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Golder Associates

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FINAL REPORT
ON
RCRA FACILITY INVESTIGATION
BUFFALO COLOR CORPROATION
BUFFALO, NEW YORK
(Revision 1)

Golder Associates Inc.

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Golder Associates

December 21, 1998

963-9117

Buffalo Color Corporation
100 Lee Street
Buffalo, New York 14240

Attention: Mr. David E. Sauer, Manager, Environmental Affairs

RE: REVISION 1 OF THE FINAL REPORT ON
RCRA FACILITY INVESTIGATION
BUFFALO COLOR CORPORATION
BUFFALO, NEW YORK

Gentlemen:

Golder Associates Inc. (Golder Associates) is pleased to submit the above referenced Revision 1 of the Final Report on the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at the Buffalo Color Corporation (BCC), located in Buffalo, New York as required by Module III E.7(a) of the 6 New York Code of Rules and Regulations (NYCRR) Part 373 Post-Closure Permit (Permit) for the BCC facility. These modifications include replacement text, tables, and figures to the Final RFI Report issued by Golder Associates in November 1997. Revision 1 of the Summary Report is provided as a new document.

The revised reports include the revisions identified in the BCC correspondence dated June 30, 1998 "Buffalo Color Corporation RCRA Facility Investigation Report, Response to NYSDEC Comments". Additionally, modifications were made where applicable in the reports to the NYSDEC Water Quality Standards for Surface Waters and Groundwater (6NYCRR Part 703.5, Table 1) which were amended in March and June 1998. The standards for the following constituents were revised:

- Benzene
- 1,2-Dichlorobenzene
- 1,3-Dichlorobenzene
- 1,4-Dichlorobenzene
- N,N-Dimethylaniline
- Bis(2-Ethylhexyl)phthalate
- Nitrobenzene
- Cadmium
- Mercury
- Zinc
- Cyanide
- Nitrate-Nitrogen
- Nitrite-Nitrogen
- PCBs

Golder Associates appreciates the opportunity to provide professional services to BCC. If you have any questions regarding this report, please do not hesitate to call.

Very truly yours,

GOLDER ASSOCIATES INC.

David J. Mitchell

David J. Mitchell, P.G.
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Attachments

F/N: REVRFI.DOC

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1. INTRODUCTION

1.1 General

This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report has been prepared to meet the requirements in Module III E.(7)(a) of the Buffalo Color Corporation (BCC) 6 New York Code of Rules and Regulations (NYCRR) Part 373 Post-Closure Permit (New York State Department of Environmental Conservation (NYSDEC) Identification (ID) Number 9-1402-00076/00-112-0) issued to BCC on February 10, 1995. BCC has been required to perform a RFI at the facility located at 100 Lee Street in Buffalo, New York in response to the corrective action requirements of RCRA and the Hazardous and Solid Waste Amendments of 1984 (HSWA). The RFI was performed to determine the nature and extent of releases of hazardous wastes and/or constituents from solid waste management units (SWMUs) and areas of concern (AOCs) at the facility. The requirement to perform the RFI for the SWMU Area A, B, C, and E (Area ABCE) is specified in Module III E.(5)(a) of the Permit.

1.2 Report Organization

This draft Final RFI Report presents the results of the environmental investigations for Area ABCE at the BCC facility as well as supplemental investigations performed off-site at adjacent locations. Section 2 presents the facility background information and Section 3 presents the procedures followed during the RFI. Characterization of the environmental setting at the facility is presented in Section 4 and the results of the RFI investigation are presented in Section 5. Potential contaminant migration pathways and receptors are identified in Section 6, and Section 7 presents the RFI summary of findings and conclusions.

2. FACILITY INFORMATION

2.1 Facility Description

The BCC plant, located at 100 Lee Street within the City of Buffalo, Erie County, New York, exclusive of Area D, (Figure 1) occupies approximately 42 acres near and adjacent to the Buffalo River. There has been continuous production of various dyestuffs and organic chemicals at the facility for over 100 years. The plant was originally built in 1879 by a predecessor of Schoellkopf Aniline and Dye Company, which became National Aniline Chemical Company (NACCO) in 1917. NACCO was the result of a merger of five companies, including Schoellkopf Aniline and Dye Company, which later became Allied Chemical Corporation (Allied Chemical). On July 1, 1977, BCC purchased certain assets from Allied Chemical, including the plant and the right to produce certain chemicals, and has operated it since that date.

2.2 Facility History

Prior to BCC's acquisition of the plant, it had produced in excess of 1,400 different dyes and organic chemicals based on aniline, various aniline and coal tar derivatives. Since 1977, the operations at BCC have mainly involved production of Indigo dye, alkylanilines, anhydrides, and dye intermediates. Currently, various drummed wastes are generated as a result of these operations, including off-grade dyes, anhydride tars, still bottoms, spent catalysts, and waste cleaning solvents. These wastes are stored for less than 90 days in a drum storage area and transported off-site for disposal.

Prior to the time of the sale, the plant was divided into eight areas designated with the letters A, B, C, D, E, F, G, and H. BCC purchased the manufacturing areas A through E, while Allied Chemical retained the research and development, Area F, and the parking lot, Areas G (Elk Street) and H (Smith Street).

Chemical production and solid waste activity in the 19-acre Area D had already ceased prior to the 1977 sale. It has remained idle and BCC demolished the structures in Area D in 1984. A remediation project for Area D is currently being performed under a Consent Order between Allied-Signal and the NYSDEC. Operations continue in Area ABCE, which has been designated as a SWMU by virtue of the density of sewers and chemical-handling activities inside its 42-acre combined area. As provided in the permit, only information relevant to Area ABCE is set forth herein.

Area A is the oldest section of the plant, being the site of the original 1879 facility. It is the only one of the four sections of Area ABCE to front on the Buffalo River. A built-up Area A appears on the 1889 Sanborn Fire Insurance Map (Sanborn Map), indicating usage of aniline, carbolic acid (phenol), benzene, nitrobenzol (nitrobenzene), and nitric acid. The 1900 Sanborn Map indicates departments making direct, azo, and sulfur dyes in Area A, as well as nigrosine and eosine. The later Sanborn Maps do not identify processes in Area A. Demolitions since the late 1960s have involved Area A departments called aniline, sulfur colors, wool colors, CSA, and Harmon products. The Indigo Department, which was moved into Area A in 1923, now occupies the half-dozen Area A buildings which date from the 1917 era, as well as a scattering of newer structures which were built in the 1970s and 1980s.

Production facilities in Area B apparently were constructed almost in their entirety in 1916 and 1917. Although it is shown as residential on the earliest Sanborn Map, the industrial development of Area B appears fully completed in the 1917 version. The azo and direct dye operations were apparently moved from Area A to Area B into what became known as the Acid and Direct Dyes (A&D) Department. The Phenyl Acid, H Acid, and Warehousing Departments are also shown on the 1917 Sanborn Map. All of these structures, which covered virtually all of Area B, were demolished in the 1970s and 1980s. The entire area is now covered with grass, parking lots, and administrative buildings.

The cornerstone and the manufacturers' identification plates on some of the heavy equipment still standing in the Area C powerhouse carry the date of 1917. Coal piles can be seen behind the powerhouse in a 1951 aerial photograph of the area. This section of the plant is shown as a lumber yard on the 1900 Sanborn Map. In addition to the powerhouse and a large icehouse, the 1940 Sanborn Map shows departments called Phthalic Anhydride and Anthraquinone. Today, the powerhouse, some shops, and the idle icehouse are all that remain standing in Area C. The boilers were converted from burning coal to burning No. 6 fuel oil in 1970. The Area C buildings which involved chemical processing departments were razed in the 1970s.

Area E appears to be the last of the four areas developed for chemical processing. The 1900 and 1940 Sanborn Maps show the west side (Lee Street) to contain lumber yards, while the 1889, 1900, 1940, and 1950 Sanborn Maps show the east side (Orlando Street) to be occupied by various oil and energy companies. The 1950 Sanborn Map records the appearance of the Dye Plant's three main operating buildings in Area E. The first recorded operating permit for a river outfall was issued to Allied Chemical in 1947 for a new line serving Area E and these three buildings. The 1950 Sanborn Map also shows the presence of the horizontal tank park along the southern edge of Area E. The wastewater treatment plant, and its Lagoons 1 and 2, were built in Area E in 1971, while Lagoon 3 was added five years later. The Lagoons were phased out and closed by 1989. Except for the elimination of several more demolished buildings, the Sanborn Map of 1986 generally describes Area ABCE today. These historic features are presented on Figure 2.

A long list of chemicals (approximately 2,000) used or made in Area ABCE could be made from the available facility records. Since 1967, notifications have been made to various regulatory authorities of the detection, disposal, or use of 107 chemicals in area ABCE.

A total of 56 chemical constituents were reported by BCC to have been detected in one or more media in Area ABCE, made the subject of a notification of some regulatory authority, and appear in the accounting or operating reports of the facility prior to performing the RFI. These chemicals, which are summarized from a compendium presented in Appendix A are:

- Acetone;
- Aniline;
- Benzene;
- Benzidine;
- 4-Chloroaniline;
- Chlorobenzene;
- Cyanide;
- 1,2-Dichlorobenzene;
- 1,4-Dichlorobenzene;
- N,N-Diethylaniline;
- Diethylphthalate;
- N,N-Dimethylaniline;
- 2,4-Dinitrotoluene;
- 2,4-Dinitrophenol;
- Di (n) octylphthalate;
- Ethanol
- N-Ethylaniline;
- Ethylbenzene;
- Hydrochloric acid;
- Methanol;
- N-Methylaniline;
- 2-Methylphenol;
- 4-Methylphenol;
- Naphthalene;
- 1-Naphthylamine;
- 2-Naphthylamine;
- Nitric acid;
- 4-Nitroaniline;
- Nitrobenzene;
- Arochlor 1242;
- Phenathrene;
- Phenol;
- Phosphoric acid;
- Sulfuric acid;
- Toluene;
- O-Toluidine;
- P-Toluidine;
- 1,2,4-Trichlorobenzene; and
- Xylenes;

- Aluminum;
- Antimony;
- Arsenic;
- Barium;
- Chromium;
- Chromium (VI);
- Cobalt;
- Copper;
- Iron;
- Lead;
- Manganese;
- Mercury;
- Nickel;
- Silver;
- Tin;
- Vanadium; and
- Zinc.

2.3 Adjacent PVS Chemicals, Inc. Facility Site History

As discussed in Section 3.1, supplemental groundwater investigations were conducted beyond Area ABCE as part of the RFI. The off-site investigation included the PVS Chemicals, Inc. (PVS) facility located across Lee and Prenatt Streets south of Areas B, C and E (the PVS site or facility). Historic information regarding the PVS facility was obtained from PVS and from the Phase I and Phase II reports Engineering Investigations at Inactive Hazardous Waste Sites (Site No. 915004), Engineering Science in association with Dames and Moore (January 1986) and Engineering Science (October 1989), respectively.

Starting about 1905, a facility manufacturing Sulfuric Acid and other acids was operated by the Contact Process Company on Area D of the Schoellkopf Aniline and Dye Company site. After the merger of the Schoellkopf Company with General Company and others, the equipment from the Contact Process Company was moved the short distance to the PVS Lee Street site. From 1930 to 1947, the chemical plant was owned and operated by a subsidiary of Allied Chemical which merged into the Allied Chemical and Dye Corporation in 1947. The company name was changed to Allied Chemical Corporation in 1958. In 1981, a portion of the Allied Chemical Plant, including the site of the impoundment studied in the Phase I and II reports, was sold to PVS Chemicals, Inc. (New York) subsidiary of PVS Chemicals, Inc. The site is currently owned by PVS Chemicals, Inc. (New York).

From approximately the late 1960s to 1977, an unlined surface impoundment at the PVS site received various wastewater streams from production operations at the plant (ECDEP, 1982). According to plant records, the processes and period of use for each include:

- Sulfuric contact (1930 - present)
- Nitric acid - ammonia oxidation (1930 - 1983)
- Oxalic acid - carbohydrate oxidation (1942- 1983)
- Muriatic and salt cake (1930 - 1944)
- Ammonium thiosulfate (1957 - 1984 & 1991-present)
- Metallic nitrates (1956 - 1983)
- Liquid sulphan (1951 - 1989)
- Liquid sulfuric acid (1954 - 1962)

The liquid wastes conveyed to the surface impoundment from the late 1960s to 1977 included wastewater containing nitric and sulfuric acid, sulfur drainings, metallic nitric rinses (containing cadmium, copper, nickel, potassium or iron) and other miscellaneous waste streams. The volume of the process flows and the concentration of the contaminants within the waste streams are not known.

The unlined surface impoundment was removed from service in about 1977 (ECDEP, 1982). The accumulated solids and subsurface soils were excavated, and approximately 8500 tons of material were transported to the Land Reclamation Landfill in Cheektowaga for disposal. The excavation was backfilled with clean on-site fill. The former impoundment site is currently vacant, except for several railroad cars which are occasionally parked on tracks adjacent to the former impoundment site.

In 1977, two surface impoundments were constructed by Allied Chemical Corporation northwest of the former unlined impoundment (Snyder Engineering, 1984). These impoundments were constructed on a base of low permeability clay with an artificial liner and an underdrain system. The surface impoundments were utilized to collect acidic wastewater until March 27, 1984. After March 27, 1984 residual liquid (precipitation) collected in the impoundments. By September 11, 1984, the lined surface impoundments had been closed in conformance with a closure plan submitted to the U.S. Environmental Protection Agency on August 12, 1983.

In 1984, PVS Chemicals, Inc. retained Empire Soils Investigations, Inc. to install monitoring wells and evaluate the hydrogeologic conditions around the closed, lined surface impoundments (Empire Soils Investigations, Inc., 1985). As part of their work, Empire Soils Investigations, Inc. installed two monitoring wells in the vicinity of the closed, lined surface impoundments for sampling of groundwater quality in the upper portion of the bedrock and to determine the direction of groundwater flow in the upper bedrock.

Other work previously performed in conjunction with investigations of the unlined impoundment included sampling of three on-site wells located between the unlined impoundment and the Buffalo River by the USGS in 1982. The sampling was performed in light of the potential for the unlined surface impoundment to release contaminants to groundwater. The USGS sampling indicated iron and lead concentrations exceeded USEPA criteria for drinking water and New York State Class GA groundwater standards. These wells are no longer considered acceptable for sampling since they are unprotected and some appear damaged.

In January 1986, a Final Phase I report for the unlined surface impoundment was prepared by Engineering Science. Since that time, the surface impoundment sites have been inactive. The Phase II investigation report was issued in October 1989. The PVS Chemicals, Inc., facility is currently active.

2.4 Previous PVS Groundwater Contamination Assessment

The PVS Phase II investigation (Engineering Science, 1989) reported the following:

Six groundwater monitoring wells were sampled during the Phase II investigation and analyzed for HSL organic compounds, HSL metals and total organic halogens (TOX). Wells B-1, B-2, and GW-4 are screened in the upper bedrock. Wells GW-1, GW-2, and GW-3 are screened in the overburden. The most upgradient locations are B-1 and GW-1.

Eight HSL organic compounds were detected in the bedrock wells. The concentrations of benzene and toluene in GW-4 were in excess of three times the concentrations in the upgradient well B-1, indicating releases attributable to the site rather than migration of contaminants from the BCC site. Those concentrations of benzene and toluene also exceeded the Class GA standard and guidance value, respectively.

Seven HSL organic compounds were detected in the overburden wells. The downgradient concentrations were not sufficiently in excess of the upgradient concentrations to indicate a groundwater release. The Class GA groundwater standards exceeded in the overburden wells were benzene and bis(2-ethylhexyl)phthalate in GW-1, the upgradient location.

Twenty-one HSL metals were detected in the bedrock wells. Cadmium, potassium, silver, and mercury were present in GW-4 at concentrations in excess of three times the upgradient concentrations. These results indicate releases which may be attributable to the site rather than migration from an off-site source. The concentrations of nine metals exceeded the applicable NYS standards or guidance values in the bedrock wells. Concentrations of arsenic, barium, cadmium, iron, manganese, mercury, and silver exceeded the standards, while concentrations of beryllium and magnesium exceeded the guidance values.

Seventeen HSL metals were detected in the overburden well samples. The concentrations of aluminum, cadmium, calcium, and vanadium in one or both downgradient wells were in excess of three times the upgradient concentrations. These results indicate releases of these elements to the groundwater which may be attributable to the site rather than migration from an off-site source. The concentrations of seven metals exceeded the applicable NYS standards or guidance values in the overburden wells. Concentrations of arsenic, cadmium, iron, lead, manganese, and silver exceeded standards, while concentrations of magnesium exceeded the guidance value.

In summary, the groundwater results for the bedrock wells indicate releases of benzene, toluene, cadmium, potassium, silver, and mercury which are most likely attributable to an on-site source(s). The results for the overburden wells indicate releases of aluminum, cadmium, calcium, and vanadium which are most likely attributable to an on-site source(s). The pH values measured in the field were in the range of 5.84 to 6.25 for the overburden wells, and 8.95 to 12.49 in the bedrock wells. These pH values are significantly higher than those reported in 1984 for USGS wells W-1, W-2, and W-3, located along the Buffalo River (3.0 to 5.3). The difference may be attributed to changes over time, or to differences in well placement. The USGS wells are very near the Buffalo River shoreline and there is visual evidence of fill material in that area.

The metals being released to the groundwater include some of the same metals found in the PVS facility wastestreams (i.e. cadmium and potassium). This provides further evidence that the PVS site is the probable source. The source(s) of the organic compounds is more difficult to determine, since those compounds are not known to be constituents of the PVS wastestreams. The data do not indicate that a groundwater migration from the BCC property is the likely source of that contamination.

2.5 RCRA Corrective Action Regulatory Background

Three former Area E surface impoundments (Lagoons 1, 2, and 3) which were operated at the BCC facility beginning in the early 1970s received wastewater from dye manufacturing processes. A RCRA Part A Permit for operation of these impoundments was filed in 1980 by BCC and the three lagoons were closed in the mid-to-late 1980s in accordance with closure plans approved by the NYSDEC. Hazardous constituents were detected in the groundwater in monitoring wells located along the hydraulically-downgradient edge of the closed lagoons. A RCRA Facility Assessment (RFA) was undertaken by the NYSDEC to identify potential releases from identified SWMUs at the site. The RFA included visual site inspections performed by the NYSDEC in 1986 and in 1988 by the NYSDEC and the United States Environmental Protection Agency

(USEPA). The revised RFA (April 1991) updated the status and proposed investigation requirements for eight SWMUs.

The final 6 NYCRR Part 373 Post Closure Permit was issued to BCC on February 10, 1995.

2.6 Solid Waste Management Units

Module III-A(3) of the Permit identifies the following SWMUs and AOCs at the facility:

2.6.1 Area ABCE

This area, which contains chemical handling areas and numerous sewer lines (Figure 2), is bounded by the Conrail tracks to the west, Elk Street to the north, Orlando Street to the east, Prenatt Street (railroad (RR) tracks), Lee Street, South Park Avenue, the Buffalo River, and Area D (abandoned DL&W railroad tracks). Area ABCE contains the following features:

- <u>Active Features</u>
  - a) Sewer lines (throughout entire area); and
  - b) <u>Building 324 Container Storage Area (Area E)</u>

    The indoor area was built in the mid-1980s to replace the Old Container Storage Area. Hazardous waste in drums are accumulated and stored here (for less than 90 days) to be shipped off-site. The area is exempt from RCRA permitting. This unit has operated from 1986 until the present. Module III E(1) of the Permit does not identify any corrective action requirements for this area;
- <u>Inactive Features</u>
  - a) Abandoned sewer lines (throughout entire area);

b) Old Container Storage Area (Area E)

This area operated from 1949 to 1986. After 1980, hazardous waste was stored in drums for less than 90 days before being shipped off-site. A drum storage area west of Lagoons 1, 2, and 3 on which drums of solid waste were stored in the early 1980s was clean-closed in 1990, and approved by the NYSDEC. As part of the corrective action program at the facility, a detailed sampling plan was developed for this SWMU by BCC in order to comply with the Sampling Visit portion of the RFA. The sampling work plan was approved by the NYSDEC on April 26, 1990. In accordance with the approved plan, BCC submitted the analytical report, dated December 20, 1990, on the 2-foot borings taken at five locations in the Old Container Storage Area. Based upon these activities, and as defined in the Part 373 Permit Module III-E(1), this SWMU requires no further action.

c) Deep Well (Area E)

Used by Allied Signal for the disposal of ammonium sulfate solution from about 1957 to 1963. The deep well was used to a depth of 180-feet (ft) from surface level from 1957 to 1960, and then from late 1960 to 1963 to a depth of 744-ft. A closure plan was submitted to the NYSDEC Division of Mineral Resources (DMR) on December 15, 1988. The closure plan was approved by the NYSDEC on March 1, 1989, and the Deep Well was plugged, in accordance with the approved closure plan, by April 14, 1989. This unit requires no further action, as specified in Module III E(1) of the facility's Permit;

d) Surface Impoundments (Area E)

Lagoons 1, 2, and 3

Process waste, in the form of process wastewater (1,000,000 to 2,000,000 gallons per day (gpd) in the 1970s and 200,000 to 600,000 gpd in the 1980s) was transported via the process waste sewer to the pretreatment plant. The surface impoundments received the wastewater and regulated variations in flow and concentration to prevent "slug" discharges. After the effective date of RCRA, the process wastewater was a characteristic hazardous waste due to corrosivity, having a pH in excess of 12.5. Other constituents detected in the wastewater included aniline, N-methylaniline, N,N-dimethylaniline, N-ethylaniline, N,N-diethylaniline, and cyanide. From June 1977 through December 1984, dilute (1 to 10-percent) sulfuric acid wastewater was also pumped into the alkaline surface impoundments from the adjacent Allied Chemical and later PVS

Sulfuric Acid plant. This material was a RCRA characteristic hazardous waste due to corrosivity, having a pH less than 2.0;

The process wastewater was then pumped to three reactors in series where it was neutralized with slaked lime and later sulfuric acid to render it non-corrosive and no longer a RCRA characteristic hazardous waste under NYSDEC regulations, and acceptable to the BSA under their Sewer Use Ordinance (SUO).

The operational periods of the three lagoons were as follows:

- Lagoon 1: June 23, 1971 - June 30, 1988;
- Lagoon 2: June 23, 1971 - January 27, 1987; and
- Lagoon 3: June 30, 1977 - August 31, 1984.

Following a period of operation between 1971 to 1976, according to documents obtained from Allied Signal Corporation, during the time period of 1976 to 1977 the original two surface impoundments were cleaned out and relined and the third impoundment was constructed. These surface impoundments were constructed as follows:

- Excavation of all fill, sand, and other extraneous material;

- The bottom of the impoundments were in the same undisturbed clay region;

- The sides of the impoundments were built of natural soil with a surface containing at least three feet of compacted clay at a 1:1 slope.

