The non-carcinogenic hazard index (HI) was 0.825 which is less than the USEPA's HI threshold of 1.007 for TCE. When the HI is less than L007 for TCE, no human health effects are indicated.

8.5 Conclusions

The objectives of the RI were as follows:

- Assess the nature and extent of residual solvent contamination in the previously identified source regions.
- Based on geochemical analysis and the nature of residual contamination, predict the long term monitoring requirements and potential off-site impacts if a no action alternative is selected. Assess the long-term monitoring requirements and evaluate appropriate improvements to the ongoing monitoring program.
- Assess whether localized flow control or drainage diversion can be utilized to reduce the influx of precipitation and surface water runoff into the suspected source regions.
- Assess the permeability characteristics of the existing soils in the source regions to determine if the existing soils could be used for re-grading and cover to limit infiltration.
- Assess whether modifications to the existing drainage system would exceed the treatment capacity of the existing remediation systems.
- Determine if groundwater flow control is feasible and appropriate.
- Assess the capacity of the existing pumping well system to control.off-site migration.
- Define the nature and extent of the VOC contamination in the bedrock aqnifer.
- Improve baseline information for on-site and off-site residential wells nearby the site.
- Assess VOC contamination in the surface water runoff from the site.

- Collect sufficient data to determine the adequacy of the operating air stripper for the treatment of surface water runoff. Evaluate methods to upgrade the surface water collection system so that all water that passes through the existing surface water air stripping treatment system can be treated.

The RI has met these objectives as follows:

- Source regions have been identified by investigation and interviews. The nature and extent of the contaminants in the source areas have been defined. Source areas are being remediated using IRMs by either excavation or active mechanical systems including SVE and dewatering.

- Quarterly monitoring will be conducted for a period of two years after completion of the IRMs. Subsequent monitoring requirements, if any, will be negotiated with the NYSDEC at the end of that period based on the results.

- Flow control and drainage diversion were implemented in source areas to reduce the influx of precipitation into source regions including the loading dock/drum storage area, the former solvent tank location, and the former quarry.

- Remediated soils will be reused in the former quarry area to regrade the surface of the landfilled area to promote runoff and limit infiltration.

- The current primary air stripping tower remediation system has the capacity to treat approximat-ely 140 gpm. Under normal flow conditions this rate is not exceeded; however, during period of extremely high precipitation or melt-off, this rate could be exceeded by direct surface runoff. Rotron is currently redirecting seasonal flows around the quarry and loading dock areas to limit storm flows entering the air stripper. Surface runoff is relatively free of ,VOCs and thus dilutes contaminated water entering the remediation system during storm events. Flood duration periods are short, and violation of the discharge requirements are unlikely during such periods. Additional modifications to the air stripping towers are proposed which will eliminate surface water run-off from the treatment stream. The'proposed modifications ensure that water extracted from PW-1, the loading dock sump and the solvent tank sump will be treated at least once before discharging to the fire pond, even during periods of high flow.

- Groundwater flow control is feasible at PW-1 and it will be operated as a scavenger well to capture VOC's in the region around PW-1.

- Steady, continuous pumping of PW-1 will reduce the potential for VOC contaminated groundwater migration off-site.

- VOCs in the bedrock aquifer are concentrated near areas where source regions are in close proximity to bedrock including the former quarry and the loading dock areas. Soils in the former quarry meet the clean-up objectives, but some seepage has historically occurred and may have historically impacted groundwater quality in this region.

- A database has been established for tracking future on-site and off-site sampling. All current data have been entered into the existing database.

- The vast majority of VOC-contaminated shallow water was emanating from the loading dock and solvent tank areas. This is now controlled by dewatering systems. Surface water quality should begin to improve over time since these sources have been eliminated.

8.5.1 Data Limitations and Recommendations

Evaluation of the site characteristics as well as fate and transport mechanisms has delineated source regions and the mechanisms for surface and groundwater contamination. IRMs currently underway will address all of the source regions and the issue of groundwater contamination near PW-1. Quarterly monitoring of the existing monitoring well network will provide sufficient control to identify off-site movement of the plume footprint.

Quarterly monitoring of the bedrock monitoring well network is recommended for a two-year period to confirm the efficiency of the remedial program.

8.6 Recommended Remedial Action Objectives

Goals for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375-1.10. The overall remedial goal is to meet all Standards, Criteria, and Guidance (SCGs) and be protective of human health and the environment.

At a minimum, the remedy selected should eliminate or mitigate all significant threats to the public health and to the environment presented by the hazardous waste disposed of at the site through the proper application of scientific and engineering principles.

The r medial objectives selected for this site are:

- Reduce, control, or eliminate to the extent practicable the contamination present within the soils on-site
- Eliminate the threat to surface waters by eliminating, to the extent practicable, any future contaminated run-off from the contaminated soils on-site.
- Eliminate the potential for direct human or animal contact with the contaminated soil on-site
- Eliminate the threat to indoor air quality from the migration of the contaminants of concern into the plant building.
- Mitigate the impacts of contaminated groundwater to the environment.
- Prevent, to the extent practicable and possible, the migration of contaminants in soils to groundwater.
- Provide for attainment of SCGs for groundwater quality at the limits of the area of concern (AOC), to the extent practicable.