In 1983, the Lagoon 1 sideslopes were changed to a 1:2 slope and one foot of clay, and a 3-inch layer of crushed stone were added.

These impoundments were closed under NYSDEC-approved closure plans that involved removal and off-site disposal of over 4,000 cubic yards of sludge and clay. These impoundments were certified closed according to the approved plans, as follows:

- Lagoon 1: May 25, 1989;
- Lagoon 2: May 3, 1989; and
- Lagoon 3: August 12, 1986.

Clay remaining in Lagoon 1 was collected into a central position and resampled. The results of the sampling were made a part of the recorded land records of the facility property.

e) Buildings 351 and 352/Wastewater Treatment Plant (Area E)

Wastewater from the facility was pretreated in this plant, which went on-line in June 1971. This project entailed the construction of a new sewer system in the plant which separated the flows between process waste and non-contact cooling water. The process waste sewer directed the organic and inorganic waste streams to the pretreatment facility where the extreme acidity and later alkalinity of the wastewater were neutralized with lime. Suspended solids were precipitated and subsequently sent to off-site permitted landfills. Pretreated wastewater was sent to the BSA while non-contact cooling water from the plant discharged to the Buffalo River through 13 plant outfalls (presently only two outfalls, Numbers 006 and 011, remain active). This unit was operated from 1971 until 1988, and requires no further action, as specified in Module II E(1) of the Permit.

Table 1 summarizes the historic chemical handling and operational areas of Area ABCE. The Task I "Report on Description of Current Conditions" (Golder Associates April, 1995) and the Task II "Pre-Investigation Evaluation of Corrective Measures" (Golder Associates May, 1995) was submitted to the NYSDEC on April 7, 1995 and May 9, 1995, respectively.

A work plan for the RFI, required by Module III E(5) of the Permit, was developed by BCC (Golder Associates June, 1995) and was submitted to the NYSDEC on June 29, 1995. BCC proposed a phased approach to the investigation and that the first phase of the investigation focus specific emphasis on assessing groundwater conditions at the facility perimeter in Area ABCE and former surface impoundment areas. The second phase was proposed to further develop the site hydrogeologic conceptual model and evaluate potential release conditions in the interior of the site.

The closed units (former Lagoons 1, 2 and 3) are required by Module III-E(15) to have corrective action through post-closure. The units are subject to groundwater corrective action and post-closure care requirements, including groundwater monitoring, as specified in the Post-Closure Care Module of the Permit.

2.6.2 Area D

Area D is bounded by the Conrail tracks, Area ABCE (abandoned DL&W tracks), and the Buffalo River. This area contains the following features:

1. Active Features
    - a) None.
2. Inactive Features
    - a) Metal Sludge Weathering Area;
    - b) Incinerator; and
    - c) Iron Oxide Sludge Lagoons.

As indicated in Module III E(17) of the Permit, remediation of Area "D" is being addressed separately by Allied Signal through the NYSDEC Consent Agreement Number (No.) B9-0014-84-01RD.

2.6.3 Area of Concern

1. Active Features
    - a) None.
2. Inactive Features
    - a) Idle Building 320 in Area E.

BCC is required by Module III E(2) to develop an RFA Sampling Visit (SV) work plan to address floor sweeping and cleanup materials at least 60 days prior to demolition of Building 320. Building 320, currently an inactive production area, is not scheduled for demolition, and, therefore, no work plans are required or have been prepared at this time.

2.7 Waste Characteristics

A summary of the waste related activity associated with the SWMUs and AOCs at the BCC facility Area ABCE and hazardous waste constituents detected was provided in the "RCRA Facility Investigation Task I, Description of Current Conditions" report. A summary of the groundwater monitoring wells and piezometers installed prior to the RFI is presented in Table 2. Groundwater constituents detected in the former Lagoons 1, 2, and 3 related monitoring wells are discussed in Section 5.3.2. The hazardous waste constituent groups associated with these activities, based on historical data available, included the following:

- Volatile organic compounds (VOCs);
- Semi-volatile organic compounds (SVOCs);
- Metals; and
- Cyanide.

3. RFI SCOPE OF WORK AND INVESTIGATION PROCEDURES

3.1 Introduction

The RFI was performed to determine the nature and extent of potential releases of hazardous waste and/or constituents from Area ABCE of the BCC facility. The NYSDEC approved Scope of Work (SOW) prepared by Golder Associates (Appendix III-6 of the Permit) proposed a phased approach to the RFI. A summary of previous investigations and their relevance to the RFI investigation was included in the report "RCRA Facility Investigation Task I, Description of Current Conditions" prepared for BCC (Golder Associates, April 1995).

The RFI Work Plan, (Golder Associates June, 1995) submitted to the NYSDEC on June 29, 1995, which was subsequently approved, included the following RFI Management Plans:

- Volume 1 : Project Management Plan (PMP);
- Volume 2 : Quality Assurance Project Plan (QAPjP);
- Volume 3 : Health and Safety Plan (HSP);
- Volume 4 : Community Relations Plan (CRP); and
- Volume 5 : Data Management Plan (DMP).

These RFI Management Plans specified the methods and procedures to be used to manage the RFI, to describe data developed by the RFI, to gather and provide valid RFI data, to protect the health and safety (H&S) of the investigators and general public, and to keep the community informed about the RFI.

Columbia Analytical Services Inc. (CAS) (formerly General Testing Corporation (GTC)) was the analytical laboratory used during the RFI for the chemical analyses of soil and water samples. Geotechnical testing of soil samples was performed by Golder Associates' geotechnical laboratory. Drilling services were provided by SJB Services, Inc., and Zebra, Inc. Surveying services were provided by DeLeplante - LaJeunesse and Associates, Inc.

The field work for the RFI was initiated on April 22, 1996, and was completed in August 1996. Field work for the supplemental investigations was initiated on May 27, 1997, and was completed in July 1997.

Phase I

The initial investigation (Phase I) activities performed by Golder Associates focused on developing a thorough hydrogeologic characterization of the facility (Area ABCE) and emphasized evaluating groundwater quality and potential migration of hazardous constituents at the perimeter of Area ABCE. Also, this initial phase included a groundwater study relative to the closed former surface impoundments (Lagoons 1, 2, and 3) at the facility. The activities for this investigation included drilling, installation and development of wells and piezometers, hydraulic testing and monitoring, soil sampling for chemical and geotechnical parameters, groundwater sampling for chemical constituents, and an evaluation of man-made influences on the environmental setting.

Phase II

The second phase (Phase II) of the project involved obtaining additional data from the interior of the facility to further characterize and evaluate potential release sources, migration pathways, and extent of release(s) through sampling of soil and groundwater for chemical constituents.

Supplemental Investigation

Review of the results of groundwater sampling analytical data and groundwater flow data from completion of the Phase I and Phase II investigation activities indicated that hazardous constituents were detected in groundwater samples collected from monitoring wells located at the perimeter of Area ABCE. Consequently, as indicated in BCC's October 28, 1996 correspondence to the NYSDEC, supplemental investigations were necessary to further characterize and evaluate groundwater quality and flow off-site.

A supplemental investigation was approved by the NYSDEC and performed to characterize and evaluate the potential migration and extent of hazardous constituents in groundwater from SWMU Area ABCE to off-site and apparently hydraulically downgradient areas bordering BCC, specifically, the PVS facility and areas along the western edge of the site including the Buffalo Sewer Authority (BSA) sewer and Orlando Street. Additional surficial soil samples were also collected from unpaved areas in Area ABCE.

With the exception of a modification of materials for monitoring well construction, and elimination of analysis of groundwater samples for PCBs and alcohols, the supplemental investigations were conducted in accordance with the investigative methodologies presented in the RFI Work Plan.

3.2 Investigation Methods and Procedures

3.2.1 Reconnaissance

A reconnaissance survey of Areas ABCE was conducted prior to the implementation of the Phase I field work. The survey included field traverses of the site to verify the selected soil sampling/well locations with respect to utilities and other local site features. Location of and obtaining utility clearances was performed by BCC.

3.2.2 Soil Borings

3.2.2.1 Phase I Soil Borings

General

Fourteen (14) shallow aquifer wells, four (4) deep aquifer wells, and five (5) piezometers were installed during Phase I of the RFI. Their locations are shown on Figure 3. Site-specific boring requirements are described in the following sections: Standard Operating Procedures (SOPs) for soil boring sampling and logging are found in Appendix 2-5-2; and field ID of soil are found in Appendix 2-5-3 of the Quality Assurance Project Plan

(QAPjP). Boring logs for wells and piezometers are provided in Appendix B. Well and piezometer installation logs are presented in Appendix C.

Shallow Aquifer Borings

The boreholes were advanced using 4¼-inch inside diameter hollow stem augers (HSA). Continuous soil samples were collected and classified based on geologic description and by the Unified Soil Classification System (USCS) system for each shallow boring, with the exception of the three shallow well borings advanced adjacent to the location of three new deep wells. At these three locations, soil was sampled at a frequency of one sample every 5 feet of advancement. Conventional 2-inch diameter, 2-foot long split-spoon samplers driven by a 140-pound (lb) hammer with a 30-inch drop were used for sample collection. Blow counts were recorded from Standard Penetration Tests and unconfined compressive strength of soil samples was tested with a pocket penetrometer. The sampling spoons were cleaned with Alconox® and potable water between samples, and were steam-cleaned and decontaminated as per Section 3.2.9 between boreholes.

Soil samples from the shallow aquifer borings were collected for analysis according to the procedures in Section 3.2.5 of this report. Augering for the shallow aquifer boreholes terminated within the upper portions of the glaciolacustrine clay unit (see Section 4.3.2 for description), as determined by examination of the soil samples. All drilling cuttings and fluids were containerized in 55-gallon drums. Disposal of drummed cuttings was managed by BCC.

Deep Aquifer Borings

The deep aquifer borings were advanced and sampled in the same manner as the shallow aquifer borings, with the addition of a surface casing driven into the top of the glaciolacustrine clay unit. The purpose of the surface casing was to reduce the possibility of contaminant dragdown into the deep aquifer unit if the upper soils were impacted at the drilling location.

Initially the borehole was advanced with 6¼-inside diameter HSAs to a depth of 1-foot to 3 feet into the glaciolacustrine clay unit. The augers were withdrawn and the borehole was backfilled with a bentonite grout. A 10-inch diameter (nominal) steel casing was then lowered into the borehole and driven into the upper portion of the glaciolacustrine clay unit. The inside of the casing was then flushed with potable water until generally a clear return was achieved. The borehole was then advanced through the clay unit with 4¼-inch HSAs, with completion at the upper surface of the Onondaga Limestone (as indicated by auger refusal at the anticipated depth). The surface casing was left in place.

Piezometer Borings

The piezometer borings were advanced and sampled in the same manner as the shallow aquifer borings. The completion depth for the three piezometers within the backfill of the BSA line was 14 feet below ground surface (bgs), which is consistent with the depth of the BSA sewer at these locations. The completion depth for the remaining two piezometers is the same as that targeted for the shallow aquifer wells (i.e. the top of the glaciolacustrine clay unit).

3.2.2.2 Phase II Borings

Phase II of the RFI included the advancement of twenty-four (24) soil borings using a hydraulically-driven Geoprobe® unit. With this method, a soil sample was obtained by hydraulically driving a hollow sampler (similar in size to the split-spoon sampler used for Phase I soil sampling) to the required depth without the need for augering. Twenty (20) near-surface soil samples were collected at approximate depths of 2 feet bgs, while four (4) multiple depth borings included collection of soil samples at approximately 2 feet, 5 feet, and at the water table. A groundwater sample from each of the multiple depth borings was collected during the boring process, as per Section 3.2.6.

No wells were installed within the Phase II borings. The borings were filled with bentonite pellets or chips immediately following sample collection.

3.2.3 Monitoring Well/Piezometer Installation

The Phase I monitoring wells and piezometers were installed immediately after the boreholes were completed. SOPs for monitoring well/piezometer installation were provided in Appendix 2-5-1 of the QAPjP. The shallow and deep wells were constructed using 2-inch diameter Schedule 5, Type 316 stainless steel risers and screens. The screens were 5 or 10 feet in length, continuously wound, with a Number 10 slot size and threaded end cap. The construction of the five piezometers is the same as above, with the exception that the risers and screens were made of Schedule 40 polyvinyl chloride (PVC) instead of stainless steel and the screens had machine cut slots instead of continuously wound.

For each well or piezometer, an appropriately-sized quartz sandpack was installed from approximately 2-inches beneath the screen to 1-foot to 5 feet above the top of the screen. A bentonite pellet seal was then installed above each sandpack to a minimum thickness of 3 feet. The remainder of each borehole was then filled with a 5% bentonite powder/95% Portland® cement grout. The top of each 2-inch riser has a slip-on or expandable cap and is protected by a lockable, 6-inch square, 5-foot long steel protective casing (except RFI-16, RFI-24, RFI-33, as noted below) painted safety-yellow in color. The protective casings are anchored within 3 feet by 3 feet by 6-inch thick fiber-reinforced concrete pads. The interiors of the protective casings were filled with pea gravel and small drain holes were installed at the grout/gravel interface to allow for drainage. The top of each well riser was surveyed for location and elevation to the nearest 0.01 foot following well installation. The risers of wells RFI-16, RFI-24, and RFI-33 are protected by 8-inch diameter steel covers set flush with the ground surface so as not to impede traffic.

3.2.4 Well Development and Hydraulic Testing

All wells and piezometers were developed after a minimum of 24 hours following installation using a stainless steel, Teflon®, or PVC bailer. Well development continued until a minimum of five well volumes were removed and until the groundwater field parameters (e.g., pH, temperature, specific conductivity) were stable. SOPs for well development were presented in Appendix 2-5-1 of the QAPjP.

After the wells were developed, a rising head test was performed on each well/piezometer to estimate the approximate hydraulic conductivity of the screened interval. Procedures for hydraulic conductivity testing were described in Appendix 2-5-4 of the QAPjP. Drilling fluids and cuttings generated during drilling, and development and testing activities were contained and transported to a designated on-site staging area for management by BCC. Field records of monitoring well and piezometer development are contained in Appendix D and hydraulic testing results are presented in Appendix E.

3.2.5 Subsurface Soil Sampling

3.2.5.1 Phase I Soil Sampling

General

The investigations at the facility during Phase I include continuous soil sampling (exceptions noted below) at the well/piezometer installation locations for the purpose of geologic/engineering classification. Specific horizons of these soils were retained for chemical screening, confirmatory, and geotechnical testing.

Geologic/Engineering Soil Sampling

Continuous split-spoon soil samples were collected at all Phase I boring locations with the exception of the shallow wells in a new cluster (RFI-18, RFI-20, and RFI-22 - See Figure 3 for location), which were only sampled on 5-foot centers. Appendix 2-5-2 of the QAPjP contains SOPs for split-spoon soil sampling. The collected soils were field described using USCS guidelines. A pocket penetrometer was used on a representative portion of cohesive soil samples to estimate the unconfined compressive strength of the material. A soil boring log was constructed for each boring location based on this information. These logs are provided in Appendix B.

Chemical Screening/Confirmatory Soil Sampling

For each of the fourteen (14) Phase I shallow wells, three (3) soil screening samples were collected; at approximately 2 feet bgs, 5 feet bgs, and near the water table. One (1) confirmatory sample was collected per borehole at differing horizons, depending on the borehole (Refer to Table 3 for a schedule of well IDs and sample horizons for Phase I soil samples).

For the four (4) Phase I deep wells, except for RFI-16, screening samples were collected at the base of the fill, the base of the fluvial/alluvial deposits (or at 10 or 15 feet if no fluvial/alluvial deposits were noted as in RFI-19D and RFI-21D), and at the base of the Basal Tills for a total of three samples per boring. As in the shallow wells, the soil horizon of the confirmatory sample varied. For RFI-16, soil samples were collected as for the Phase I shallow wells.

Each soil sample collected was transferred from the sampler to new, clean, laboratory-provided containers appropriate for the anticipated analysis and the top of each container was immediately tightly closed to seal it. Details regarding sample containers, volumes, preservatives, and analytical methods were provided in the QAPjP.

The sampler was cleaned with Alconox® and water after each sample was collected and was steam-cleaned and decontaminated as per Section 3.2.9 after completion of each boring. Soil samples not utilized for analysis were containerized for disposition in the same manner as the boring cuttings.

Geotechnical Soil Sampling

Specific geotechnical tests were performed to provide information for the evaluation of potential corrective measures. The soil samples were collected by split-spoon sampler as described in the previous sections, though the entire volume of soil recovered was retained for testing. Sampling and testing methods followed ASTM standard methods for soil gradation, liquid and plastic limits, and moisture content.

Phase I sampling included two samples from each of the RFI deep aquifer borings, except for RFI-16; one from the alluvial/fluvial or Upper Tills unit, and one from about 5 feet to 7 feet below the top of the glaciolacustrine clay unit. Two shallow aquifer borings were sampled. One sample from each boring was taken from the alluvial/fluvial or Upper Tills unit (as above) and one sample, each from 0 feet to 2 feet below the top of the glaciolacustrine clay. Table 3 presents the well locations sampled and the geotechnical sampling intervals.

3.2.5.2 Phase II Soil Sampling

Chemical Screening/Confirmatory Sampling

Soil samples for chemical screening were collected at approximately 2 feet bgs for the twenty near-surface borings using the Geoprobe® sampler. At the four multiple-depth borings, screening samples were collected at approximately 2 feet bgs, 5 feet bgs, and at the water table. Confirmatory soil samples were collected only at the four multiple-depth borings and were taken at approximately 2 feet bgs. Geoprobe® operation procedures were presented in Appendix 2-5-9 of the QAPjP. Table 4 summarizes the boring locations and sample horizons for the Phase II soil sampling and these locations are shown on Figure 3.

Analytical methods (see Table 5) were the same as for the Phase I chemical screening/confirmatory samples. No samples were collected during Phase II for geotechnical testing.

3.2.6 Groundwater Sampling

3.2.6.1 Phase I Groundwater Sampling

Sampling of the eighteen (18) new groundwater monitoring wells was accomplished during Phase I of the investigation. Two rounds of sampling were performed with the first sampling event occurring after completion of the well installation program and the second event occurring approximately one month after the first event.

The list of analytes and analytical methods for groundwater samples is presented in Table 5. Note that for three wells (RFI-20, RFI-24, and RFI-32) encrusting and corrosive parameters (total dissolved solids and hardness) are added to the list of analytes for Phase I. General groundwater sampling procedures are given below, while detailed RFI groundwater sampling SOPs were presented in Appendix 2-5-7 of the QAPjP.

Wells were purged, before each sampling event, using dedicated disposable bailers (of high density polyethylene material) and were purged until at least three volumes of water were removed, or until purged dry. The wells were then sampled using the dedicated bailers. Samples to be analyzed for VOCs were collected within three hours of completing the well purging unless the groundwater recovery rate in the well necessitated a longer period before sampling. However, all samples were collected within 24 hours of well purging. At no time during the RFI was the presence of non-aqueous phase liquid (NAPL) observed in any of the RFI wells.

Groundwater sample containers were filled to the top, leaving no air space. Field and trip blanks were included for each sampling event. Sample containers were sealed tight and placed in a cooled container or shuttle at the time they were collected. Containers were labeled with the type of test to be performed and a number which was coded to match the chain-of-custody form. Table 16 of the QAPjP provides details regarding sample containers, volumes, preservatives, and analytical methods.

Field groundwater parameters, measured during well development or groundwater sampling, included pH, specific conductance, and temperature. These parameters were measured and recorded as indicators of groundwater conditions. The specific measurement procedures were provided in Appendix 2-5-8 of the QAPjP. Each instrument used to measure these parameters was operated in accordance with the manufacturer's instruction manual. Field instruments, such as pH meters and specific conductivity meters, were standardized/calibrated according to manufacturers' instructions. During sampling, calibration was performed at the beginning of each day and at least every 8 hours, and at the end of each working shift.

3.2.6.2 Phase II Groundwater Sampling

Groundwater samples from the four multiple-depth soil borings were collected through a screen point attachment on the Geoprobe® sampler. A small Waterra® pump was used to recover the sample through the probe rods. The rods were left in position long enough to collect a groundwater sample before their removal. In other respects, groundwater sampling proceeded as for Phase I groundwater sampling.

3.2.7 Supplemental Investigations

3.2.7.1 PVS Chemicals Inc. Facility

The supplemental investigation included the following activities at the PVS facility:

- Installation of eight (8) monitoring wells within the shallow overburden at the PVS facility (i.e. extending to a depth equivalent to the top of the glaciolacustrine clay unit). The newly installed monitoring wells are designated RFI-34 through RFI-41 and located as indicated on Figure 3. The monitoring wells were developed and a variable head test was performed on each of the wells to determine hydraulic conductivity of the shallow aquifer. Two water level monitoring events were performed at each new monitoring well;

- Two groundwater sampling events were performed at each of the newly installed monitoring wells. Additionally, two groundwater sampling events were performed at RFI-PZ-19 which was previously installed on the PVS property during Phase I of the RFI. Analytical testing was conducted for those parameters listed for groundwater in Table 5 excluding analysis for alcohols and PCBs, which were not detected within Phase I and Phase II RFI groundwater samples. In addition to trip blank analysis, quality control samples (per event) included one field duplicate, one rinsate blank, and one matrix spike/matrix spike duplicate. Analysis for encrusting/corrosive indicators was performed at three monitoring points per sampling event (RFI-38, RFI-39, RFI-40). Additionally, analysis for filtered (dissolved) metals was performed for each event at monitoring wells RFI-38, RFI-39, and RFI-40. No additional quality control samples were collected for encrusting/corrosive indicators or dissolved metals analysis; and

- Surveying was performed to record field coordinates and relevant surface elevations of the monitoring wells installed during the supplemental investigation.

3.2.7.2 BSA Sewer

The component of the supplemental investigation regarding the BSA sewer included the following activities:

- Installation of one monitoring well (designated RFI-42) within the backfill of the BSA sewer at the location shown on Figure 3. The monitoring well was developed and a variable head test was performed to determine hydraulic conductivity of the sewer backfill. Two water level monitoring events were performed at the monitoring well;
- Two groundwater sampling events were performed at the monitoring well. Additionally, two groundwater sampling events were performed at RFI-PZ-17 which was previously installed within the BSA sewer backfill during Phase I of the RFI. Analytical testing was conducted for those parameters listed for groundwater in Table 5 excluding analysis for alcohols and PCBs; and
- Surveying was performed to record field coordinates and relevant surface elevations of the monitoring well installed during the supplemental investigation.

3.2.7.3 Eastern Property Border/Orlando Street

The component of the supplemental investigation regarding the eastern property border/Orlando Street included the following activities:

- Installation of one monitoring well (designated RFI-43) east of the BCC property line and Orlando Street at the location shown on Figure 3. The monitoring well was completed at a depth equivalent to the top of the glaciolacustrine clay unit. The monitoring well was developed and a variable head test was performed to determine hydraulic conductivity of the shallow overburden at this location. Two water level monitoring events were performed at the well;

- Two groundwater sampling events were performed at the monitoring well. Analytical testing was conducted for those parameters listed for groundwater in Table 5 excluding analysis for alcohols and PCBs; and

- Surveying was performed to record field coordinates and relevant surface elevations of the monitoring well.

3.2.7.4 Additional Activities

The following activities were also performed as part of the supplemental investigation:

- Two water level monitoring events at each of the Phase I RFI monitoring wells and piezometers and existing BCC pre-RFI monitoring wells and piezometers were performed concurrently with water level monitoring events scheduled for the monitoring wells installed as part of the supplemental investigation. The water level within the river stilling well installed as part of the RFI was also measured during these events;

- Two groundwater sampling events were performed at existing monitoring wells RFI-24 and RFI-25. Analytical testing of groundwater from these wells was conducted for total metals and dissolved metals only; and

- Six (6) additional surficial soils samples were collected from open grassed portion(s) of Plant areas A, B, C and E at the locations indicated on Figure 3. These samples were analyzed for VOCs, SVOCs, PCBs, metals, and cyanide.

3.2.8 Air Monitoring

Continuous air monitoring for organic vapors, and explosive gases (% lower explosive limit (LEL)) was performed during all Phase I, Phase II and supplemental investigation boring and well/piezometer installations. Air monitoring procedures, including action levels, were detailed in the RFI Health and Safety Plan (HSP). Field air monitoring logs are presented in Appendix F.

3.2.9 Equipment Decontamination

Equipment, tools, and materials used in drilling and well installation were decontaminated before being used at any boring or well on site, between each boring or well, and prior to demobilization from the site. The drill rig and equipment were degreased with steam (using potable water) and Alconox®, and steam-cleaned upon arrival to the site. Subsequent lubrication was done with vegetable oil, if necessary. All drilling equipment in contact with the soil was steam-cleaned before use and between boreholes. This included drilling rods, bits and augers, dredges or any other large piece of equipment. Equipment, such as augers, drill rods, and samplers, were steam-cleaned and wrapped in plastic until used in the drilling process. Protective casings were steam-cleaned prior to use in a boring or well. Decontamination SOPs are delineated in Appendix 2-5-5 of the QAPjP.

Well construction materials, such as sand, bentonite, and cement, was obtained in bags or sealed containers. Riser pipe and well screen was delivered sealed by the supplier and remained sealed until installation in the borehole. New or clean gloves and clean outer clothing were used by drilling and monitoring personnel for each well installation.

Sampling equipment was obtained precleaned or cleaned on site prior to use. Non-dedicated (other than split spoon samplers) or non-disposable sampling equipment was decontaminated by the following procedure in an area beyond the potential contaminated zone:

- Wash and scrub with low phosphate detergent;
- Tap water rinse;
- Rinse with 10% HNO_3, ultrapure (1% for split spoons);
- A methanol rinse, followed by hexane rinse (solvents were pesticide-grade or better);
- Deionized demonstrated analyte-free (DAF) water rinse;
- Air dry; and
- Wrap in aluminum foil for transport.

If metal samples were not being collected, the nitric acid rinse was omitted. If organic samples were not collected, the solvent rinse was omitted. Sampling equipment included spatulas, bowls, and pans for homogenizing samples.

3.2.10 River Stilling Well

A stilling well was installed at the base of the South Park Avenue bridge abutment along the North shore of the Buffalo River in Area A for the purpose of measuring the river stage (Figure 3). It was constructed so as to resist damage due to freezing of the river. The elevation of the measuring point of the well was surveyed to the nearest 0.01 foot.

3.2.11 Sample Management

Sample containers were supplied by the laboratory. Sample containers, volumes, reagents, preservation procedures, and analytical holding times was performed in accordance with those outlined in Tables 15 and 16 of the QAPjP except as noted in Section 3.2.14. Copies of these tables are provided with the analytical data in Appendices H and I. Sample containers were kept closed until the time each set of sample containers were filled. After filling, the containers were securely closed, any residue was rinsed or wiped from the sides of the containers, and the containers were immediately placed in a cooler. Preservatives were added as soon as possible after collection. Samples were kept chilled using ice and/or "blue ice," and shipped to the laboratory usually on the day of sample collection.

All samples were marked on a sample label attached to the sample container. The information on the sample label included, the project name, sample ID number, requested analysis, sample date and time, and initials of the individual performing the sample collection.

Each sample was assigned a unique sample ID number recorded on the sample bottle label, in the field boring log, and on chain-of-custody document (as appropriate). Sample collection forms are provided in Appendix G. Designation of sample ID numbers is described below.

Groundwater samples were identified through use of the well ID number (e.g., RFI 22). Soil samples were identified through the use of the well ID number with additional codes to follow as outlined below:

- Following the well ID number is an alphabetic character indicating that the sample was collected for screening (S), confirmation analysis (C), or geotechnical analysis (G);

- Following that is a two-digit alpha-numeric code to indicate the depth at which the sample was collected. These codes are listed as follows:

2F	-	2 feet bgs
3F	-	3 feet bgs
5F	-	5 feet bgs
WT	-	water table
BF	-	base of fill
AF	-	alluvial or fluvial
BA	-	base of alluvial/fluvial deposits
xC	-	x feet below top of clay
BG	-	base of sand gravel deposits (deep aquifer)

Therefore, a sample with ID number RFI30S2F would be the soil sample collected from borehole RFI-30 at a depth of 2 feet bgs for screening.

> Sample RFI29C5F is the soil sample collected from borehole RFI-29 at 5 feet bgs for analysis of target parameters.
>
> Sample RFI32G1C is the soil sample collected from borehole RFI-32 at 1-foot below top of clay for testing of geotechnical parameters.

All environmental samples were handled under chain-of-custody procedures, beginning in the field. The Field Manager was the field sample custodian. Sample custody for field activities included the use of chain-of-custody forms, sample labels, custody seals, and field notebooks. Once samples were transported to the analytical laboratory, custodial responsibility was transferred to the Laboratory Sample Custodian where they followed the laboratory's sample receipt and chain-of-custody procedures.

3.2.12 Quality Assurance /Quality Control (QA/QC) Samples

Four types of QA/QC samples were utilized to meet the project data quality objectives. QA/QC samples were collected only for samples undergoing chemical analysis. These are defined as follows:

- Trip Blanks

  A blank that is prepared in the laboratory, transported to the sampling site, handled in the same manner as other samples, except that it remained unopened, and then returned to the laboratory for VOC analysis to ensure that contamination is not introduced to samples via transportation or handling procedures;

- Field/Equipment Rinsate Blanks

  A blank prepared in the field using analyte free water. Water was poured over/through sampling equipment which has been decontaminated in accordance with specified procedures. The blank water is collected in sample bottles and analyzed for all the parameters of interest. The purpose of this blank is to ensure that field conditions and/or equipment are not introducing contaminants to the samples.

- Field Duplicates

  A duplicate sample taken in the field and sent to the laboratory for analysis. The results provide some indication of the homogeneity of the sample medium and the precision of the analytical laboratory and its equipment; and

- Matrix Spike/Matrix Spike Duplicates (MS/MSDs)

  A "MS" is a subsample of an investigatory sample to which the laboratory adds a spike containing analytes at known concentrations prior to extraction/analysis of the sample to assess the effect of sample matrix on the extraction and analysis methodology. The MSD is another subsample from the original investigatory sample (subsampling performed at the laboratory) which is similarly spiked.

Field duplicates were identified through the use of an F at the beginning of the sample ID number (e.g., FRFI32) or the word FDUP followed by sequential numbers beginning with 01, with one exception in which it was identified as FIELD DUPLICATE. Trip blanks and rinsate blanks were identified as TRIP BLANK and RINSATE, respectively. On two occasions rinsate blanks were identified using a five-digit ID number as follows:

- Digits 1 and 2 were RB (rinsate blank);
- The third digit was W (groundwater) or S (soil); and,
- The fourth and fifth digits were sequential numbers beginning with 01.

Field duplicates, MS/MSDs and rinsate blanks were collected at a frequency of one for every twenty primary samples. Field duplicates and MS/MSDs were collected for the soil screening method, however, trip blanks and rinsate blanks were not deemed necessary. Trip blanks were utilized for each day samples were collected for VOC analysis of water samples. QA/QC samples collected are summarized in Table 6.

3.2.13 Analytical Procedures

Samples collected during this project were analyzed using USEPA and ASTM methodologies. Methodologies for chemical and geotechnical testing were from the following documents:

- "Methods for Chemical Analysis of Water and Wastes," USEPA-600/4-79-020, 1989, revised March 1983;
- "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods," SW-846, 3rd Edition, USEPA Office of Solid Waste, Washington, DC, November 1986; and
- "Annual Book of ASTM Standards," Volumes 04.08 and 04.09, American Society of Testing and Materials, Philadelphia, PA, 1995.

Method references for the soil and groundwater sample analyses performed for this project are summarized in Table 5.

3.2.14 Data Validation

In order to assess the quality of the data and meet the data quality objectives (DQOs) and hence its usability, a data validation and review procedure was performed. This validation procedure consisted of a review of data quality indicators to meet certain acceptance criteria for precision, accuracy, representativeness, completeness and comparability. The following information was reviewed by the RFI laboratory, Columbia Analytical Services, Inc. and Golder Associates:

- Sample results;
- Preservation methods;
- Dates of analyses and sample preparation to check hold times;
- Sample preparation and analytical methods used;
- Chain-of-custody;
- Laboratory and field duplicate results;
- MS/MSD recovery results;
- Surrogate recovery results;
- Procedural blank results (method blanks, trip blanks, field rinsate blanks);
- Quantitation limits; and
- Units specified for all determinations.

Included with each laboratory report provided in Appendices H and I, Columbia Analytical Services, Inc. provides a list of data qualifiers and a detailed case narrative that discusses the results of the analyses and data quality control/quality assurance (QA/QC) issues.

The following items summarize minor deviations from the QAPjP and QA/QC issues associated with the samples collected for this project based on this review:

1. Holding times for VOC analyses (Method 8260)

   All water samples (preserved with HCL) were analyzed within 14 days from sample receipt and all soil samples were analyzed within 14 days in accordance with "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods", SW846. While the QAPjP specified a holding time for soils of 7 days, this is acceptable and within the method requirements for soils.

2. Holding times for Phase II Soil Samples (PRB1MC2F, PRB2MC2F, PRB3MC2F, PRB4MC2F) PCB analyses (Method 8080)

   These four (4) samples were listed on the Columbia Analytical Services, Inc. report (Submission #9608000121) as being extracted on (9/20/96) which is outside the holding time specified in the QAPjP and the SW-846 method. This occurred due to a laboratory oversight. Consequently, these data are qualified. No PCBs were detected in these samples and PCBs were only detected in two (2) of twenty-three (23) Phase I confirmatory soil samples at low concentration (<0.5 mg/kg). PCBs are stable, not volatile and the samples were stored in a cooler until extraction. Therefore, while qualified, these data are considered usable.

3. Hexavalent Chromium Analyses for Soil Samples

   Hexavalent chromium analyses for soil samples were performed using NJDEP Modified Method 3060, USEPA SW-846, 2nd Edition, Alkaline Digestion. According to Columbia Analytical Services, Inc., at the time these samples were analyzed, there was no holding time requirement for this test. The December 1996 revision to Method 3060A suggests a holding time of one month to extraction and 4 days for analyses following extraction. Samples were extracted and analyzed within these time periods.

4. Benzyl Alcohol Analytical Method

   USEPA Method 8270 was used by Columbia Analytical Services, Inc. for analyses of water samples for benzyl alcohol instead of Method 8015.

5. MS/MSD Samples

Site specific QC for MS/MSD samples was performed on samples from this project and original samples were used for aliquots/subsamples for QC. In some instances, laboratory batch QC also was used.

6. Matrix Interferences

Due to the characteristics of the samples collected given the site operational history, matrix interferences were encountered in some samples which resulted in surrogate and internal standard recoveries and matrix spike recoveries outside of the specified QC criteria and sample dilutions. Sample matrix also accounted for some variability in field duplicate samples. Columbia Analytical Services, Inc. indicated that matrix problems for selective water samples may be pH related and high concentrations of iron present in soil samples may have contributed to QC variances in the metal analyses.

Except for the variations noted above and in the analytical report case narratives, review of the analyses and QA/QC data indicate that the data generated from the samples collected for this project met the data quality objectives and acceptance criteria and therefore, are considered valid and useable.

4. ENVIRONMENTAL SETTING CHARACTERIZATION

4.1 General

The area surrounding the BCC site is zoned for heavy industry. North of the facility are Conrail railroad tracks and Allied Signal's Research facility. South of the facility is PVS Chemicals Inc., which is involved with production of inorganic acids, and the Buffalo River. Area A of the plant is the only area of Area ABCE that fronts the Buffalo River. To the south of Area A is an inactive rail line and Area D and to the east of Area E is industrial property reportedly owned by Mobil Oil Company. The nearest residential areas are about 150 feet north and east of the site, across Elk and Orlando Streets.

Regionally, the ground surface is generally flat with a gentle slope toward Lake Erie. Ground surface elevations at the site are typically about 584 to 586 feet above mean sea level (MSL). Runoff at the site is typically induced by manmade drainage and stormwater sewer lines. Shallow groundwater is recharged by rainfall or snow-melt that does not runoff as surface water. Figure 4 shows existing ground surface conditions for Area ABCE. As depicted on Figure 4, greater than 50-percent of the facility is covered by paved areas or existing structures.

4.2 Regional Geologic/Hydrologic Setting

Portions of the following discussions of regional geology and hydrology have been derived and paraphrased from previous reports by others on adjacent study areas (Engineering Science, Inc., 1989; Remcor, Inc. 1995). Modifications to the discussions have been made as necessary for relevance to the BCC facility.

4.2.1 Regional Geology

The BCC facility is located within the Erie-Ontario Lowland physiographic province of New York State. This portion of the Erie-Ontario Lowland is underlain by layers of sedimentary bedrock which are largely covered with unconsolidated deposits. The bedrock consists mainly of shale, limestone, and dolomite. The bedrock units are comprised of fine-grained sediments deposited in seas during the Silurian and Devonian Periods, and are bedded or layered.

The Onondaga Limestone occurs as bedrock beneath the site. The upper portion of the Onondaga Limestone was subjected to glacial scouring and weathering and is characterized as a hard, gray, finely crystalline, massively bedded, stylolitic and cherty limestone. The limestone is typically heavily jointed and exhibits a high degree of secondary porosity. The regional dip of the bedrock is gently south-southwest at approximately 1-percent (40 feet per mile).

In the site vicinity, the unconsolidated deposits overlying bedrock are mostly glacial deposits formed during Pleistocene time about 10,000 to 15,000 years ago, when a continental ice sheet covered the region. The glacial deposits consist of glacial till, which is a nonsorted mixture of clay, silt, sand and stones deposited directly from the ice sheet; lake deposits, which are bedded clay, silt, and sand that settled out in lakes fed by the melting ice, and; sand and gravel deposits which were laid down in glacial streams. The glacial sand and gravel deposits may be either ice-contact or outwash types. Other unconsolidated deposits are alluvium consisting of sand and gravel laid down by rivers and streams during Recent geologic time. The unconsolidated deposits generally are less than 50 feet thick in the vicinity of the site, excluding fill materials.

4.2.2 Regional Hydrology

The BCC site is situated within the Lake Erie and Niagara River drainage basin. The Buffalo River is the predominant surface drainage near the site. The river is approximately eight miles in length and is classified as a Class C waterway suitable for secondary contact recreation. The Buffalo River generally flows from east to west and eventually drains into Lake Erie several miles west of the site, although periodic flow reversals occur due to Lake Erie seiche conditions. The Buffalo River has a reported median summer low monthly flow of 48 cubic feet per second (cfs) but, during the spring, runoff conditions may exhibit monthly flows as high as 1,200 cfs. Historically, the banks of the Buffalo River have been reportedly altered for industrial development. Fill has been placed in several areas of the study area for this purpose. The river is presently used by commercial shipping barges. The Buffalo River is not used as a drinking water source.

The Buffalo River was considered to be a generally poor habitat for fish and invertebrates (Makarewicz, 1982), but recent studies have shown that an increasing variety of fish species are living and propagating in the water (Adrian and Merckel, 1989). Bank vegetation is sparse and completely lacking in many areas. As stated previously, the bank of the Buffalo River has been extensively altered by industrial development, and the Buffalo River channel is periodically dredged. Since much of the Buffalo River bank has been developed for industrial use and the banks drop off quickly, only a small amount of shallow, protected nursery habitat for young fish exists. Areas upstream and downstream of BCC are frequently disturbed by propwash from boats and the water is turbid.

There were no known releases from the former Lagoons (1, 2 and 3) Area to surface water or the Buffalo River during the period of their operation (1971 to 1988). BCC currently has two permitted outfalls (Numbers 006 and 011) to the Buffalo River for discharge of non-contact cooling water and stormwater runoff from the site. PVS currently has two permitted outfalls (Numbers 001 and 002) to the Buffalo River. Surface water samples were not required to be collected as a component of the RFI.

Groundwater can be found locally in both the unconsolidated deposits and the limestone bedrock of the region. The unconsolidated deposits exhibit a wide range of permeability and can yield varying quantities of water, or none at all. Groundwater within the bedrock is transmitted through fractures such as horizontal and vertical joints, which are widened by dissolution processes. The availability of groundwater in the bedrock can vary widely based on the occurrence of fractures and the size of the solution openings.

Surface water sources provide most of the water used in the area. The City of Buffalo's municipal water supply source is Lake Erie.

4.3 Facility Specific Geology/Hydrogeology

4.3.1 Introduction

The discussion of the facility specific geology and hydrogeology is based on characterization of the subsurface underlying the site from advancement of twenty-three (23) Phase I soil borings, four (4) Phase II soil borings, and ten (10) Supplemental Investigation soil borings. In addition, data from previous studies performed at the site or in the vicinity of the site were also utilized as applicable.

4.3.2 Facility Geology

The subsurface geology of the BCC facility and adjacent PVS facility can be characterized by 0 to 20 feet of fill material overlying as much as 50 feet of unconsolidated sediments of glacial or alluvial origin. Geologic cross-sections of the RFI study area have been developed from the RFI soil boring logs and existing pre-RFI piezometer and monitoring well logs and are located on Figure 5 and presented on Figures 6, 7, and 8. The following discussions summarize the characteristics of the subsurface units encountered within the study area. The units are described in the sequence in which they are encountered in the subsurface of the study area.

Fill

Fill material is pervasive over the surface of the majority of the study area. Typically the fill consists of variable proportions of re-worked clay and silt till, crushed stone or gravel, brick, foundry sand, and building demolition debris. The fill thickness was found to range from 0 feet to 20 feet with the maximum observed thickness occurring along the Buffalo River at boring RFI-24.

Alluvium

The alluvial deposits found within the study area are typically comprised of very loose to compact, brown, fine to very coarse sands and less commonly clayey silt to clayey sand. Interbedded thin seams of leaves and/or wood particles were also commonly observed within samples obtained from the alluvium. This unit was encountered in nine Phase I borings and five Supplemental Investigation borings and ranged in thickness from 0 feet to 21 feet with the maximum observed at boring RFI-40 which is located in close proximity to the Buffalo River. A laboratory gradation analysis for a typical sample (RFI-23DGAF) is provided in Appendix I.

As indicated on the geologic cross sections, beneath overlying fill, a transition from the alluvium to clay and silt tills occurs within the subsurface as proximity to the Buffalo River decreases. This transition represents an erosional contact between the alluvium and the clay and silt tills and appears to delineate the lateral extent of historic Buffalo River deposits in the study area.

Clay and Silt Tills (Upper Tills)

Clay and silt tills, described hereafter as Upper Tills to differentiate from the deeper Basal Till unit, were observed at twelve RFI Phase I borings and four RFI Supplemental Investigation borings. The Upper Tills are described as soft to firm, light brown to gray-brown, silty clays to clayey silts with occasional gray clay infilling of vertical fractures and interbedded fine to medium sand partings and seams. In addition, as a till, the unit exhibits a significant fraction of granular material. The unit ranges in thickness from 0 feet to 10 feet and underlies a majority of Areas B, C, and E of the BCC facility as well as portions of Area A and the supplemental investigation study areas.

Glaciolacustrine Clay

Beneath the alluvium or Upper Tills, a lacustrine silty clay unit was encountered in each Phase I and Supplemental Investigation boring (the exception being three Phase I piezometer borings completed near the invert of the BSA sewer). This unit can be described as soft to very soft, brown to gray-brown, uniform silty clay to clay with reddish brown varving and occasional silt to fine sand seams and partings. Based on logs of borings which completely penetrated the glaciolacustrine clay, the clay ranges in thickness from 24 feet to as much as 36 feet beneath the site. Geotechnical testing of the glaciolacustrine clay has indicated that this unit is comprised of nearly 100-percent clay size particles (see Appendix J).

Basal Till

Underlying the glaciolacustrine clay is a relatively thin Basal Till unit comprised of a loose to compact, gray-brown, mixture of sand, silt, and gravel with little to some clay. The Basal Till was encountered within the four RFI deep wells (RFI-16, RFI-19D, RFI-21D, and RFI-23D) as well as other deep wells located in the vicinity of the study area (Malcolm Pirnie, 1989; Engineering Science, Inc., 1989; Thomsen Associates, 1987). As indicated on the geologic cross-sections, the unit has been found in the study area to range in thickness from 2 feet to 5 feet.

Onondaga Limestone

Immediately underlying the Basal Till, the Onondaga Limestone bedrock was encountered in four RFI Phase I borings (RFI-16, RFI-19D, RFI-21D, and RFI-23D). These borings were advanced just to the top of bedrock, and consequently minimal sample material of the bedrock was retrieved, however, the sample fragments of bedrock that were collected were described as fractured and weathered, dark gray limestone. Considering that the contact with the overlying Basal Till is characterized by a weathered surface, the approximated slope of the top of bedrock beneath the BCC facility is to the south at a rate of 1.2 feet per 100 feet.

The stratigraphy underlying the study area and described above is generally consistent with that found by previous investigators performing studies in or around the general vicinity of the BCC facility. These studies include investigation of Area D (Malcolm Pirnie, 1989), investigation of the former Lagoons Area of BCC (Thomsen Associates, 1987), investigation of the Allied Signal facility (Remcor, 1995), and investigation of the former Allied Signal facility now operated as PVS (Engineering Science, Inc., 1989).