The remedial objectives of the NYSDEC are to eventually return the site to a non-impacted condition. The current IRM program will go a long way towards fnlfilHng this goal; however, based on the nature and type of contaminant and the soils and rock around the site, complete clean-up may not be possj.ble. The realistic remedial objectives are to provide sufficient site clean-up to meet specific clean-up objectives and maintain a safe drinking water resource for the downgradient users.

Following completion of the IRMs, it is believed that ongoing contributions of dissolved VOCs into the bedrock aquifer and to the surface water body will be reduced to the point where the existing plumes will be receiving essentially no additional source. It is reasonable to expect the plumes to attenuate due to pumping and treating contaminated groundwater at PW-1, dilution with recharging precipitation and attenuation due to natural occurring chemical reactions including biodegradation, chemical adsorption, dispersion, or breakdown.

It is anticipated that the IRMs will be su:.ffi.cient to meet the recommended remedial action objectives of both the NYSDEC and the Ulster County and New York State Departments of Health.

9.0 R FERENCES

Anonymous, September 1982. *Environmental Information Package.* (summary of remedial actions)

Bridge, J.S., and Gordon, E.A., 1985. *Quantitative interpretation of ancient river systems in the Oneonta Formation, Catskill Magnafacies,* in The Catskill Delta, Woodrow, D.L., Sevon, W.D. editors., USGS Special Paper No. 201. pp 163-181.

Chazen Environmental Services, Inc., September 1995a. *Remedial Investigation Work Plan, EG&G Rotron, Olive Facility.*

Chazen Environmental Services, Inc., September 1995b. *Remedial Investigation Work Plan, Appendix A - Sampling & Analysis Plan (SAP), EG&G Rotron Olive Facility.*

EG&G Environmental Consultants, August 1981. *Remedial Action Plan: Closure of Industrial Landfill at EG&G Rotron, Inc., Commercial Products Division, Shokan# NY.*

EG&G Environmental Consultants, December, 1981. *Investigation/Remedial Action Plan: Closure of Industrial Landfill at EG&G Rotron, Inc., Commercial Products Division, Shokan, New York.*

EG&G Environmental Consultants, March 1982. *Amendment to the Investigation/Remedial Action Plan: Closure of Industrial Landfill at EG&G Rotron, Inc., Commercial Products Division, Shokan, NY.*

EG&G Environmental Consultants, September 1982. *Site Groundwater Investigative Program for EG&G Rotron, Inc., Shokan, NY.*

EG&G Environmental Consultants, March 1983. *Final Site Groundwater Treatment Program for EG&G Rotron, Inc., Shokan, NY.*

EG&G Environmental Consultants, April1983. *Final Site Groundwater Treatment Program for EG&G Rotron, Inc., Shokan, New York (Preliminary)*

EG&G Washington Analytical Services Center, Inc. (WASC), January 1984. *Engineering Report Related to SPDES Permit for EG&G Rotron, Inc., Shokan, NY.*

EPA, October 1988. *Guidance For Conducting Remedial Investigations and Feasibility Studies Under CERCLA,* Interim Final.

Faill, -T., 1985. *The Acadian orogeny and the Catskill Delta* in The Catskill Delta, Woodrow, D.L., Sevon, W.D. editors., USGS Special Paper No. 201. pp 15-37.

Fisher, D.W., Isachsen, Y.W., Rickard, L.V., 1970. *Geologic Map of New York State*, NYS Geological Survey.

Geraghty & Miller, Inc., February 1995. *Focused Remedial Investigation Work Plan, EG&G Rotron Site, Olive, NY.*

Isachsen, Y.W. et al, 1991. *Geology of New York,· A Simplified Account,* New York State Museum/Geological Survey, Educational Leaflet No. 28, 284 p.

NYSDEC, August 30, 1988. *New York State Hazardous Waste Site Citizen Participation Plan.*

Rickard, L.V., 1975, *Correlation of the Silurian and Devonian rocks in New York State:* New York State Museum and Science Service, Map and Chart Series no. 24, 16 p.

Sevon, W.D., 1985. *Nonmarine facies of the Middle and Late Devonian Catskill coastal alluvial plain* in The Catskill Delta, Woodrow, D.L., Sevon, W.D. editors., USGS Special Paper No. 201. pp 79-90.

USEPA 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. Interim Final.* EPA/540/G-89/004

USEPA 1990. *National Oil and Hazardous Substances Pollution Contingency Plan.* 40 CFR Part 300. March 8, 1990.

Vroblesky, D.A, L.C. Rhodes, J.F. Robertson, and J.A. Harrigan, 1996, *Locating VOC Contamination in a Fractured Rock Aquifer at the Ground-Water ISurface Water Interface Using Passive Vapor Collectors,* Ground Water, Vol. 34, No.2.

Vroblesky, D.A., J.F. Robertson, Mario Fernandez, and C.M. Aelion, 1992, *The permeable-membrane method of passive soil gas collection,* in: Proceedings of the Sixth National Outdoor Action Conference, National Water Well Association, May 5-13, 1992, pp. 3-16.

TABLES