4.3.3 Facility Hydrogeology

Consistent with previous investigations performed in the vicinity of the BCC facility (Malcolm Pirnie, 1989), two aquifers have been identified within the study area. The first aquifer encountered beneath the site, designated the Shallow Aquifer, represents a continuously saturated unconfined system within the fill and sediments above the glaciolacustrine clay unit which underlies the study area. The second aquifer designated as the Confined Aquifer occurs within the Basal Tills and weathered upper surface of the Onondaga Limestone and is under apparent confined conditions. The thick deposition of uniform glaciolacustrine clay underlying the study area serves to act as an aquitard for the Shallow Aquifer and as a confining unit for the deeper aquifer found at its base.

As part of the RFI, four water level monitoring events were performed to characterize the potentiometric surface and flow regimes of each aquifer. The initial water level monitoring events were performed during April and August of 1996 as part of the Phase I and Phase II investigations of the BCC facility. Two subsequent water level monitoring events were performed as part of the Supplemental Investigation and occurred in June and July of 1997. Water levels obtained during each of the four events are presented in Tables 7 to 10.

To evaluate the effect of seasonal changes on the aquifers potentiometric surfaces, the 1996 water level monitoring events were scheduled in late spring and late summer (April and August, respectively). The results of the 1996 monitoring events for both the shallow and confined aquifers, indicate flow directions were consistent and groundwater levels in general did not fluctuate significantly between the two events.

With few exceptions, water levels within monitoring wells and piezometers included in the program did not differ significantly between the 1996 and 1997 monitoring events so as to alter flow directions. Consequently, considering the similarity in water levels observed between the 1996 and 1997 monitoring events and the inclusion of additional data points from performance of the Supplemental Investigation, potentiometric maps for the shallow and confined aquifers are presented for the June 1997 and July 1997 time periods. The following discussions describe the characteristics of the shallow and confined aquifers.

4.3.3.1 Shallow Aquifer

Groundwater Flow

Potentiometric surface contour maps for the shallow aquifer during June 1997 and July 1997 are presented as Figure 9 and Figure 10, respectively. In general, flow in the shallow aquifer of Area ABCE is from the west and north towards the Buffalo River. A location map of BSA lines, BCC process and clear water sewers, and PVS sewers is presented in Attachment A. This figure has been compiled from available historic and current record drawings for utilities within the study area and includes relative locations of lines, materials of construction, and invert elevations. However, some underground utilities and manmade features appear to influence local groundwater flow conditions. A predominant natural feature of the shallow aquifer flow regime is the stratigraphic transition between the Upper Tills and alluvium (shown as a dashed line on the potentiometric maps). This transition results in an increased gradient across this boundary corresponding to the head loss between the low permeability fill/Upper Tills and the higher permeability alluvium.

Hydraulic gradients span a wide range in the shallow aquifer from a high of 0.25 foot per foot (ft/ft) at a breach in the BSA sewer sheet piling at Area E to a low of 0.001 ft/ft within the alluvium on the east side of the PVS property (July 1997 event). With the exception of an area near the center of the PVS facility, it is noted that beyond the influence of the stratigraphic transition described previously, gradients are low to essentially flat within the alluvium.

Several areas of groundwater mounding are apparent in the study area. A mound is present on the northwest side of Area B most likely due to the influence of fill placed within a former building foundation at this location. A second notable mounding of groundwater occurs within the central portion of the PVS facility. Mounding at this location could be attributed to retention of water within the low permeability Upper Tills observed underlying this area accentuated by the influence of the BSA sewer located to the north and alluvium located to the south.

Considering the potentiometric surface maps developed for the shallow aquifer, the following observations are provided with regard to the influence of other manmade features on shallow groundwater flow:

- Groundwater flow within the interior of Area ABCE is likely influenced by the network of subsurface utilities found within the study area. Groundwater flow within the vicinity of the lines of this network may be theoretically affected by potential infiltration to and exfiltration from these subsurface features. Additionally, preferential flow of groundwater within bedding and backfill of these features is likely occurring;

- With a one foot elevation contour interval, no distinct influence on groundwater flow direction by BCC Outfalls 006 and 011 (non-contact cooling water and storm water) is indicated on the potentiometric maps. The potential influence of Outfalls 006 and 011 on localized groundwater flow within the alluvium is minimized given that these lines are at or below the water table (see Attachment A) and within the alluvial deposits that exhibit high hydraulic conductivities similar to the range found in pipe bedding materials. As indicated in Attachment A, Outfalls 006 and 011 are fully submerged at their discharge point to the Buffalo River. However, where sections of Outfall 006 and 011 piping extend beyond the alluvium/upper tills transition and are found within fine grain soils where groundwater elevations are higher than the river, the bedding and backfill of these lines likely represent localized sinks and preferential pathways for groundwater flow.

- Headwalls along the Buffalo River in Area A and on the PVS facility do not appear to extend deep enough into the alluvium to act as barriers to groundwater flow to the river;

- The steep gradient observed along the Buffalo River near the central portion of the PVS property may be attributable to potential leakage from the facility's high volume effluent discharge outfalls located in close proximity to monitoring well RFI-39;

- A BSA trunk sewer extends west to east across the BCC facility and along the property line between PVS and Area E (Figure 2). As indicated on the potentiometric maps, the BSA sewer and/or the sewer backfill appear to act as a sink for groundwater flow between Area B and Area C as well as between Area E and a portion of the PVS property. Additionally, underground features located interior to Area C appear to be directing groundwater flow to the BSA sewer at this portion of the facility;

- A branch line of the BSA sewer extending along Orlando Street acts as a localized sink for groundwater flow from Area E and appears to direct groundwater to the south; and

- The RFI included a subsurface investigation in the vicinity of closed Lagoons 1, 2, and 3 in order to better define the shallow groundwater flow conditions between the lagoons and the Buffalo River. Specifically, the area investigated included a section of the BSA sewer extending west-east just south of the closed Lagoons, and in the vicinity of BCC's Outfall 011 which transverses the BSA line. Within the study area, the BSA sewer is bound by sheet piling consisting of wood planking and steel piling. In the area where Outfall 011 crosses the sewer line, a 5-ft to 10-ft section of the sheet piling has been reportedly removed. Past reports have indicated that shallow groundwater flow in the vicinity of the former lagoons is toward this area and may also be along the outfall line or the BSA sewer line (Empire Soils Inc., 1990).

  The results of this sub-investigation of the RFI indicate that the breach in the BSA sewer sheet piling does act as a confluence for groundwater flow from Area E to the BSA sewer/backfill and the alluvium located downgradient from Area E. However, the steep gradients within this part of Area E may be in part due to the transition between the Upper Tills and alluvium which apparently occurs at the south-east corner of Area E. As stated previously, beyond the breach in the BSA sheet piling, Outfall 011 does not appear to act as a preferential flow pathway as the outfall piping is bedded approximately at the water table and within the permeable alluvial deposits.

Hydrogeologic Characteristics

Variable head tests (rising or falling) were conducted in each of the shallow aquifer and BSA backfill Phase I monitoring wells and piezometers as well as in the Supplemental Investigation monitoring wells to determine the hydraulic conductivity of the subsurface materials adjacent to the screened interval at each location. Results of the variable head tests are summarized within Table 11, while graphical results of testing for each RFI monitoring well or piezometer are presented in Appendix E.

As indicated within Table 11, hydraulic conductivities for monitoring wells screened within the Upper Tills of the investigation area ranged from $8.7\text{x}10^{-5}$ centimeters per second (cm/s) to $7.23\text{x}10^{-7}$ cm/s. The mean hydraulic conductivity for the Upper Tills unit was $1.01\text{x}10^{-5}$ cm/s. The range and mean of hydraulic conductivity determined for the Upper Tills are typical of a clayey silt to silty clay deposit.

Three piezometers (RFI-PZ-16, RFI-PZ-17, and RFI-PZ-18) and one monitoring well (RFI-42) were screened within backfill of the BSA sewer. The hydraulic conductivity of the sewer backfill was found to range from $4.74\text{x}10^{-3}$ cm/s to $3.08\text{x}10^{-6}$ cm/s with a mean of $1.20\text{x}10^{-3}$ cm/s.

Ten monitoring wells and two piezometers were screened within the alluvium underlying the investigation area. The hydraulic conductivity for the alluvium was found to range from a low of $1.09\text{x}10^{-4}$ cm/s at RFI-PZ-19 to a high of $2.09\text{x}10^{-2}$ cm/s at RFI-25. The mean hydraulic conductivity for the alluvium was $2.89\text{x}10^{-3}$ cm/s. This mean value of hydraulic conductivity is typical for alluvial sands and gravels and is approximately two orders of magnitude (one-hundred times) greater than the mean determined for the Upper Tills unit.

No RFI monitoring wells or piezometers were screened exclusively within the glaciolacustrine clay underlying the investigation area. However, this unit has been determined to extend beyond the investigation area to other properties in the vicinity including the Allied Signal research facility where hydraulic testing of a monitoring well screened within the glaciolacustrine clay indicated a hydraulic conductivity of 3.5×10^{-9} cm/s for this unit (Remcor, 1995).

Given the hydraulic characteristics presented above, the approximate velocity (average linear velocity) of groundwater flow within the shallow aquifer has been calculated for both the Upper Tills unit and alluvium following a typical flow line from Area B across the PVS facility to the Buffalo River. To complete this approximation, an assumption must be made regarding the effective porosity of the Upper Tills and alluvium. As reported in literature (Fetter, 1988), the range of porosity (total) for clays and silts which typify the Upper Tills varies from 33 to 60-percent while the range for alluvial sands and gravels varies from 25 to 50-percent. Effective porosity is that portion of the pore space through which saturated flow occurs and has been conservatively taken as the low end of the total porosity range for both aquifer media. Therefore, taking the low end of the porosity range for both aquifer mediums in conjunction with the average hydraulic conductivity for these mediums and calculating the hydraulic gradient within the Upper Tills and alluvium along a flow line from Area B across the PVS facility to the Buffalo River, the average linear velocity of groundwater flow within these units can be shown to be:

Upper Tills:	0.0013 ft/day (0.47 ft/year); and
Alluvium:	0.262 ft/day (96 ft/year).

Note: June 1997 water levels have been utilized for the above approximations.

It should be noted that this approximation is specific for this one area of the site and average linear velocities of groundwater flow within the two units will differ (higher or lower) for other portions of the study area.

Although the alluvium within the investigation area and adjacent to the Buffalo River has been shown to exhibit relatively high hydraulic conductivities, groundwater gradients within these deposits are generally low and could potentially be reversed during elevated river stages. However, a gradient reversal within the alluvium would also be expected to be of short duration considering the hydraulic responsiveness of the alluvium. Given the recorded elevations of groundwater at the upgradient perimeter of Area ABCE and the hydraulic characteristics of the fill and Upper Tills, a gradient reversal beyond the lateral extent of the alluvium at the interior of the investigation area would not appear likely. The effects of elevated river stages on the groundwater elevations and gradients within the investigation area could not be evaluated during the RFI as river levels measured at the South Park Avenue stilling well during each of the four water elevation monitoring events were relatively consistent and typical of normal river stages.

4.3.3.2 Confined Aquifer

Groundwater Flow

Groundwater in the confined aquifer flows under apparent confined conditions within the Basal Till unit and upper portion of the Onondaga Limestone found beneath the base of the glaciolacustrine clay. Potentiometric surface contour maps for the confined aquifer during June 1997 and July 1997 are presented as Figure 11 and Figure 12, respectively. The potentiometric maps for the confined aquifer are constructed from water levels obtained from four RFI monitoring wells and eight pre-RFI monitoring wells screened within the Basal Till and upper portion of the Onondaga Limestone (all located within Area ABCE). Based on water levels from the deep monitoring wells, a groundwater divide, or zone of no flow is apparently present within the confined aquifer below the central portion of Area E. Flow was generally to the west and east of this divide during both the June 1997 and July 1997 monitoring events. This general flow pattern was also observed during the April 1996 and August 1996 monitoring events. Gradients within the confined aquifer ranged from zero (0) ft/ft to 0.008 ft/ft during both the June 1997 and July 1997 monitoring events indicating a very gentle slope to the potentiometric surface.

Vertical gradients across the glaciolacustrine clay unit were calculated from water level measurements obtained from seven shallow/deep well pairs during each of the four water level monitoring events recorded during the RFI. The average vertical gradient calculated for the June 1997 and July 1997 monitoring events was -0.13 ft/ft and -0.11 ft/ft, respectively, indicating a slight downward gradient. The vertical gradients calculated for the shallow/deep well pairs during the April 1996 and August 1996 monitoring events also indicated slight downward gradients across the glaciolacustrine clay.

Hydrogeologic Characteristics

Rising head tests were conducted in each of the RFI monitoring wells screened within the confined aquifer to determine the hydraulic conductivity of the subsurface materials adjacent to the screened interval at each location. Results of the rising head tests are summarized within Table 11, while graphical results of testing are presented in Appendix E.

As indicated within Table 11, hydraulic conductivities for monitoring wells screened within the Basal Till/upper portion of the Onondaga Limestone ranged from 1.50×10^{-2} cm/s to 4.04×10^{-7} cm/s. The mean hydraulic conductivity for this zone was 6.15×10^{-3} cm/s.

4.4 Air Quality and Meteorology

The Buffalo, New York area has a humid, continental climate which is modified by its proximity to Lake Erie. Atmosphere air flow is predominantly from the continent. Temperatures average from highs in the 70s and 80s during the summer to lows of zero to -10 degrees Fahrenheit (°F) in the winter. Heavy "lake-effect" snows are common through February. Otherwise, precipitation in the region is moderate and fairly evenly distributed throughout the year (National Oceanic and Atmospheric Administration (NOAA), 1982). The annual average precipitation for the period of 1961 through 1990 have been recorded 38.58 inches (NOAA, 1993). August is reported as the wettest month receiving an average of 4.17 inches of precipitation. The year-long average daily temperature is 47.7 degrees Fahrenheit; July is the warmest month and January the coldest. The average wind direction and speed in Buffalo are southwest at 11.9 miles per hour (mph). January is the month with the highest average wind speed, 14.2 mph and August has the lowest average of 9.8 mph. The average atmospheric pressure in Buffalo is 990.0 millibars (NOAA, 1993). The regional atmosphere has favorable dispersive ability. Frequent weather changes help prevent stagnation, resulting in few extended periods of fog or high pollution levels (NOAA, 1982).

BCC currently operates a number of NYSDEC permitted air emission sources at the facility. There have been no known releases of contaminants to the air from the SWMUs or AOC. No emissions monitoring or testing was required or performed at the facility except during drilling activities as air quality was not required to be investigated during the RFI.

5. RFI SOIL AND GROUNDWATER ANALYTICAL RESULTS

5.1 Introduction

The laboratory reports containing the chemical analytical results for soil and groundwater samples collected and Quality Control/Quality Assurance sample results are provided in Appendices H and I. The reports containing the geotechnical testing results for selected soil samples are provided in Appendix J.

The following sections present the results of the analyses of soil and groundwater investigation samples. For presentation purposes, only the constituents detected are reported in summary tables. Analytes detected in method blanks and in samples are not reported in the tables. A summary of blank detections is provided with Appendix H. In addition to specific constituent concentrations, total concentrations for VOCs, SVOCs, and metals analyzed are provided for the samples for general comparative purposes. Actual sample detection limits for each analytical method are found in the laboratory reports provided in the above Appendices to this report. The analytical results for each media (i.e. soil and groundwater) are compared to potentially applicable action levels as defined in Module I. J.(1) and required by Module III E.(7)(a) of the BCC Permit based on NYSDEC regulations and guidelines. Included are the following:

- Class GA Fresh Groundwater Standards and Guidance Values (6NYCRR Parts 700-705, Water Quality Regulations for Surface Waters and Groundwaters, as amended June 1998);
- Local and typical background soil concentrations as reported in the New York State Department of Health "Draft Technical Report - Seneca-Babcock Neighborhood Soil Sampling Program" (October 1996); and
- Division Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels (NYSDEC, HWR-94-4046, January 24, 1994). The NYSDEC recommended soil cleanup levels and adjusted levels based on an analyzed soil organic carbon content of 5.3% (as recommended in this document) are presented. The soil analyses for organic carbon content and the calculations for the adjusted levels are provided in Appendix H.

Action levels for soil/sediment and groundwater were also provided as Table 1 to BCC in the NYSDEC correspondence of September 10, 1993. The was subsequently updated and provided by the NYSDEC as the "Technical and Administrative Guidance Memorandum No. 3028 - Contained-In Criteria for Environmental Media (August 26, 1997)". However, presentation of these values does not reflect BCC's concurrence that these guidance levels represent properly determined site specific action levels or clean-up levels.

5.2 Soil Analyses

Soil/fill samples were collected at various depths in Area ABCE during the Phase I and Phase II activities for chemical screening analysis for selected VOCs and SVOCs using a gas chromatographic (GC) method (refer to Appendix 2-5-6 of the QAPjP) as well as for confirmatory analyses for VOCs, SVOCs and metals using standard USEPA methods. Additional surficial soil samples were collected from grassed or unpaved areas in Area ABCE as part of the supplemental investigation activities for confirmatory analyses. Selected soil samples were also collected during Phase I for geotechnical analysis.

5.2.1 Geotechnical Analyses

The results of the geotechnical soil sample analyses by ASTM methods are presented and summarized in Appendix J. These data provide engineering properties of the soil materials in Area ABCE which may be utilized if a Corrective Measures Study (CMS) is required.

5.2.2 Screening Analyses

The soil screening analyses for target VOCs and SVOCs (aniline, benzene, chlorobenzene, 1,2-dichlorobenzene, N,N-dimethylaniline, N-methylaniline, 4-methylphenol, nitrobenzene, phenol, toluene and 1,2,4-trichlorobenzene) summarized in Table 12 and Table 13 for the Phase I and Phase II samples, respectively. These analyses were performed to screen for the presence/absence of potential releases of likely hazardous constituents at elevated concentrations (parts per million or greater) in shallow (0-4 ft. bgs) subsurface soils or fill materials and at depth (>4 ft. bgs.) in Area ABCE, given the historic chemical and dye production operations and wastes generated in these areas. The results of these screening analyses indicate the following:

Phase I Screening Analyses

Of the fifty-four (54) soil samples analyzed, target constituents were detected at elevated concentrations above the specified detection limits in three (3) samples:

Area B:

RFI19DSBF (6-8 ft. bgs.)
- Aniline (1,100 mg/kg)

Area C:

RFI21DSBF (2-4 ft. bgs.)
- Chlorobenzene (45 mg/kg)

RFI31SWT (6-8 ft. bgs.)
- 1,2,4-Trichlorobenzene (190 mg/kg)

Phase II Screening Analyses

Of the thirty-two (32) soil samples analyzed, target constituents were detected at elevated concentrations above the specified detection limits in the following five (5) samples :

Area A:

PRB3MS2F (0-4 ft. bgs.)
- Chlorobenzene (15 mg/kg)

PRB3MS5F (4-6 ft. bgs.)
- Chlorobenzene (24 mg/kg)

PRB3MSWTF (6-8 ft. bgs.)
- Chlorobenzene (37 mg/kg)

PRB23S2F (0-2 ft. bgs.)
  - 1,2,4-Trichlorobenzene (110 mg/kg)

Area E:

PRB7S2F (0-2 ft. bgs.)
  - Chlorobenzene (18 mg/kg)

The locations of the samples are identified on Figure 3. The concentration of the above constituents detected in these samples exceed reported background levels and NYSDEC recommended soil cleanup levels (adjusted for 5.3% organic carbon content of site soils). Only sample RFI190SBF exceeded the NYSDEC soil action level for aniline.

5.2.3 Confirmatory Analyses

The confirmatory soil sample analyses for VOCs, SVOCs, PCBs, metals and cyanide summarized in Tables 14 and 15 for the Phase I and Phase II activities, were performed to provide confirmation analyses to determine the presence/absence of potential releases of hazardous constituents in shallow subsurface soils or fill materials and at depth in Area ABCE. Constituents detected at concentrations that exceeded background levels, NYSDEC action levels or recommended cleanup levels (adjusted for 5.3% organic carbon content of site soils) are highlighted in the tables and discussed below:

Phase I Confirmatory Analyses

Twenty three (23) soil samples were collected for confirmatory analyses during Phase II activities at various depths from the monitoring well and piezometer borings. Constituents detected and those at concentrations that exceeded background levels, NYSDEC action levels or recommended cleanup levels (adjusted for 5.3% organic carbon content of site soils) are highlighted in Table 14 and include:

Area A:

RFI16C2F (2-4 ft. bgs.)
- Aniline (4.4 mg/kg)
- Benzo(b)fluoranthene (18 mg/kg)
- Benzo(k)fluoranthene (9.5 mg/kg)
- Benzo(a)anthracene (13 mg/kg)
- Chrysene (12 mg/kg)
- Iron (137,000 mg/kg)
- Chromium (572 mg/kg)
- Copper (553 mg/kg)
- Selenium (30.6 mg/kg)

RFI22CWT (14-16 ft. bgs)
- Aniline (1.4 mg/kg)
- Chromium (248 mg/kg)
- Copper (853 mg/kg)
- Selenium (9.1 mg/kg)
- Cyanide (5.1 mg/kg)

RFI24C5F (6-8 ft. bgs.)
- Benzo(a)anthracene (270 mg/kg)
- Benzo(a)pyrene (200 mg/kg)
- Benzo(b)fluoranthene (260 mg/kg)
- Benzo(k)fluoranthene (84 mg/kg)
- Indeno(1,2,3-cd)pyrene (100 mg/kg)
- Carbazole (120 mg/kg)
- Chrysene (230 mg/kg)
- Dibenzofuran (130 mg/kg)
- Naphthalene (200 mg/kg)
- Cyanide (4.9 mg/kg)

RFI25C2F (2-4 ft. bgs.)
- Benzo(a)anthracene (17 mg/kg)
- Benzo(b)fluoranthene (16 mg/kg)
- Benzo(k)fluoranthene (10 mg/kg)
- Chrysene (16 mg/kg)
- Arsenic (191 mg/kg)
- Iron (496,000 mg/kg)
- Selenium (109 mg/kg)
- Cyanide (3.6 mg/kg)

RFI26C5F (4-6 ft. bgs.)
- Chromium (164 mg/kg)

Area B:

RFI19DCAF (10-12 ft. bgs.)
- Nitrobenzene (3.6 mg/kg)

RFI28C2F (2-4 ft. bgs.)
- Benzo(b)fluoranthene (9 mg/kg)

Area C:

RFI20C2F (2-4 ft. bgs)
- Cyanide (32.7 mg/kg)

RFI31C2F (2-4 ft. bgs.)
- Chlorobenzene (20 mg/kg)
- Arsenic (434 mg/kg)
- Cyanide (1.35 mg/kg)

Area E:

RFI32C2F (2-4 ft. bgs.)
- Cyanide (1.79 mg/kg)

RFIPZ18C2F (0-2 ft. bgs.)
- Chromium (457 mg/kg)
- Selenium (24.6 mg/kg)
- Cyanide (2.19 mg/kg)

Phase II Confirmatory Analyses

Four (4) shallow (0-4 ft. bgs.) soil samples were collected for confirmatory analyses during Phase II activities from the multiple depth borings. Constituents were detected at concentrations that exceeded background levels, NYSDEC action levels or recommended cleanup levels (adjusted for 5.3% organic carbon content of site soils) in all four (4) samples. These are highlighted in Table 15 and include:

Area A:

PRB3MC2F (0-4 ft. bgs.)
- Chlorobenzene (26 mg/kg)
- Aniline (8.5 mg/kg)
- Cadmium (14.5 mg/kg)
- Selenium (10.8 mg/kg)

PRB2MC2F (0-2 ft. bgs.)
- Selenium (7.15 mg/kg)

PRB1MC2F (0-2 ft. bgs.)
- Aniline (2.9 mg/kg)
- Selenium (12.7 mg/kg)

Area E:

PRB4MC2F (0-4 ft. bgs.)
- Selenium (20.2 mg/kg)

Supplemental Investigation Surficial Soil Samples

The six (6) surficial soil samples collected as part of the supplemental investigation were collected at a depth of 1-2 inches below the surface for VOC, SVOC, metals and cyanide analyses. Vegetative cover (grass) was removed prior to sample collection. As indicated in Table 16, three (3) of the six (6) samples had constituents detected at concentrations that exceeded background levels, NYSDEC action levels or recommended cleanup levels (adjusted for 5.3% organic carbon content of site soils) and include:

Area A:

BCSS-1
- Cadmium (30 mg/kg)
- Chromium (501 mg/kg)
- Iron (346,000 mg/kg)
- Manganese (2,350 mg/kg)
- Nickel (301 mg/kg)
- Selenium (24.4 mg/kg)
- Cyanide (1.53 mg/kg)

Area C:

BCSS-4

- Aniline (3.1 mg/kg)
- Benzo(b)fluoranthene (9.3 mg/kg)
- Cadmium (31 mg/kg)
- Iron (343,000 mg/kg)
- Manganese (2,770 mg/kg)
- Mercury (18 mg/kg)
- Nickel (338 mg/kg)
- Selenium (31.5 mg/kg)
- Cyanide (2.12 mg/kg)

Area E:

BCSS-6

- Aniline (0.48 mg/kg)

Summary of Soil Analyses

The results of the soil sample analyses indicate the presence of hazardous constituents in soil/fill materials including VOCs, SVOCs, metals and cyanide with the above samples having concentrations exceeding typical background concentrations and/or NYSDEC recommended cleanup levels (adjusted for 5.3% organic carbon). Most sample constituent concentrations were below the NYSDEC soil action level concentrations. Constituents were detected primarily in shallow subsoils/fill (0- 4 ft. bgs.) and at greater depths (>4 ft. bgs) in specific sample locations in Area ABCE. The predominant VOC detected at concentrations above these levels is chlorobenzene (15-45 mg/kg). The predominant SVOC detected at concentrations above these levels is aniline (0.48-1,100 mg/kg). Other SVOCs include 1,2,4-trichlorobenzene (110-190 mg/kg), nine (9) polyaromatic hydrocarbons (PAHs) (9-270 mg/kg) and nitrobenzene (3.6 mg/kg). Other sources of PAHs may also include reported past use of coal, petroleum products and fuels in Area ABCE as well as fuel combustion by-products. PCBs were not detected above NYSDEC action levels.

The predominant metals detected at concentrations above these levels include iron (137,000-496,000 mg/kg), chromium (164-572 mg/kg), copper (553-853 mg/kg), cadmium (14.5-31 mg/kg), manganese (2,350-2,770 mg/kg), nickel (301-338 mg/kg) and selenium (9.1-109 mg/kg). Hexavalent chromium (CrVI) was detected in four (4) samples at concentrations of 6.53-29.9 mg/kg. No background concentrations or NYSDEC action level is reported for this constituent and NYSDEC recommended cleanup objectives are site specific.

Cyanide was detected in nine (9) soil samples above reported local background levels at concentrations of 1.35-32.7 mg/kg. However, the concentrations were below the NYSDEC soil action level of 1,600 mg/kg and the NYSDEC guidelines indicate that soil cleanup objectives for cyanide are site specific.

Based on the samples collected and analyzed, it also appears that elevated concentrations of these hazardous constituents are more prevalent in soils in Area A of Area ABCE. This would appear to correlate with Area A being the oldest area of chemical usage, production and waste generation activities.

Based on these analyses, there is potential for exposure to hazardous constituents in subsoils/fill and surficial soil/fill in selected locations in Area ABCE from potential contact, runoff of particulates to surface water drainage courses and potential leaching of these constituents to groundwater in unpaved areas.

5.3 Groundwater Analyses

5.3.1 Shallow Aquifer-Area ABCE

The results of the two (2) rounds (June 1996 and August 1996) of groundwater sample analyses for VOCs, SVOCs, metals, inorganics, PCBs and alcohols collected from the RFI shallow aquifer wells in Area ABCE during Phase I are summarized in Tables 17 and Table 18. Samples from wells RFI-20, RFI-24 and RFI-32 were also analyzed for hardness and total dissolved solids.

5.3.1.1 Area ABCE Perimeter Wells

The Area ABCE RFI shallow aquifer perimeter monitoring wells located along the Conrail Railroad and Elk Street are RFI-27, RFI-30, RFI-20, RFI-33, and RFI-17.

PCBs and alcohols were not detected in any groundwater samples. Constituent concentration ranges that were detected and those that exceeded the 6NYCRR Part 703 Class GA groundwater standards/NYSDEC action levels in samples in both sampling events in one or more of these perimeter wells in Area ABCE are shown on Figure 13 and include:

VOCs
- Tetrachloroethene (0.18-0.19 mg/l) (RFI -27)
- Chlorobenzene (0.62-0.76 mg/l) (RFI-20)

SVOCs
- 1,2,4-Trichlorobenzene (0.077-0.088 mg/l) (RFI-20)

Metals
- Iron (2.5- 48 mg/l) (RFI-17,20, 27,30,33)
- Chromium (0.16-0.42 mg/l) (RFI-30,33)
- Lead (0.073-0.0848 mg/l) (RFI-20)
- Manganese (0.326-2.86 mg/l) (RFI-17,20,27,30,33)

Inorganics
- Chloride (539-1,440 mg/l) (RFI-27,30,33)
- Sulfate (605-1,800 mg/l) (RFI-20,30)

5.3.1.2 Interior Monitoring Wells

The Area ABCE shallow interior RFI wells are RFI-22, RFI-25, RFI-26, RFI-24, RFI-28, RFI-18, RFI-29 and RFI-32. PCBs and alcohols were not detected in any groundwater samples. Constituent concentration ranges that were detected and those that exceeded the 6NYCRR Part 703 Class GA groundwater standards/NYSDEC action levels in samples in both sampling events in one or more of these interior wells in Area ABCE are highlighted in Tables 17 and 18 and shown on Figure 13. The constituents that exceed these values are summarized in Table 19 by chemical class, area location and interior wells in that area. The constituents exceeding these values include six (6) VOCs, sixteen (16) SVOCs, nine (9) metals, chloride, cyanide, pH, sulfate and sulfide. These results are discussed below:

VOCs

- The predominant VOC that exceeded Class GA groundwater standards in Areas A, C and E is chlorobenzene. No VOCs exceedances were detected in Area B (RFI-18 or RFI-28).

SVOCs

- The predominant SVOC that exceeded Class GA groundwater standards in Areas A and B is aniline. Area A samples were also observed to have a greater number and distribution of SVOCs compared to Areas B, C and E. Dichlorobenzenes exceeding these standards were observed in Areas A, C and E. O+P toluidine and 1-naphthylamine were observed in Areas A and B only. 1,2,4-trichlorobenzene exceeded the standard in Area C only. Bis(2-Ethylhexyl)Phthalate slightly exceeded the standard in RFI-32 only.

Metals

- Metals detected in samples varied. Iron and manganese were detected in Areas A, B, C and E at concentrations that exceeded Class GA groundwater standards. Arsenic and lead exceeded these standards in Areas A and B, and chromium exceeded these standards in Areas A, B and C. Vanadium exceeded the standard only in Area A and nickel exceeded the guidance value in Areas B and C.

Inorganics

- Sulfate exceeded Class GA groundwater standards in Areas A, B and C while sulfide and cyanide exceeded these standards only in Area A.
- Nitrate/nitrite-nitrogen did not exceeded these standards in any samples from Area ABCE.
- Chloride exceeded these standards in Areas A, B, C and E.
- Area B, C and E well samples were observed to be neutral in pH while three Area A well samples were slightly alkaline (pH range 9.04-10.8 for RFI-22, RFI-24, RFI-26).

5.3.1.3 Groundwater Multiple Depth Borings

The results of the groundwater sample analyses for VOCs, SVOCs, metals, inorganics, PCBs and alcohols collected at the shallow water table from the four (4) multiple depth internal borings in Area ABCE during Phase II activities are summarized in Table 20. These samples were collected to evaluate the presence/absence of these constituents in the saturated zone for comparison to the results of analyses of samples collected from the shallow aquifer wells. It should be noted that these samples were collected from open boreholes, were turbid, and were not filtered to remove suspended soil particles present. Consequently, this should be taken into consideration for comparison of constituent concentrations to Class GA groundwater standards.

PCBs and alcohols were not detected in these samples. Constituents that were detected above the 6NYCRR Part 703 Class GA groundwater standards/NYSDEC action levels in these samples include four (4) VOCs, eight (8) SVOCs, thirteen (13) metals, chloride, cyanide, pH, sulfate and sulfide.

The constituents that were detected in these samples above 6NYCRR Part 703 Class GA groundwater standards/NYSDEC action levels are generally consistent with those constituents observed in shallow aquifer groundwater samples with the following exceptions:

- Acetone
- 2,4-Dinitrotoluene
- 2,6 Dinitrotoluene
- 3-Nitroaniline
- Barium
- Copper
- Mercury
- Selenium

These above constituents, however, did not the exceed Class GA groundwater standards/action levels in the shallow aquifer interior or perimeter RFI well samples.

5.3.2 BCC Former Lagoons (1, 2 and 3) Groundwater Monitoring Data

The analytical results from the last three (3) routine groundwater monitoring events for selected VOCs, SVOCs, metals, and inorganics (as required by the Permit) collected from the BCC shallow aquifer and confined aquifer wells in Area E are summarized in Table 21. The shallow aquifer wells include R09, R11, R13, R14 and R15 (upgradient well). Well R08, which has been previously analyzed to contain elevated concentrations of VOCs and SVOCs is not currently monitored for chemical constituents. The confined or deep aquifer wells include R02, R03, R04, R06, R12 and R07 (upgradient well). These sampling events were performed by BCC on May 15-17, 1996, October 17, 1996 and May 13-14, 1997 which correspond to relatively the same time periods that samples were collected from the RFI wells in Area ABCE during Phase I and off-site wells and piezometers during the supplemental investigations.

As indicated in Table 21 and Figure 13, analysis of recent shallow aquifer groundwater samples and prior well R08 samples in the former Lagoons area in Area E indicated the following constituents exceeded the Class GA groundwater standards or NYSDEC action levels in downgradient (of the former lagoons area) wells:

VOCs

- Acetone
- Benzene
- Chlorobenzene
- Chloroform
- 1,1-Dichloroethane
- Ethylbenzene
- Methylene Chloride
- Toluene
- 1,1,1-Trichloroethane
- Xylenes

SVOCs

- Aniline
- 4-Chloroaniline
- Bis(2-Ethylhexyl)phthalate
- N,N-Dimethylaniline
- N-Methylaniline
- 1-Naphthylamine
- O+P Toluidine
- Total Phenolics
- 1,2-Dichlorobenzene

Metals/Inorganics

- Iron
- Manganese
- Chloride
- Sulfate
- pH
- Sodium

The following constituents in the upgradient shallow aquifer well samples for the former Lagoons area (R15) also exceeded the Class GA standards:

- Benzene
- Ethylbenzene
- Toluene
- Xylenes
- Total Phenolics
- Iron
- Manganese

- Chloride
- Sodium

5.4 Shallow Aquifer - Supplemental Investigation Off-Site

The results of the two (2) rounds (June 1997 and July 1997) of groundwater sample analyses for VOCs, SVOCs, metals, and inorganics collected from ten (10) RFI shallow aquifer wells and two (2) piezometers in areas off-site including the PVS property during the supplemental investigation activities are summarized in Table 22 and Table 23. Alcohols or PCBs were not detected within Phase I and Phase II RFI groundwater samples and consequently were not included for analysis of off site groundwater samples. In addition, selected groundwater samples for soluble/dissolved metal analyses (RFI-24SOL, RFI-25SOL, RFI-38SOL, RFI-39SOL, and RFI-40SOL) were also collected in addition to samples collected for total metals analyses. These dissolved metal analyses were performed to provide information for potential assessment of constituent loadings if needed for a Corrective Measures Study.

Constituents that were detected at concentrations that exceeded the 6NYCRR Part 703 Class GA groundwater standards/NYSDEC action levels in samples in both sampling events in the off-site shallow aquifer wells and piezometers are summarized in Table 24 and shown on Figure 13. These results are discussed below:

VOCs

- Only samples from RFI-38 (Chloroform) and RFI-40 (Chlorobenzene) exceeded Class GA groundwater standards. No VOCs were detected in RFI-34 or RFI-PZ-19 which are upgradient of RFI-38 and RFI-40, respectively. VOCs were also not detected or did not exceed these standards in samples from the other off-site wells or piezometers.

SVOCs

- Only samples from RFI-38 (Naphthalene) and RFI-40 (1,2-Dichlorobenzene, 1,3-Dichlorobenzene, 1,4 Dichlorobenzene and 1,2,4-Trichlorobenzene) had SVOCs detected that exceeded Class GA groundwater standards. No SVOCs were detected in RFI-34 or RFI-PZ-19 which are upgradient of RFI-38 and RFI-40, respectively. SVOCs were also not detected or did not exceed these standards in samples from the other off-site wells or piezometers except for very low level detections of bis(2-ethylhexyl)phthalate which was detected in RFI-41, RFI-42, and RFI-PZ-17 just above the June 1998 revised standard.

Metals

- Ten (10) metals (arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, and zinc) were detected in varying frequency in off-site groundwater samples from the ten (10) wells and two (2) piezometers at concentrations that exceeded Class GA groundwater standards or NYSDEC action levels.

- Iron exceeded Class GA groundwater standards in all ten (10) wells and two (2) piezometers and manganese exceeded Class GA groundwater standards in nine (9) wells and two (2) piezometers.

- With the exception of copper, zinc and mercury, the other metals were also detected in Area ABCE shallow downgradient wells (upgradient from the supplemental wells and piezometers) at concentrations that exceeded Class GA groundwater standards.

Inorganics

- Sulfate exceeded Class GA groundwater standards in all samples except RFI-42 and RFI-PZ-17. The sulfate concentration range of exceedances in samples from the shallow aquifer off-site wells on the PVS property appears to be higher than that observed in the shallow aquifer wells in Area ABCE.

- Nitrate/nitrite-nitrogen exceeded Class GA groundwater standards only in samples from RFI-34 and RFI-38 and not in samples from shallow aquifer wells in Area ABCE.

- Chloride exceeded Class GA groundwater standards only in samples from RFI-38 and RFI-41. The chloride concentration range of exceedances in samples from Area ABCE shallow wells appear to be higher than that observed in shallow off-site well samples.

- Well RFI-38 samples were slightly acidic (pH 3.8 - 4.2) whereas well RFI-39 samples were slightly alkaline (pH 9.0 - 9.1) and exceeded Class GA groundwater standards. pH ranges reported by other parties for shallow aquifer samples collected on the PVS property by other parties were 3.0-6.25. By comparison, shallow aquifer Area ABCE wells were observed to be either neutral in pH or slightly alkaline (pH range 9.04-10.8 for RFI-22, RFI-24, RFI-26). Only a water sample from PRB-1M located near the northwest perimeter of Area A at a very slightly acidic pH of 5.7.

- Sulfide exceeded Class GA groundwater standards only in samples from RFI-39. No samples from Area ABCE shallow wells upgradient from this well or piezometer RFI-PZ-19 exceeded Class GA groundwater standards for sulfide.

5.5 Confined Aquifer-Area ABCE

The results of the two (2) rounds (June 1996 and August 1996) of groundwater sample analyses for VOCs, SVOCs, metals, inorganics, PCBs and alcohols collected from the four RFI confined aquifer wells (RFI16, RFI19D, RFI21D and RFI23D) in Area ABCE during Phase I are summarized in Table 25 and Table 26. Samples from wells RFI-16 and RFI-19D were also analyzed for hardness and total dissolved solids during the August 1996 event.

Constituents were detected at concentrations that exceeded the 6NYCRR Part 703 Class GA groundwater standards/NYSDEC action levels in the following samples in both sampling events:

RFI-16
- Benzene (0.013 - 0.027 mg/l)
- Chlorobenzene (0.0094 - 0.011 mg/l)
- pH (field) (11.4-12.3 S.U.)

RFI-19D
- Aniline (0.029 - 0.031 mg/l)
- Iron (3.55 - 21 mg/l)
- Sulfide (1.8 -2.2 mg/l)
- pH (field) (10.1-10.7 S.U.)

RFI-21D
- Chlorobenzene (0.0064 - 0.01 mg/l)
- Chloride (304 -350 mg/l)
- pH (8.72-8.9 S.U.)

RFI-23D

- Iron (1.81 - 4.7 mg/l)
- pH (field) (9.67-11.5 S.U.)

Former Lagoons Area Confined Aquifer Wells

As indicated in Table 21, analysis of recent confined aquifer groundwater samples in the former Lagoons area located within Area E indicated the following constituents exceeded the Class GA standards in specific downgradient wells (R02, R03, R04, R06, R12):

- Benzene
- Bis(2-ethylhexyl)phthalate
- Ethylbenzene
- Toluene
- Xylenes
- Total Phenolics
- Sulfate
- pH (8.52-8.9 S.U.)

The following constituents in the upgradient confined aquifer well (R07) samples for the former Lagoons area also exceeded the Class GA groundwater standards:

- Total Phenolics
- pH (10.12 S.U.)

The constituents detected in the confined aquifer include constituents that were reported to be associated with historic operations and waste materials at the facility and that were also detected in soil and/or shallow aquifer groundwater samples collected from Area ABCE. Benzene, toluene and alkaline pH values were also observed in confined aquifer samples collected during investigations performed by other parties on the PVS property.

The presence of these constituents may be a result of migration due to documented historic construction or other penetrations (e.g. borings, caissons, foundations, former deep well etc.) through the glaciolacustrine clay confining layer. While benzene, toluene, ethylbenzene and xylenes have been reported to be constituents associated with historic chemical and dye production operations and wastes in Area ABCE, other potential sources for these constituents could include:

- Former oil, petroleum and energy operations in Area E as indicated on historic Sanborn Fire Insurance Maps including Genesee Oil Works, Tidewater Associated Oil Co., W. H. Foot & Co. Oil Works and Elmer E. Harris & Co; and
- Offsite sources of petroleum related constituents such as Mobil Oil, located to the east, which has been reported to be operating a groundwater remediation system. Although the Mobil Oil facility is technically downgradient of Area E as shown on Figure 12, the mounding/groundwater divide indicated on this figure is believed to be a relatively localized effect which is not consistent with the general westerly regional deep aquifer flow direction.

The confined aquifer is not currently used as a source of potable water. Therefore, the potential for exposure to these constituents in the confined aquifer would be limited and only a low risk to human health and the environment would be expected.

6. POTENTIAL CONTAMINANT MIGRATION PATHWAYS AND RECEPTORS

6.1 Potential Migration Pathways

The results of the Phase I and II RFI investigations indicate the presence of hazardous substances within soils/fills and groundwater samples collected from specific locations within Area ABCE. In addition, the results of the supplemental investigations indicate the presence of hazardous substances in shallow groundwater samples at specific locations within the PVS property.

Based on results of the RFI, inter-media contaminant transfer pathways which may be applicable to the investigation area include:

Release Media	Potential Receiving Media	Transfer Pathways
Soil	Groundwater	Migration through the unsaturated zone
	Subsurface Gas	Migration through the soil/Volatilization
	Surface Water	Overland runoff and mechanical transport of sediments
Groundwater	Surface Water	Groundwater discharge
	Stormwater/Sanitary Sewer Flow	Groundwater infiltration
	Subsurface Gas	Volatilization

The primary contaminant migration pathways identified by the RFI for Area ABCE include:

- Overland runoff and mechanical transport of contaminated soils from Area ABCE with discharge to stormwater drains. However, this potential contaminant pathway is mitigated by surficial conditions at the BCC facility including: flat topography limiting flow velocities, limited areas of bare soil, and significant areas of graveled surfaces, established grass, and impervious surfaces including buildings, paved areas, and closure cover of the former Lagoons area;

- Mechanical erosion of contaminated fill/soils of the Buffalo River bank where exposed along Area A of the BCC facility; and

- Transport of contaminants within shallow groundwater along the network of subsurface utilities (i.e. sewers) located within the interior of Areas ABCE. However, for significant portions of Areas, B, C, and E, the transport of contaminants in groundwater by this mechanism appears to be limited to within the boundaries of these areas and the PVS property. The controlling factor limiting off-site migration of contaminants by this mechanism may be interception by and infiltration to, the BSA sewer lines located along the downgradient perimeters of these areas.

- Lateral flow through the shallow aquifer of contaminants within groundwater with eventual discharge to the Buffalo River. This particular pathway appears most applicable for Area A of the BCC facility. As indicated within the geologic/hydrogeologic findings of the RFI, a significant portion of Area ABCE and the off-site investigation area is underlain by fill and glacial till (Upper Till) of low hydraulic conductivity. Considering the low hydraulic conductivity of these materials, releases of contaminants to the shallow aquifer within these portions of the facility would be expected to be relatively localized and limited in migration from the source, the exception being transport within more permeable bedding and backfill of subsurface structures such as piping and building foundations. In particular, based on evaluation of groundwater chemistry data generated during the RFI, soils of low hydraulic conductivity appear to have limited migration of contaminants to within the downgradient boundaries of Area B, Area C, and Area E.

6.2 Potential Receptors

Potential receptors were initially identified in the Task I Report. Based on the results of the investigations, potential receptors that may be exposed to contaminants from Area ABCE include the following:

6.2.1 Local Uses and Possible Future Uses of Groundwater

The Erie County Health Department (ECHD) reportedly knows of no drinking water wells anywhere within the cities of Buffalo or Lackawanna, or within four miles of the facility in the towns of West Seneca or Cheektowaga. There appears to be no use of the groundwater in or around the facility. The Mobil Oil refinery facility on Elk Street operates a leak prevention system (located approximately 500 ft southeast of the former surface impoundments) and extracts groundwater from the upper aquifer at a rate of 50 gallons per minute (gpm) to 300 gpm (Mobil Oil Corp, 1971) and subsequently discharges this water to the BSA sewer line. The current remedial action being conducted within Area D, located south of Area ABCE, will include an extraction well system for removal of contaminated groundwater from the shallow aquifer underlying Area D.

Based upon review of topographic maps, zoning maps, flood plain maps, and Buffalo River soundings, no other extraction wells appear to be within four miles of the facility. Consequently, the likelihood of ingestion of hazardous constituents determined to be present in groundwater in the shallow and confined aquifer is low.

6.2.2 Local Uses and Possible Future Uses of Surface Waters

As discussed in Section 1.2.2, the Buffalo River is not used as a drinking water source, nor are any firms reportedly known to be using the river as a source of cooling water (BCC Part 373 Application, May 1986). The river is reportedly a Class C stream in the area of the BCC facility. The closest reported downstream surface water intake used for potable water supply is located near the confluence of Lake Erie and the Niagara River. In the past, the Buffalo River was considered to be a generally poor habitat for fish and invertebrates (Makarewicz, 1982), but recent studies have shown that an increasing variety of fish species are living and propagating in the water (Adrian and Merckel, 1989). The ecological resources of the Buffalo River were discussed in detail in the Area

D Risk Assessment (Wehran Engineering, Inc. (Wehran), February 1990) and relevant excerpts of this document are presented in Appendix K.

Surface water samples were not required to be collected as a component of the RFI. BCC currently has two permitted outfalls (Numbers 006 and 011) to the Buffalo River for discharge of non-contact cooling water and stormwater runoff from the site. The discharge of contaminants in storm water runoff from the facility are monitored at these outfalls.

Contaminants in groundwater in the shallow aquifer would discharge to the Buffalo River from Area ABCE, in particular from Area A where constituents exceeding Class GA groundwater standards have been detected in samples from monitoring wells located adjacent to the river. While ultimately shallow groundwater discharges to the Buffalo River also from Areas B, C, and E, some restriction of contaminant migration from these areas to the river appears to be evident based on shallow groundwater potentiometric contours and comparison of groundwater chemistry in Area ABCE with downgradient off-site shallow aquifer wells and piezometers.

The potential acute impacts of the discharge of these constituents to the Buffalo River would be expected to be reduced due to dilution effects and other physical, chemical and biological processes occurring within the Buffalo River system.

Storm water monitoring results were provided in the Task I Summary of Current Conditions Report and have been added to Appendix A. These monitoring results are for Outfalls 006 and 011 which discharge non-contact cooling water and storm water runoff from the facility. The primary constituents detected in the outfalls based on frequency of detection and/or concentration include:

- Outfall 006
  - * Aniline
  - * Cyanide
  - * N,N-Diethylaniline
  - * N,N-Dimethylaniline
  - * N-Ethylaniline
  - * N-Methylaniline
  - * Phenol

- Outfall 011
  - * Aniline
  - * Cyanide
  - * Chlorobenzene
  - * N,N-Diethylaniline
  - * N,N-Dimethylaniline
  - * N-Ethylaniline
  - * N-Methylaniline
  - * Phenol
  - * 1,3-Dichlorobenzene

In wells located near the outfalls, where detected, the groundwater sample concentrations of the specific constituents above were generally greater than the concentrations of the constituents detected in the effluent samples from these outfalls during the 1985-1994 period.

6.2.3 Human Use of or Access to the Facility

Access to the BCC facility is restricted to BCC employees, their subcontractors, and authorized visitors. All visitors must sign in and obtain a visitors badge prior to admittance to the facility. The BCC facility is surrounded by a chain-link fence with locking gates, except for cross streets and railroad track areas. The facility also has a 24-hour uniformed guard security service. The facility and areas adjacent to the facility are not used for recreation or hunting. Exposure of authorized persons or trespassers to contaminated surficial or sub-surface soil by dermal contact or ingestion (during activities such as smoking or eating) could potentially occur in unpaved, dusty areas of the site or during soil excavation/intrusive activities. It would be anticipated that volatilization of organics from surficial soil would likely be limited. Chlorobenzene was the volatile organic compound detected most frequently and at elevated concentrations in the soil samples. Organic vapor monitoring in the breathing zone during drilling and soil sampling activities did not indicate elevated levels of VOCs.

6.2.4 Description of Biota in the Buffalo River

A detailed description of the biota of the Buffalo River is found in Section 4.2 of the Area D Risk Assessment (Wehran, February 1990) and relevant excerpts of this document are presented as Appendix K.

6.2.5 Description of the Facility Ecology

The overlying ecology of the BCC facility can be generalized as industrial with chemical process buildings, asphalt paving, and small patches of grass. There have not been studies of the Area ABCE overlying facility ecology due to its industrial nature. A habitat survey and wetlands delineation adjacent to Area ABCE for Area "D" was performed and has been provided in the "Pre-Final Remedial Design Report, Buffalo Color Corporation, Area "D", (Parsons Engineering Science, October 1995) which was submitted to the NYSDEC by Allied Signal Inc. Excepts from this report regarding this information is provided in Appendix K.

6.2.6 Endangered or Threatened Species Residing Near the Facility

An assessment of ecological resources was performed as part of the Area D Risk Assessment by Wehran-New York, Inc. (February 1990) and a habitat survey and wetland delineation (Parsons Engineering Science, October 1995) was performed as part of the Area D remedial design. In addition, in response to an inquiry by Golder Associates for Area ABCE, the NYSDEC reported in correspondence of October 7, 1997, that the site was not found to contain any known species of special management concern including threatened or endangered status based on Natural Heritage Data Files and Significant Habitat Maps. A copy of this correspondence is provided in Appendix K.

7. SUMMARY AND CONCLUSIONS

7.1 Introduction

BCC has performed a RFI at the facility located at 100 Lee Street in Buffalo, New York in response to the corrective action requirements of RCRA and the Hazardous and Solid Waste Amendments of 1984 (HSWA). The plant, currently owned and operated by BCC, has been in continuous operation as a dyestuffs and organic chemicals manufacturing facility for over 100 years. The RFI was performed to determine the nature and extent of hazardous wastes and/or constituents from solid waste management units (SWMUs) and areas of concern (AOCs) at the facility. The requirement to perform the RFI for the SWMU Area A, B, C, and E (Area ABCE) is specified in Module III E(5)(a) of the Part 373 Post-Closure Permit NYSDEC Identification (ID) Number 9-1402-00076/00-112-0) issued to BCC on February 10, 1995.

The RFI was performed in accordance with the NYSDEC approved RFI Work Plan with modifications noted herein. The RFI was performed in two phases. The initial investigation (Phase I) activities focused on developing a thorough hydrogeologic characterization of the facility (Area ABCE) and emphasized evaluating groundwater quality and potential migration of hazardous constituents at the perimeter of Area ABCE. Also, this initial phase included a groundwater study relative to the closed former surface impoundments (Lagoons 1, 2, and 3) at the facility.

Fourteen (14) shallow aquifer wells, four (4) confined aquifer wells, and five (5) piezometers were installed under Phase I of the RFI with two (2) rounds of sample collection and analyses from the monitoring wells. During the installation of the monitoring wells and piezometers, fifty-four (54) soil samples were collected at various depths for chemical screening analyses and twenty-three (23) soil samples were collected at various depths for confirmatory chemical analyses. In addition, ten (10) soil samples were collected for geotechnical analyses.

The second phase (Phase II) of the project involved obtaining additional data from the interior of the facility to further characterize and evaluate potential release sources, migration pathways, and extent of release(s) through sampling of soil and groundwater for chemical constituents. Twenty-four (24) soil borings were completed which included collection and chemical screening analyses of twenty (20) near-surface soil samples and twelve (12) multiple depth soil samples. Confirmatory chemical analyses were performed on four (4) soil samples as well as four (4) groundwater samples collected from each of the multiple depth borings.

Review of the results of groundwater sampling analytical data and groundwater flow data from completion of the Phase I and Phase II investigation activities indicated that hazardous constituents were detected in groundwater samples collected from monitoring wells located at the perimeter of Area ABCE. Consequently, a supplemental investigation was performed to characterize and evaluate the potential migration and extent of hazardous constituents in groundwater from SWMU Area ABCE to off-site and apparently hydraulically downgradient areas bordering BCC, specifically, the PVS facility and areas along the eastern edge of the site including the BSA sewer and Orlando Street. This included the installation of ten (10) additional shallow aquifer wells. Samples were collected from these wells and also two (2) off-site piezometers. Six (6) additional surficial soil samples were also collected from unpaved areas in Area ABCE. The soil and groundwater samples were analyzed for VOCs, SVOCs, metals, and specific inorganic parameters.

The data and information developed from these investigation activities has been utilized to:

- Characterize the environmental setting for the study area;
- Determine the nature and extent of releases of hazardous waste and constituents from Area ABCE;
- Compare soil and groundwater constituent concentrations to NYSDEC action levels; and
- Identify potential contaminant migration pathways and potential receptors.

The significant findings and conclusions resulting from these investigations are discussed in the following sections.

7.2 Summary of Findings

Based on the RFA report dated April 1991, and Module III E(1) of the Permit, there is no evidence that a release of hazardous waste or hazardous constituents has occurred at the following SWMUs:

- Old Container Storage Area;
- Container Storage Area (Building 324);
- Wastewater Treatment Plant (Buildings 351 and 352); and
- The Deep Well.

Based on the RFA report, dated April 1991, and Module II E(2) of the Permit, it has been determined that there is a potential for the release of hazardous waste and/or hazardous constituents to have occurred from Building 320 (identified as an AOC). This potential release requires the implementation of a RFA sampling visit work plan to address floor sweeping and cleanup materials at least 60 days prior to the demolition of Building 320. Building 320 is currently an inactive production area and is not scheduled for demolition at the present time, and, therefore, no work plans are required at this time.

An inactive feature of the Area ABCE SWMU is the former surface impoundments (Lagoons 1, 2, and 3). During the closure of the surface impoundments, all hazardous wastes and sludge were removed from the impoundment areas. The contaminated soil beneath the surface impoundments remained in place, as noted in Module III (E)(15) of the Permit. Hazardous constituents have been detected in the groundwater downgradient of the closed lagoons at levels exceeding groundwater protection standards, as specified in Module V(C). During the time period necessary to conduct the RFI and potential Corrective Measures Study (CMS) for Module III(e), BCC is required to continue to monitor the groundwater at specific monitoring wells associated with the former lagoons. BCC is also required to monitor two outfalls (Numbers 006 and 011) that discharge storm water/surface water and non-contact cooling water in order to comply with its State Pollutant Discharge Elimination System (SPDES) permit. Additionally, BCC monitors the facility's process effluent discharge to the BSA. This monitoring data was reviewed as part of the RFI.

The investigation of the nature and extent of releases of hazardous constituents from Area ABCE and in the vicinity of the former Lagoons 1, 2, and 3 has been performed as required under Module III(E) of the Permit. The following presents the major findings of these investigations and Table 27 provides a summary of constituents exceeding NYSDEC Class GA groundwater standards/guidance values (which were amended in 1998) and guidance action or cleanup levels for soil. As indicated in Section 5, BCC does not necessarily concur that the referenced guidance levels represent properly determined site specific action levels or clean-up levels.

Soil - Area ABCE

- Hazardous waste constituents including VOCs (chlorobenzene), SVOCs (aniline, carbazole, polyaromatic hydrocarbons, (PAHs), nitrobenzene, 1,2,4 trichlorobenzene), metals (arsenic, cadmium, chromium, copper, iron, manganese, mercury, nickel, selenium) and cyanide have been detected in soil samples at concentrations that exceed typical background concentrations and/or NYSDEC guidance action or cleanup levels in Area ABCE of the BCC facility. No samples of soil exceeded NYSDEC guidance action or cleanup levels for PCBs.

- These constituents were detected primarily in shallow subsoils (0-4 ft. bgs.) and at greater depths in specific sample locations in Area ABCE. Based on the samples collected and analyzed, it also appears that elevated concentrations of these constituents are more prevalent in soils in Area A compared to Areas BCE. This appears to correlate with Area A being the oldest area of chemical usage, production and waste generation activities.

Shallow Aquifer - Area ABCE

- Analyses of groundwater samples from shallow aquifer interior monitoring wells in Area ABCE indicate the presence of hazardous constituents including twelve (12) VOCs, twenty (20) SVOCs, thirteen (13) metals, chloride, cyanide, sulfate, sulfide and pH at concentrations that exceed the NYSDEC Class GA groundwater standards or guidance values. Some exceedances of the NYSDEC levels were also observed in samples from Area ABCE shallow aquifer perimeter wells (located along the Conrail Railroad and Elk Street perimeter of Area ABCE) for chlorobenzene, tetrachloroethene, 1,2,4 trichlorobenzene, metals (chromium, iron, manganese, lead, zinc), chloride, and sulfate. However, in general, samples from the perimeter wells were observed to have less constituents detected and exceedances than samples from the interior wells. No samples of groundwater in any wells exceeded Class GA groundwater standard or guidance values for PCBs or alcohols.

- Storm water monitoring results were provided in the Task I Summary of Current Conditions Report and have been added to Appendix A. These monitoring results are for Outfalls 006 and 011 which discharge non-contact cooling water and storm water runoff from the facility. The primary constituents detected in the outfalls based on frequency of detection and/or concentration include: Outfall 006 (Aniline, Cyanide, N,N-Diethylaniline, N,N-Dimethylaniline, N-Ethylaniline, N-Methylaniline, and Phenol) and Outfall 011 (Aniline, Cyanide, Chlorobenzene, N,N-Diethylaniline, N,N-Dimethylaniline, N-Ethylaniline, N-Methylaniline, Phenol, and 1,3-Dichlorobenzene).

  In wells located near the outfalls, where detected, the groundwater sample concentrations of the specific constituents above were generally greater than the concentrations of the constituents detected in the effluent samples from these outfalls during the 1985-1994 period.

- Considering the results of groundwater analyses from monitoring points RFI-22, RFI-24, and RFI-25, the close proximity of these monitoring points to the Buffalo River, and the groundwater potentiometric surface in this vicinity of the investigation area, it appears that groundwater containing organics, metals and inorganic constituents above Class GA groundwater standards is discharging to the Buffalo River along this boundary of Area A.

- As indicated within the site geologic and hydrogeologic description, a significant portion of Area ABCE and the off-site investigation area is underlain by fill and glacial till (Upper Till) of low hydraulic conductivity. Considering the low hydraulic conductivity of these materials, releases of constituents to the shallow aquifer within these portions of the facility would be expected to be relatively limited in migration from their source, the exception being transport within more permeable bedding and backfill of subsurface structures such as piping and building foundations.

- Transport of contaminants within shallow groundwater along the network of subsurface utilities (i.e. sewers) located within the interior of Areas ABCE is likely occurring. However, for significant portions of Areas B, C, and E, the transport of contaminants in groundwater by this mechanism appears to be limited to within the boundaries of these areas and the PVS property. The controlling factor limiting off-site migration of contaminants by this mechanism may be interception by and infiltration to, the BSA sewer lines located along the downgradient perimeters of these areas.

- Although the alluvium within the investigation area and adjacent to the Buffalo River has been shown to exhibit relatively high hydraulic conductivities, groundwater gradients within these deposits are generally low and could potentially be reversed during elevated river stages. However, a gradient reversal within the alluvium would also be expected to be of short duration considering the hydraulic responsiveness of the alluvium. Given the recorded elevations of groundwater at the upgradient perimeter of Area ABCE and the hydraulic characteristics of the fill and Upper Tills, a gradient reversal beyond the lateral extent of the alluvium at the interior of the investigation area would not appear likely.

- Considering the shallow aquifer potentiometric maps developed for the investigation area, although some transport of constituents may be occurring within groundwater flow along inter-site structures, the ultimate fate of these constituents would be either discharge to the Buffalo River or potentially infiltration to the BSA sewer.

Shallow Aquifer - Off-Site

- Analyses of groundwater samples obtained from off-site monitoring points RFI-34, RFI-35, RFI-36, RFI-37 and RFI-39 do not indicate the presence of organic hazardous constituents or chloride concentrations characteristic of groundwater samples from Area ABCE. These results indicate that hazardous constituents within groundwater from Area ABCE have not adversely impacted the off-site portion of the investigation area in the vicinity of these monitoring points. The combination of soils of low hydraulic conductivity within Area ABCE and portions of the PVS property, the apparent groundwater mounding in the center of the PVS property, and the influence of the BSA sewer appears to have limited migration of hazardous constituents characteristic of Area ABCE to an approximate boundary along Lee Street to its intersection with Prenatt Street and extending east along Prenatt Street to a location beyond monitoring point RFI-36.

- Considering the analyses of groundwater samples obtained from monitoring points RFI-42, RFI-43, RFI-PZ-17 and RFI-41, hazardous constituents characteristic of groundwater from Area E and the former lagoons have not migrated beyond the eastern perimeter of Area ABCE.

- Groundwater samples from RFI-38 exceeded Class GA groundwater standards for chloroform, nitrophenol, naphthalene, eight metals, chloride, sulfate, nitrate/nitrite-nitrogen and pH. Chloroform was not detected in RFI groundwater samples from Area ABCE and only in pre-RFI monitoring well R08 located in Area E. Nitrophenol was not detected in groundwater samples from Area ABCE. Naphthalene was only detected in groundwater samples from Area A and also was not detected in samples from RFI-34 or RFI-28 which are upgradient from RFI-38. Nitrate/nitrite-nitrogen also exceeded the Class GA groundwater standard in RFI-34 samples, but not in any samples from Area ABCE. Low pH values observed in samples from RFI-38 are not characteristic of pH values observed in samples from Area ABCE. In addition, Sanborn Fire Insurance Maps show the presence of former tanks and a nitric acid facility in the general area of RFI-38. Based on these data, the hazardous constituents observed in groundwater at this location would appear to be from a localized source(s) other than groundwater migration from Area ABCE.

- A potential pathway for migration of constituents from Area E to the subsurface at RFI-40 could be exfiltration from or along the backfill of BCC Outfall 011 which is located in relatively close proximity to RFI-40. However, analysis of groundwater samples obtained from RFI-PZ-19 did not indicate the presence of any organic constituents found within Area E or downgradient of the former lagoons. RFI-PZ-19 is located upgradient of RFI-40 and in relatively close proximity to Outfall 011. The groundwater chemistry observed from samples collected at RFI-40 is different than the groundwater chemistry observed in samples collected from monitoring wells downgradient of the former lagoons area located in Area E (refer to Figure 13). Additionally, RFI-40 is located in the general area of a former railroad spur on the PVS property. Consequently, the presence of hazardous constituents observed in groundwater at RFI-40 would appear to be from a localized source(s) other than groundwater migration from Area E and/or the former lagoons area.

- The breach of the BSA sewer sheet piling within Area E does present a conduit for groundwater flow from Area E to the BSA sewer/backfill and the alluvium located downgradient from Area E. However, analysis of groundwater samples obtained from downgradient monitoring point RFI-PZ-19 and RFI-PZ-17, located within the BSA sewer backfill in the flow direction of the sewer, do not indicate the presence of hazardous constituents characteristic of Areas B, C and E or the former lagoons.

- The sulfate concentration range of exceedances in samples from the shallow aquifer off-site wells on the PVS property appears to be higher than that observed in the shallow aquifer wells in Area ABCE.

- The Phase I and Phase II investigations related to the former surface impoundments located on the PVS property performed by other parties indicated that the facility produced acids (sulfuric, nitric, oxalic, muriatic), ammonium thiosulfate, metallic nitrates, and liquid Sulfan. Liquid wastes containing nitric, sulfuric acid, sulfur drainings, metallic nitrate rinses (containing cadmium, copper, nickel, potassium or iron) and other waste streams were reported to have been conveyed to the surface impoundments. The results of these other investigations indicated releases of metals (aluminum, cadmium, calcium, and vanadium) and pH values of 3.0 to 6.25 in the shallow aquifer potentially attributable to the PVS site.

Confined Aquifer - Area ABCE

- A limited number of exceedances of the Class GA groundwater standards were also observed in samples from Area ABCE confined aquifer wells which included VOCs (benzene, chlorobenzene, ethylbenzene, toluene, xylenes), SVOCs (aniline, phenolics, bis(2-ethylhexyl)phthalate,) iron, chloride, sulfate, sulfide and pH.

- The constituents detected in the confined aquifer groundwater samples are constituents reported to be associated with historic operations, materials and wastes at the facility and were also detected in soil and/or shallow aquifer groundwater samples collected from Area ABCE. Benzene, toluene and alkaline pH values were also detected in samples collected from the confined aquifer by previous investigations performed by other parties on the PVS property.

- The presence of these constituents may be associated with potential migration of constituents due to documented historic construction or other penetrations (e.g. borings, caissons, foundations, former deep well etc.) through the glaciolacustrine clay confining layer and the observed downward gradient between the shallow and confined aquifer systems in the study area. Benzene, toluene, ethylbenzene and xylenes may be present due to other potential sources of these constituents including former oil, petroleum and energy operations in Area E and/or offsite sources of petroleum related constituents.

7.3 Conclusions

As a result of completing the RFI activities, review of the investigation data and assessment of these findings, the following conclusions are made:

- Hazardous constituents have been detected in soil/fill and subsoil/fill samples at concentrations that exceed typical background concentrations and/or NYSDEC guidance action or cleanup levels. There is, therefore, a potential for exposure to hazardous constituents in subsoils/fill and surficial soil/fill in Area ABCE through contact, runoff of particles to surface water and leaching of constituents to groundwater in unpaved areas;

- Contaminated groundwater is migrating through the shallow aquifer in Area A and is discharging to the Buffalo River, which is a receptor. Hazardous constituents have been detected in the shallow aquifer beneath Area A at concentrations which exceed Class GA groundwater standards. However, neither the shallow aquifer nor the Buffalo River are used as sources of potable water;

- Hazardous constituents detected in the shallow aquifer in Areas B, C and E are not migrating to any significant extent beyond the southern and eastern boundaries of these Areas;

- Based on differences in groundwater chemistry and considering over 100 years of continuous operations involving the production of dyestuffs, organic chemicals and inorganic acids and the generation of associated wastes within the study area, the constituents exceeding Class GA groundwater standards at RFI-38 and RFI-40 on the PVS property appear to be from localized source(s) other than groundwater migration from either Area ABCE or the former lagoons area. These other sources could include past material storage and handling, material transfer operations (loading/unloading), waste generation or spills associated with these activities; and

- Hazardous constituents have also been detected to a lesser degree in the confined aquifer beneath Area ABCE at concentrations exceeding Class GA groundwater standards. In addition to Area ABCE, the source of benzene, toluene, ethylbenzene, and xylenes may also be upgradient off-site sources. However, the confined aquifer is not used as a source of potable water and potential impacts to human health and the environment would be expected to be limited.

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REFERENCES

Adrian, D. and Merckel, C.N.; 1989; "Update on the Status of the Biota of the Buffalo River, Buffalo, New York." State University College at Buffalo, Aquatic Biology Program.

Buffalo Color Corporation; May 1986; "6 New York Code of Rules and Regulations Part 373 Permit Application," Buffalo, New York.

Buffalo Color Corporation; March 1989; "6 New York Code of Rules and Regulations Part 373 Post-closure Permit Application," Buffalo, New York.

Buffalo Color Corporation, "6NYCRR Part 373 Post Closure Permit (9-1402-00076/00112-0), EPA ID D080335052", effective January 5, 1995.

Buffalo Color Corporation, October 1995, "Area 'D' Site Pre-Final Remedial Design Report, Allied Signal, Parsons Engineering Science, Inc".

Buffalo Color Corporation, "Groundwater Monitoring Reports (NYD080335052)" (Periods ending June 30, 1997; December 31, 1996; June 30, 1996; and May 21-June 23, 1993).

EDR Sanborn, Inc., Sanborn Fire Insurance Maps, 1889, 1900, 1917, 1940, 1950, 1986.

Empire Soils Investigations, Inc.; October 1990; "Hydrologic Investigation, Buffalo Color Corporation," Buffalo, New York.

Engineering Science, Inc., In Association with Dames & Moore, January 1986, "Phase I Investigation Site No. 915004, Allied Chemical Industrial Chemical Division, City of Buffalo".

Engineering Science, Inc., October 1989, "Phase II Investigation Site No. 915004, Allied Chemical Industrial Chemical Division, City of Buffalo".

Fetter, C.W., 1988, "Applied Hydrogeology, 2nd Edition", page 68.

Golder Associates Inc., April 1995, "Report on RCRA Facility Investigation Task I: Description of Current Conditions, Buffalo Color Corporation, Buffalo, New York".

Golder Associates Inc., June 1995, "RCRA Facility Investigation Work Plan, Volumes 1 through 5, Area ABCE, Buffalo Color Corporation, Buffalo, New York".

Makarewicz, J.C., et al.; 1982; "Biological Survey, Buffalo River and Outer Harbor of Buffalo, New York," Volumes 1 and 2; The Research Foundation of the State of New York, State University of New York at Brockport, New York.

Malcolm-Pirnie, Inc.; 1989; "Remedial Investigation Report at the Buffalo Color Corporation Area D," Engineering Report, Buffalo, New York.

Mobil Oil Corporation; May 1971; "Buffalo Drilling Well Point System Engineering Report and Final Plans and Specifications," Buffalo, New York.

National Oceanic and Atmospheric Administration; 1982 and 1993; "Climatological Data Annual Summary," New York Volume 94, United States Department of Commerce, Washington, D.C.

New York State Department of Environmental Conservation, 6NYCRR Parts 700-705, effective September 1, 1991, "Water Quality Regulations for Surface Waters and Groundwaters".

New York State Department of Environmental Conservation, September 1993, "Correspondence to Mr. Gordon G. Bolles, Jr., Technical Manager, Buffalo Color Corporation regarding RCRA Facility Investigation Scope of Work, EPA ID No. 080335052".

New York State Department of Environmental Conservation, October 1993, "Memorandum: Ambient Water Quality Standards and Guidance Values".

New York State Department of Environmental Conservation, January 1994, Revised Technical and Administrative Guidance Memorandum, Determination of Soil Clean-up Objectives and Clean-up Levels (HWR-94-4046).

New York State Department of Environmental Conservation, August 1997, "Technical and Administrative Guidance Memorandum No. 3028, Contained-In Criteria for Environmental Media".

New York State Department of Environmental Conservation, October 1997, "Correspondence from Robert Lichorat, Fish and Wildlife Technician to Mr. Brian Senefelder, Golder Associates Inc.".

New York State Department of Health, Bureau of Environmental Exposure Investigation, October 1996, "Draft Technical Report, Seneca-Babock Neighborhood Soil Sampling Program, Results of December 1994 Sampling".

Remcor, Inc., May 1995, Project No. 94149, "Draft RCRA Facility Investigation Report", Allied Signal Inc., Buffalo Research Laboratory.

Thomsen Associates, February 1987, "Groundwater Quality Evaluation Report, Buffalo Color Corporation".

United States Environmental Protection Agency, May 1989, "RCRA Facility Investigation (RFI) Guidance Volumes I through IV, EPA 530/SW-89-031".

Wehran-New York, Inc.; February 1990; "Risk Assessment for Buffalo Color Area D," Engineering Report, Middletown, New York.

TABLE 4
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
SUMMARY OF PHASE II SOIL AND GROUNDWATER TESTING

BORING ID	SOIL SAMPLE LOCATIONS		WATER SAMPLE
	SCREENING SAMPLES	CONFIRMATORY SAMPLES	
PRB-1M	2' BGS/5' BGS/WT	2' BGS	YES
PRB-2M	2' BGS/5' BGS/WT	2' BGS	YES
PRB-3M	2' BGS/5' BGS/WT	2' BGS	YES
PRB-4M	2' BGS/5' BGS/WT	2' BGS	YES
PRB-5	2' BGS	NONE	NONE
PRB-6	2' BGS	NONE	NONE
PRB-7	2' BGS	NONE	NONE
PRB-8	2' BGS	NONE	NONE
PRB-9	2' BGS	NONE	NONE
PRB-10	2' BGS	NONE	NONE
PRB-11	2' BGS	NONE	NONE
PRB-12	2' BGS	NONE	NONE
PRB-13	2' BGS	NONE	NONE
PRB-14	2' BGS	NONE	NONE
PRB-15	2' BGS	NONE	NONE
PRB-16	2' BGS	NONE	NONE
PRB-17	2' BGS	NONE	NONE
PRB-18	2' BGS	NONE	NONE
PRB-19	2' BGS	NONE	NONE
PRB-20	2' BGS	NONE	NONE
PRB-21	2' BGS	NONE	NONE
PRB-22	2' BGS	NONE	NONE
PRB-23	2' BGS	NONE	NONE
PRB-24	2' BGS	NONE	NONE
TOTAL NUMBER OF SAMPLES	32	4	4

NOTES:
BGS -Below ground surface.
WT -Water table.

TABLE 5
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
ANALYTICAL METHODS
AQUEOUS AND SOIL SAMPLES

AQUEOUS PARAMETER	AQUEOUS METHODOLOGY	SOIL PARAMETER	SOIL METHODOLOGY
Volatile Organics-TCL	SW846 8260	Volatile Organics-TCL and Screening	SW846 8260
Semi-Volatile Organics-TCL+additional	SW846 8270	Semi-Volatile Organics-TCL + additional	SW846 8270
PCBs	SW846 8080	PCBs	SW846 8080
Alcohols	SW846 8015A	Total Cyanide	SW846 9012
Total Cyanide	SW846 9010	Total Metals	SW846*
Total Organic Carbon	SW846 9060	Sieve Analysis	ASTM C-136
Total Metals	SW846*	Particle Size Analysis	ASTM D-421/422
Chromium VI	SW846 7196	Specific Gravity (Soil)	ASTM D-854
Chloride	EPA 325.2	Hydrometer (Finer than 200 Sieve)	ASTM D-1140
Nitrate	EPA 353.2	Soil Classification	ASTM D-2487
Phosphate	EPA 365.1	Atterberg Limits	ASTM D-4318
Sulfate	EPA 375.4	Moisture Content	ASTM D-2216
Sulfide	EPA 376.1		
Carbonate Hardness	EPA 130.2		
Total Dissolved Solids	EPA 160.1		
Specific Conductance (1)	Electrode		
pH (1)	Electrode		
Temperature (1)	Thermometer		

NOTES:

EPA "Methods for Chemical Analysis of Water and Waste", 1979, revised 3/83.

SW846 - Test Method for Evaluating Solid Waste, 3rd Edition, 1990

TCL - CLP Target Compound List, see CLP Statement of Work OLM03.1. Additional SVOC analytes include 1-Naphthylamine, 2-Naphthylamine, Aniline, Benzidine, N,N-Diethylaniline, N,N-Dimethylaniline, N-Ethylaniline, N-Methylaniline, o-Toluidine, and p-Toluidine.

* - Metals analyzed are Aluminum, Antimony, Arsenic, Barium, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Vanadium, and Zinc.

Metal analysis performed using method 6010 except for Mercury (7470/7471).

Hexavalent chromium for soil samples analyzed by NJDEP Modified Method 3060.

(1) Field Measurement

TABLE 13
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE II SOIL SCREENING RESULTS

	Sample Identification and Concentration (mg/kg)										
	PRB1MS2F	PRB1MS5F	PRB1MSWT	PRB2MS2F	PRB2MS5F	PRB2MSWT	PRB3MS2F	PRB3MS5F	PRB3MSWT	PRB4MS2F	PRB4MS5F
Target Compound	AREA A	AREA A	AREA A	AREA A	AREA A	AREA A	AREA A	AREA A	AREA A	AREA E	AREA E
ANILINE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
BENZENE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
CHLOROBENZENE	<DL	<DL	<DL	<DL	<DL	<DL	**15**	**24**	**37**	<DL	<DL
1,2-DICHLOROBENZENE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
N,N-DIMETHYLANILINE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
N-METHYLANILINE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
4-METHYLPHENOL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
NITROBENZENE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PHENOL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
TOLUENE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1,2,4-TRICHLOROBENZENE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Detection Limit (mg/kg)	10	10	10	14	13	15	14	13	14	12	12
Sample Depth (FT BGS)	0 - 2	2 - 6	6 - 10	0 - 2	4 - 6	6 - 8	0 - 4	4 - 6	6 - 8	0 - 4	4 - 6
Geologic Material	SAND FILL	SILT	SILT	SAND FILL	SILTY CLAY FILL	SAND AND SILT FILL	SAND FILL	SAND FILL	SAND FILL	GRAVEL	CLAY

<u>Notes:</u>

<DL = Less than Detection Limit
FT BGS = Feet Below Ground Surface

TABLE 13
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE II SOIL SCREENING RESULTS

	Sample Identification and Concentration (mg/kg)										
	PRB4MSWT	PRB5S2F	PRB6S2F	PRB7S2F	PRB8S2F	PRB9S2F	PRB10S2F	PRB11S2F	PRB12S2F	PRB13S2F	PRB14S2F
Target Compound	AREA E	AREA E	AREA E	AREA E	AREA E	AREA C	AREA C	AREA C	AREA C	AREA B	AREA B
ANILINE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
BENZENE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
CHLOROBENZENE	<DL	<DL	<DL	**18**	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1,2-DICHLOROBENZENE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
N,N-DIMETHYLANILINE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
N-METHYLANILINE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
4-METHYLPHENOL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
NITROBENZENE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PHENOL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
TOLUENE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1,2,4-TRICHLOROBENZENE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Detection Limit (mg/kg)	12	13	13	10	13	11	12	11	11	13	11
Sample Depth (FT BGS)	6 - 8	0 - 2	0 - 2	0 - 2	0 - 4	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2
Geologic Material	CLAY	SAND AND GRAVEL FILL	SAND AND GRAVEL FILL	SAND	SILTY CLAY	SAND AND GRAVEL FILL	GRAVEL, SAND, AND CLAY FILL	GRAVEL FILL	SAND AND GRAVEL FILL	GRAVEL FILL	GRAVEL

Notes:
<DL = Less than Detection Limit
FT BGS = Feet Below Ground Surface

TABLE 13
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE II SOIL SCREENING RESULTS

	Sample Identification and Concentration (mg/kg)									
	PRB15S2F	PRB16S2F	PRB17S2F	PRB18S2F	PRB19S2F	PRB20S2F	PRB21S2F	PRB22S2F	PRB23S2F	PRB24S2F
Target Compound	AREA B	AREA B	AREA B	AREA A	AREA A	AREA A	AREA A	AREA A	AREA A	AREA A
ANILINE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
BENZENE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
CHLOROBENZENE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1,2-DICHLOROBENZENE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
N,N-DIMETHYLANILINE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
N-METHYLANILINE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
4-METHYLPHENOL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
NITROBENZENE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
PHENOL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
TOLUENE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL
1,2,4-TRICHLOROBENZENE	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	110	<DL
Detection Limit (mg/kg)	11	11	11	11	11	11	10	11	11	12
Sample Depth (FT BGS)	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2
Geologic Material	SAND AND GRAVEL FILL	SAND AND GRAVEL FILL	GRAVEL, SAND AND CLAY FILL	GRAVEL FILL	GRAVEL, SAND AND CLAY FILL	SAND AND GRAVEL FILL	NOT AVAILABLE	SAND FILL	SAND FILL	SAND FILL

Notes:

<DL = Less than Detection Limit

FT BGS = Feet Below Ground Surface

TABLE 17
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 1 - JUNE 1996)
SHALLOW AQUIFER
(DETECTIONS ONLY)

Analytes (1)	Sample Identification and Concentration (mg/l) (2)				Range		Groundwater Standards (mg/l)(3)
	RFI22	RFI24	RFI25	RFI26	MIN.	MAX.	
	AREA A	AREA A	AREA A	AREA A			
Volatile Organic Compounds							
BENZENE	0.046	0.014			ND	0.046	0.001
CHLOROBENZENE	0.26		4.6	5.2	ND	5.2	0.005
ETHYLBENZENE	0.1				ND	0.1	0.005
TETRACHLOROETHENE					ND	ND	0.005
TOLUENE	0.0062	0.0065			ND	0.0065	0.005
M+P-XYLENE	0.04				ND	0.04	0.005 each isomer
O-XYLENE	0.033				ND	0.033	0.005
TOTAL CONCENTRATION	0.4852	0.0205	4.6	5.2			
Semi-Volatile Organic Compounds							
ACENAPHTHENE	0.0061	0.02	0.01		ND	0.02	0.02
ANILINE	0.29	2.3	1.6	13	0.29	13	0.005
ANTHRACENE		0.0078			ND	0.0078	0.05*
BUTYL BENZYL PHTHALATE					ND	ND	0.05*
CARBAZOLE		0.022			ND	0.022	0.005 (4)
4-CHLOROANILINE			0.023		ND	0.023	0.005 (4)
2-CHLOROPHENOL			0.01		ND	0.01	0.001
CHRYSENE		0.0051			ND	0.0051	0.000002* / 0.0002 (4)
DIBENZOFURAN	0.0071	0.018			ND	0.018	0.05 (4)
1,2-DICHLOROBENZENE			0.052		ND	0.052	0.003
1,3-DICHLOROBENZENE			0.0058		ND	0.0058	0.003
1,4-DICHLOROBENZENE			0.046		ND	0.046	0.003
N,N-DIETHYLANILINE			0.014		ND	0.014	-
DIETHYLPHTHALATE					ND	ND	0.05*
N,N-DIMETHYLANILINE	0.031	0.088			ND	0.088	0.001
BIS(2-ETHYLHEXYL)PHTHALATE	0.007		0.009		ND	0.009	0.005
FLUORANTHENE		0.015	0.01		ND	0.015	0.05 *
N-METHYLANILINE		0.16			ND	0.16	0.005
NAPHTHALENE	0.087	0.072	0.012		ND	0.087	0.01 *
1-NAPHTHYLAMINE		0.5	0.045		ND	0.5	0.005 (4)
2-NAPHTHYLAMINE		0.073	0.016		ND	0.073	0.005 (4)
NITROBENZENE					ND	ND	0.0004
N-NITROSODIPHENYLAMINE		0.091	0.036		ND	0.091	0.05 *
PHENANTHRENE		0.019			ND	0.019	0.05 *
PYRENE		0.011	0.0061		ND	0.011	0.05 * / 0.0002 (4)
O+P-TOLUIDINE	0.051	0.14	0.034		ND	0.14	0.005 each isomer
1,2,4-TRICHLOROBENZENE					ND	ND	0.005
TOTAL CONCENTRATION	0.4792	3.5419	1.9289	13			

TABLE 17
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 1 - JUNE 1996)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)				Range		Groundwater
Analytes (1)	RFI22	RFI24	RFI25	RFI26	MIN.	MAX.	Standards (mg/l)(3)
Metals	AREA A	AREA A	AREA A	AREA A			
ALUMINUM	45.4	71.2	27.8	6.06	6.06	71.2	-
ARSENIC	0.0638	0.169	0.0828	0.819	0.0638	0.819	0.025
BARIUM	4.66	0.311	0.297	0.216	0.216	4.66	1
CADMIUM	0.103				ND	0.103	0.005
CHROMIUM	0.398	0.147	0.358	0.217	0.147	0.398	0.05
COBALT		0.0682			ND	0.0682	-
COPPER	1.02	0.358	0.126	0.0498	ND	1.02	0.2
IRON	101	225	78.7	20.2	20.2	225	0.3
LEAD	1.27	0.377	0.0799		ND	1.27	0.025
MANGANESE	0.413	2.38	2.3	0.282	0.282	2.38	0.3
MERCURY	0.00306	0.00344		0.00187	ND	0.00344	0.0007
NICKEL	0.197	0.217	0.0765	0.0526	0.0526	0.217	0.1
VANADIUM	0.18	0.182	0.064	0.648	0.064	0.648	0.25 (4)
ZINC	1.85	1.22	0.63	0.2	0.2	1.85	2
TOTAL CONCENTRATION	156.55786	301.63264	110.5142	28.74627			
Inorganics							
CHLORIDE	189	118	238	1050	118	1050	250
TOTAL CYANIDE	0.894	0.103	0.0192	6.56	0.0192	6.56	0.2
TOTAL DISSOLVED SOLIDS	NA	884	NA	NA	NA	884	-
TOTAL HARDNESS	NA	695	NA	NA	NA	695	-
HEXAVALENT CHROMIUM	0.0253	0.0297			ND	0.0297	0.05
NITRATE NITROGEN	0.226		0.354	0.0939	ND	0.354	10
NITRATE/NITRITE NITROGEN	0.226		0.354	0.0939	ND	0.354	10
NITRITE NITROGEN					ND	ND	1
pH	9.3	10.6	8.2	10.8	8.2	10.8	6.5 to 8.5 SU
TOTAL PHOSPHORUS	18.8	9.3	1.6	13	1.6	18.8	-
SULFATE	690	25.9	518	560	25.9	690	250
TOTAL SULFIDE		2.7	5.4	44.8	ND	44.8	0.05 *
PCBs					ND	ND	0.00009
Alcohols					ND	ND	-

TABLE 17
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 1 - JUNE 1996)
SHALLOW AQUIFER
(DETECTIONS ONLY)

Analytes (1)	Sample Idenification and Concentration (mg/l) (2)			Range		Groundwater Standards (mg/l)(3)
	RFI18 AREA B	RFI27 AREA B (Perimeter Well)	RFI28 AREA B	MIN.	MAX.	
Volatile Organic Compounds						
BENZENE			0.0051	ND	0.0051	0.001
CHLOROBENZENE				ND	ND	0.005
ETHYLBENZENE				ND	ND	0.005
TETRACHLOROETHENE		0.18		ND	0.18	0.005
TOLUENE				ND	ND	0.005
M+P-XYLENE				ND	ND	0.005 each isomer
O-XYLENE				ND	ND	0.005
TOTAL CONCENTRATION	0	0.18	0.0051			
Semi-Volatile Organic Compounds						
ACENAPHTHENE		0.006		ND	0.006	0.02
ANILINE	0.0051		0.032	ND	0.032	0.005
ANTHRACENE				ND	ND	0.05*
BUTYL BENZYL PHTHALATE	0.0073			ND	0.0073	0.05*
CARBAZOLE				ND	ND	0.005 (4)
4-CHLOROANILINE				ND	ND	0.005 (4)
2-CHLOROPHENOL				ND	ND	0.001
CHRYSENE				ND	ND	0.000002* / 0.0002 (4)
DIBENZOFURAN				ND	ND	0.05 (4)
1,2-DICHLOROBENZENE				ND	ND	0.003
1,3-DICHLOROBENZENE				ND	ND	0.003
1,4-DICHLOROBENZENE				ND	ND	0.003
N,N-DIETHYLANILINE				ND	ND	-
DIETHYLPHTHALATE				ND	ND	0.05*
N,N-DIMETHYLANILINE				ND	ND	0.001
BIS(2-ETHYLHEXYL)PHTHALATE	0.0066	0.014	0.0081	0.0066	0.014	0.005
FLUORANTHENE		0.016		ND	0.016	0.05 *
N-METHYLANILINE				ND	ND	0.005
NAPHTHALENE				ND	ND	0.01 *
1-NAPHTHYLAMINE			0.03	ND	0.03	0.005 (4)
2-NAPHTHYLAMINE				ND	ND	0.005 (4)
NITROBENZENE	0.014			ND	0.014	0.0004
N-NITROSODIPHENYLAMINE				ND	ND	0.05 *
PHENANTHRENE				ND	ND	0.05 *
PYRENE		0.011		ND	0.011	0.05 * / 0.0002 (4)
O+P-TOLUIDINE			0.018	ND	0.018	0.005 each isomer
1,2,4-TRICHLOROBENZENE				ND	ND	0.005
TOTAL CONCENTRATION	0.033	0.047	0.0881			

TABLE 17
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 1 - JUNE 1996)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Idenification and Concentration (mg/l) (2)			Range		Groundwater
Analytes (1)	RFI18	RFI27	RFI28	MIN.	MAX.	Standards (mg/l)(3)
Metals	AREA B	AREA B (Perimeter Well)	AREA B			
ALUMINUM	8.29	2.56	15.8	2.56	15.8	-
ARSENIC	0.0174		0.0829	ND	0.0829	0.025
BARIUM	0.182	0.119	0.104	0.104	0.182	1
CADMIUM				ND	ND	0.005
CHROMIUM	0.068		0.0481	ND	0.068	0.05
COBALT				ND	ND	-
COPPER	0.0408		0.13	ND	0.13	0.2
IRON	15.1	4.25	25.3	4.25	25.3	0.3
LEAD			0.162	ND	0.162	0.025
MANGANESE	5.95	0.491	0.197	0.197	5.95	0.3
MERCURY			0.000488	ND	0.000488	0.0007
NICKEL	0.113		0.0468	ND	0.113	0.1
VANADIUM			0.0753	ND	0.0753	0.25 (4)
ZINC	0.0782	0.0279	0.2	0.0279	0.2	2
TOTAL CONCENTRATION	29.8394	7.4479	42.146588			
Inorganics						
CHLORIDE	3750	580	1720	580	3750	250
TOTAL CYANIDE			0.0216	ND	0.0216	0.2
TOTAL DISSOLVED SOLIDS	NA	NA	NA	NA	NA	-
TOTAL HARDNESS	NA	NA	NA	NA	NA	-
HEXAVALENT CHROMIUM			0.0422	ND	0.0422	0.05
NITRATE NITROGEN			0.104	ND	0.104	10
NITRATE/NITRITE NITROGEN		0.236	0.12	ND	0.236	10
NITRITE NITROGEN	0. 0222	0.394	0.0162	0.0162	0.394	1
pH	6.8	7.7	8.4	6.8	8.4	6.5 to 8.5 SU
TOTAL PHOSPHORUS	0.473	4.49	2.66	0.473	4.49	-
SULFATE	597	593	1520	593	1520	250
TOTAL SULFIDE				ND	ND	0.05 *
PCBs				ND	ND	0.00009
Alcohols				ND	ND	-

TABLE 17
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 1 - JUNE 1996)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)			Range		Groundwater
Analytes (1)	RFI20	RFI30	RFI31	MIN.	MAX.	Standards (mg/l)(3)
Volatile Organic Compounds	AREA C (Perimeter Well)	AREA C (Perimeter Well)	AREA C			
BENZENE	0.0059		0.012	ND	0.012	0.001
CHLOROBENZENE	0.62		0.45	ND	0.62	0.005
ETHYLBENZENE				ND	ND	0.005
TETRACHLOROETHENE				ND	ND	0.005
TOLUENE				ND	ND	0.005
M+P-XYLENE			0.017	ND	0.017	0.005 each isomer
O-XYLENE			0.0055	ND	0.0055	0.005
TOTAL CONCENTRATION	0.6259	0	0.4845			
Semi-Volatile Organic Compounds						
ACENAPHTHENE				ND	ND	0.02
ANILINE				ND	ND	0.005
ANTHRACENE				ND	ND	0.05*
BUTYL BENZYL PHTHALATE		0.0084	0.0065	ND	0.0084	0.05*
CARBAZOLE				ND	ND	0.005 (4)
4-CHLOROANILINE				ND	ND	0.005 (4)
2-CHLOROPHENOL			0.014	ND	0.014	0.001
CHRYSENE				ND	ND	0.000002* / 0.0002 (4)
DIBENZOFURAN				ND	ND	0.05 (4)
1,2-DICHLOROBENZENE			0.037	ND	0.037	0.003
1,3-DICHLOROBENZENE			0.026	ND	0.026	0.003
1,4-DICHLOROBENZENE			0.035	ND	0.035	0.003
N,N-DIETHYLANILINE				ND	ND	-
DIETHYLPHTHALATE			0.0058	ND	0.0058	0.05*
N,N-DIMETHYLANILINE				ND	ND	0.001
BIS(2-ETHYLHEXYL)PHTHALATE		0.0065	0.012	ND	0.012	0.005
FLUORANTHENE				ND	ND	0.05 *
N-METHYLANILINE				ND	ND	0.005
NAPHTHALENE				ND	ND	0.01 *
1-NAPHTHYLAMINE				ND	ND	0.005 (4)
2-NAPHTHYLAMINE				ND	ND	0.005 (4)
NITROBENZENE				ND	ND	0.0004
N-NITROSODIPHENYLAMINE				ND	ND	0.05 *
PHENANTHRENE				ND	ND	0.05 *
PYRENE				ND	ND	0.05 * / 0.0002 (4)
O+P-TOLUIDINE				ND	ND	0.005 each isomer
1,2,4-TRICHLOROBENZENE	0.077		1.7	ND	1.7	0.005
TOTAL CONCENTRATION	0.077	0.0149	1.8363			

TABLE 17
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 1 - JUNE 1996)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)			Range		Groundwater Standards (mg/l)(3)
Analytes (1)	RFI20	RFI30	RFI31	MIN.	MAX.	
Metals	AREA C (Perimeter Well)	AREA C (Perimeter Well)	AREA C			
ALUMINUM	20.5	6.93	5.56	5.6	20.5	-
ARSENIC	0.0212	0.0189	0.0114	0.0114	0.0212	0.025
BARIUM	0.137	0.0899	0.101	0.0899	0.137	1
CADMIUM				ND	ND	0.005
CHROMIUM	0.0313	0.157	1.2	0.0313	1.2	0.05
COBALT				ND	ND	-
COPPER	0.105	0.0491	0.0342	0.0342	0.105	0.2
IRON	38.5	11.7	15.8	11.7	38.5	0.3
LEAD	0.0729			ND	0.0729	0.025
MANGANESE	2.69	0.95	2.14	0.95	2.69	0.3
MERCURY				ND	ND	0.0007
NICKEL	0.0442	0.155	0.907	0.0442	0.907	0.1
VANADIUM				ND	ND	0.25 (4)
ZINC	0.3	0.433	0.592	0.3	0.592	2
TOTAL CONCENTRATION	62.4016	20.4829	26.3456			
Inorganics						
CHLORIDE	65.4	571	6010	65.4	6010	250
TOTAL CYANIDE				ND	ND	0.2
TOTAL DISSOLVED SOLIDS	3260	NA	NA	NA	3260	-
TOTAL HARDNESS	2350	NA	NA	NA	2350	-
HEXAVALENT CHROMIUM				ND	ND	0.05
NITRATE NITROGEN		0.0509	0.399	ND	0.4	10
NITRATE/NITRITE NITROGEN		0.0509	0.479	ND	0.479	10
NITRITE NITROGEN			0.0798	ND	0.0798	1
pH	7.7	7.3	7.3	7.3	7.7	6.5 to 8.5 SU
TOTAL PHOSPHORUS	0.783	0.771	0.495	0.495	0.783	-
SULFATE	1760	960	1530	960	1760	250
TOTAL SULFIDE	4			ND	4	0.05 *
PCBs				ND	ND	0.00009
Alcohols				ND	ND	-

TABLE 17
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 1 - JUNE 1996)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)				Range		Groundwater
Analytes (1)	RFI17	RFI29	RFI32	RFI33	MIN.	MAX.	Standards (mg/l)(3)
Volatile Organic Compounds	AREA E (Perimeter Well)	AREA E	AREA E	AREA E (Upgradient Well)			
BENZENE					ND	ND	0.001
CHLOROBENZENE		0.035	7.3		ND	7.3	0.005
ETHYLBENZENE					ND	ND	0.005
TETRACHLOROETHENE					ND	ND	0.005
TOLUENE					ND	ND	0.005
M+P-XYLENE					ND	ND	0.005 each isomer
O-XYLENE					ND	ND	0.005
TOTAL CONCENTRATION	0	0.035	7.3	0			
Semi-Volatile Organic Compounds							
ACENAPHTHENE					ND	ND	0.02
ANILINE					ND	ND	0.005
ANTHRACENE					ND	ND	0.05*
BUTYL BENZYL PHTHALATE					ND	ND	0.05*
CARBAZOLE					ND	ND	0.005 (4)
4-CHLOROANILINE					ND	ND	0.005 (4)
2-CHLOROPHENOL			0.041		ND	0.041	0.001
CHRYSENE					ND	ND	0.000002* / 0.0002 (4)
DIBENZOFURAN					ND	ND	0.05 (4)
1,2-DICHLOROBENZENE			0.0055		ND	0.0055	0.003
1,3-DICHLOROBENZENE					ND	ND	0.003
1,4-DICHLOROBENZENE		0.0089	0.014		ND	0.014	0.003
N,N-DIETHYLANILINE					ND	ND	-
DIETHYLPHTHALATE					ND	ND	0.05*
N,N-DIMETHYLANILINE					ND	ND	0.001
BIS(2-ETHYLHEXYL)PHTHALATE	0.0099		0.014		ND	0.014	0.005
FLUORANTHENE				0.0051	ND	0.0051	0.05 *
N-METHYLANILINE					ND	ND	0.005
NAPHTHALENE					ND	ND	0.01 *
1-NAPHTHYLAMINE					ND	ND	0.005 (4)
2-NAPHTHYLAMINE					ND	ND	0.005 (4)
NITROBENZENE					ND	ND	0.0004
N-NITROSODIPHENYLAMINE					ND	ND	0.05 *
PHENANTHRENE					ND	ND	0.05 *
PYRENE					ND	ND	0.05 * / 0.0002 (4)
O+P-TOLUIDINE					ND	ND	0.005 each isomer
1,2,4-TRICHLOROBENZENE					ND	ND	0.005
TOTAL CONCENTRATION	0.0099	0.0089	0.0745	0.0051			

TABLE 17
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 1 - JUNE 1996)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)				Range		Groundwater
Analytes (1)	RFI17	RFI29	RFI32	RFI33	MIN.	MAX.	Standards (mg/l)(3)
Metals	AREA E (Perimeter Well)	AREA E	AREA E	AREA E (Upgradient Well)			
ALUMINUM	18.8	7.65	4.88	26.7	4.88	26.7	-
ARSENIC	0.022	0.0139		0.0175	ND	0.022	0.025
BARIUM	0.17	0.174	0.109	0.331	0.11	0.331	1
CADMIUM					ND	ND	0.005
CHROMIUM	0.0324	0.0166	0.0166	0.42	0.0166	0.42	0.05
COBALT					ND	ND	-
COPPER	0.0392	0.0348		0.222	ND	0.222	0.2
IRON	33.9	13.9	7.64	47.8	7.64	47.8	0.3
LEAD				0.132	ND	0.132	0.025
MANGANESE	0.595	0.386	0.297	1.97	0.297	1.97	0.3
MERCURY				0.000771	ND	0.000771	0.0007
NICKEL	0.0443			0.243	ND	0.243	0.1
VANADIUM				0.0541	ND	0.0541	0.25 (4)
ZINC	0.0892	0.101	0.0419	0.241	0.0419	0.241	2
TOTAL CONCENTRATION	53.6921	22.2763	12.9845	78.131371			
Inorganics							
CHLORIDE	17.9	2380	51	1440	17.9	2380	250
TOTAL CYANIDE					ND	ND	0.2
TOTAL DISSOLVED SOLIDS	NA	NA	838	NA	NA	838	-
TOTAL HARDNESS	NA	NA	762	NA	NA	762	-
HEXAVALENT CHROMIUM			0.0107		ND	0.0107	0.05
NITRATE NITROGEN		0.106		0.106	ND	0.11	10
NITRATE/NITRITE NITROGEN		0.106		0.106	ND	0.106	10
NITRITE NITROGEN					ND	ND	1
pH	7.7	8.4	7.5	7.7	7.5	8.4	6.5 to 8.5 SU
TOTAL PHOSPHORUS	0.771	0.15	0.277	2.18	0.15	2.18	-
SULFATE	301	171	215	375	171	375	250
TOTAL SULFIDE					ND	ND	0.05 *
PCBs					ND	ND	0.00009
Alcohols					ND	ND	-

Notes: (1) Analysis performed in accordance with USEPA Methods identified in Quality Assurance Project Plan (Golder Associates, Inc. 1995).

(2) Detections only reported. Refer to labortory results for detection limits.

(3) Groundwater standards from the NYSDEC's Part 703 "Ambient Water Quality Standards and Guidance Values", for Class GA groundwaters as amended, June 1998.

(4) NYSDEC Contained-In Action Levels, Technical and Administrative Guidance Memorandum No. 3028 (8/26/97).

Perimeter wells located on perimeter of Area ABCE along Conrail Railroad and Elk Street.

pH determined by field measurement
* = Guidance Value
(-) = No standard

NA = Not Analyzed
ND = Not Detected

TABLE 18
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 2 - AUGUST 1996)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)				Range		Groundwater
Analytes (1)	RFI22	RFI24	RFI25	RFI26	MIN.	MAX.	Standards (mg/l)(3)
Volatile Organic Compounds	AREA A	AREA A	AREA A	AREA A			
ACETONE					ND	ND	0.05 *
BENZENE	0.045	0.0097			ND	0.045	0.001
CHLOROBENZENE	0.2		4.3	6	ND	6	0.005
ETHYLBENZENE	0.01				0.01	0.01	0.005
TETRACHLOROETHENE					ND	ND	0.005
TOLUENE		0.0051			ND	0.0051	0.005
M+P-XYLENE	0.049	0.0051			ND	0.049	0.005 each isomer
O-XYLENE	0.037				ND	0.037	0.005
TOTAL CONCENTRATION	0.341	0.0199	4.3	6			
Semi-Volatile Organic Compounds							
ACENAPHTHENE		0.02	0.0092		ND	0.02	0.02
ANILINE	0.057	1.1	0.85	20	ND	20	0.005
BUTYL BENZYL PHTHALATE	0.0088				ND	0.0088	0.05 *
DI-N-BUTYLPHTHALATE	0.0068				ND	0.0068	0.05
CARBAZOLE		0.024			ND	0.024	0.005 (4)
4-CHLOROANILINE			0.016	0.2	ND	0.2	0.005 (4)
2-CHLOROPHENOL			0.014		ND	0.014	0.001
DIBENZOFURAN		0.017			ND	0.017	0.05 (4)
1,2-DICHLOROBENZENE			0.073		ND	0.073	0.003
1,3-DICHLOROBENZENE			0.0079		ND	0.0079	0.003
1,4-DICHLOROBENZENE			0.06		ND	0.06	0.003
N,N-DIETHYLANILINE			0.011		ND	0.011	-
N,N-DIMETHYLANILINE		0.078			ND	0.078	0.001
N-ETHYLANILINE			0.022		ND	0.022	-
BIS(2-ETHYLHEXYL)PHTHALATE					ND	ND	0.005
FLUORENE		0.018			ND	0.018	0.05 *
N-METHYLANILINE		0.083		0.83	ND	0.83	0.005
NAPHTHALENE	0.01	0.087	0.017		ND	0.087	0.01 *
1-NAPHTHYLAMINE		0.7	0.046		ND	0.7	0.005 (4)
2-NAPHTHYLAMINE		0.1	0.018		ND	0.1	0.005 (4)
NITROBENZENE					ND	ND	0.0004
N-NITROSODIPHENYLAMINE		0.12	0.057		ND	0.12	0.05 *
PHENANTHRENE		0.01			ND	0.01	0.05 *
O+P-TOLUIDINE		0.15	0.018	6.2	ND	6.2	0.005 each isomer
1,2,4-TRICHLOROBENZENE					ND	ND	0.005
TOTAL CONCENTRATION	0.0826	2.507	1.2191	27.23			

TABLE 18
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 2 - AUGUST 1996)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)				Range		Groundwater
Analytes (1)	RFI22	RFI24	RFI25	RFI26	MIN.	MAX.	Standards (mg/l)(3)
Metals	AREA A	AREA A	AREA A	AREA A			
ALUMINUM	6.07	17.1	1.96	1.57	1.57	17.1	-
ARSENIC	0.0466	0.0743	0.0359	0.691	0.0359	0.691	0.025
BARIUM	0.285	0.0745	0.182	0.23	0.0745	0.285	1
CADMIUM	0.0182				ND	0.0182	0.005
CHROMIUM	0.112	0.0712	0.0333	0.215	0.0333	0.215	0.05
COPPER	0.149	0.148		0.0395	ND	0.149	0.2
IRON	17.3	46.1	10.5	11.4	10.5	46.1	0.3
LEAD	0.0952	0.139			ND	0.139	0.025
MANGANESE	0.0571	0.478	1.48	0.178	0.0571	1.48	0.3
MERCURY	0.000454	0.000823		0.000667	ND	0.000823	0.0007
NICKEL		0.0664		0.0453	ND	0.0664	0.1
SELENIUM	0.00742	0.0186		0.0103	ND	0.0186	0.01
VANADIUM	0.13	0.0659		0.689	ND	0.689	0.25 (4)
ZINC	0.195	0.486	0.0569	0.0531	0.0531	0.486	2
TOTAL CONCENTRATION	24.465974	64.822723	14.2481	15.121867			
Inorganics							
CHLORIDE	165	147	218	1230	147	1230	250
TOTAL CYANIDE	0.278	0.0438		4.26	ND	4.26	0.2
TOTAL DISSOLVED SOLIDS	NA	877	NA	NA	NA	877	-
TOTAL HARDNESS	NA	141	NA	NA	NA	141	-
HEXAVALENT CHROMIUM					ND	ND	0.05
NITRATE NITROGEN					ND	ND	10
NITRATE NITRITE NITROGEN					ND	ND	10
NITRITE NITROGEN	0.06				ND	0.06	1
pH	9.04	10.2	7.69	10.3	7.69	10.3	6.5 - 8.5 SU
TOTAL PHOSPHORUS	15.6	5.54	0.538	14.8	0.538	15.6	-
SULFATE	426	31.8	374	474	31.8	474	250
TOTAL SULFIDE		9.2	3.1	37.7	ND	37.7	0.05 *
PCBs					ND	ND	0.00009
Alcohols					ND	ND	-

TABLE 18
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 2 - AUGUST 1996)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)			Range		Groundwater Standards (mg/l)(3)
Analytes (1)	RFI18	RFI27	RFI28	**MIN.**	**MAX.**	
Volatile Organic Compounds	AREA B	AREA B (Perimeter Well)	AREA B			
ACETONE	0.12			ND	0.12	0.05 *
BENZENE				ND	ND	0.001
CHLOROBENZENE				ND	ND	0.005
ETHYLBENZENE				ND	ND	0.005
TETRACHLOROETHENE		0.19		ND	0.19	0.005
TOLUENE				ND	ND	0.005
M+P-XYLENE				ND	ND	0.005 each isomer
O-XYLENE				ND	ND	0.005
TOTAL CONCENTRATION	0.12	0.19	0	ND	0.19	
Semi-Volatile Organic Compounds						
ACENAPHTHENE				ND	ND	0.02
ANILINE			0.032	ND	0.032	0.005
BUTYL BENZYL PHTHALATE				ND	ND	0.05 *
DI-N-BUTYLPHTHALATE				ND	ND	0.05
CARBAZOLE				ND	ND	0.005 (4)
4-CHLOROANILINE				ND	ND	0.005 (4)
2-CHLOROPHENOL				ND	ND	0.001
DIBENZOFURAN				ND	ND	0.05 (4)
1,2-DICHLOROBENZENE				ND	ND	0.003
1,3-DICHLOROBENZENE				ND	ND	0.003
1,4-DICHLOROBENZENE				ND	ND	0.003
N,N-DIETHYLANILINE				ND	ND	-
N,N-DIMETHYLANILINE				ND	ND	0.001
N-ETHYLANILINE				ND	ND	-
BIS(2-ETHYLHEXYL)PHTHALATE				ND	ND	0.005
FLUORENE				ND	ND	0.05 *
N-METHYLANILINE				ND	ND	0.005
NAPHTHALENE				ND	ND	0.01 *
1-NAPHTHYLAMINE			0.018	ND	0.018	0.005 (4)
2-NAPHTHYLAMINE				ND	ND	0.005 (4)
NITROBENZENE	0.014			ND	0.014	0.0004
N-NITROSODIPHENYLAMINE				ND	ND	0.05 *
PHENANTHRENE				ND	ND	0.05 *
O+P-TOLUIDINE			0.02	ND	0.02	0.005 each isomer
1,2,4-TRICHLOROBENZENE				ND	ND	0.005
TOTAL CONCENTRATION	0.014	0	0.07			

TABLE 18
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 2 - AUGUST 1996)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)			Range		Groundwater Standards (mg/l)(3)
Analytes (1)	RFI18	RFI27	RFI28	MIN.	MAX.	
Metals	AREA B	AREA B (Perimeter Well)	AREA B			
ALUMINUM	7.39	1.26	5.66	1.26	7.39	-
ARSENIC			0.0869	ND	0.0869	0.025
BARIUM	0.167	0.0949	0.0534	0.0534	0.167	1
CADMIUM				ND	ND	0.005
CHROMIUM	0.0512		0.0494	ND	0.0512	0.05
COPPER	0.0318		0.0524	ND	0.0524	0.2
IRON	12.9	2.5	8.91	2.5	12.9	0.3
LEAD			0.0601	ND	0.0601	0.025
MANGANESE	6.76	0.618	0.103	0.103	6.76	0.3
MERCURY			0.000467	ND	0.000467	0.0007
NICKEL	0.304	0.107	0.0754	0.0754	0.304	0.1
SELENIUM				ND	ND	0.01
VANADIUM			0.0774	ND	0.0774	0.25 (4)
ZINC	0.1	0.063	0.111	0.063	0.111	2
TOTAL CONCENTRATION	27.704	4.6429	15.239467			
Inorganics						
CHLORIDE	3200	539	1720	539	3200	250
TOTAL CYANIDE			0.0351	ND	0.0351	0.2
TOTAL DISSOLVED SOLIDS	NA	NA	NA	NA	NA	-
TOTAL HARDNESS	NA	NA	NA	NA	NA	-
HEXAVALENT CHROMIUM				ND	ND	0.05
NITRATE NITROGEN				ND	ND	10
NITRATE NITRITE NITROGEN				ND	ND	10
NITRITE NITROGEN			0.0379	ND	0.0379	1
PH	6.8	7.73	8.27	6.8	8.27	6.5 - 8.5 SU
TOTAL PHOSPHORUS	0.12	3.16	2.05	0.12	3.16	-
SULFATE	331	216	1000	216	1000	250
TOTAL SULFIDE				ND	ND	0.05 *
PCBs				ND	ND	0.00009
Alcohols				ND	ND	-

TABLE 18
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 2 - AUGUST 1996)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)			Range		Groundwater Standards (mg/l)(3)
Analytes (1)	RFI20	RFI30	RFI31	MIN.	MAX.	
Volatile Organic Compounds	AREA C (Perimeter Well)	AREA C (Perimeter Well)	AREA C			
ACETONE			0.62	ND	0.62	0.05 *
BENZENE				ND	ND	0.001
CHLOROBENZENE	0.76		0.38	ND	0.76	0.005
ETHYLBENZENE				ND	ND	0.005
TETRACHLOROETHENE				ND	ND	0.005
TOLUENE				ND	ND	0.005
M+P-XYLENE				ND	ND	0.005 each isomer
O-XYLENE				ND	ND	0.005
TOTAL CONCENTRATION	0.76	0	1			
Semi-Volatile Organic Compounds						
ACENAPHTHENE				ND	ND	0.02
ANILINE				ND	ND	0.005
BUTYL BENZYL PHTHALATE				ND	ND	0.05 *
DI-N-BUTYLPHTHALATE				ND	ND	0.05
CARBAZOLE				ND	ND	0.005 (4)
4-CHLOROANILINE				ND	ND	0.005 (4)
2-CHLOROPHENOL			0.012	ND	0.012	0.001
DIBENZOFURAN				ND	ND	0.05 (4)
1,2-DICHLOROBENZENE	0.0052		0.018	ND	0.018	0.003
1,3-DICHLOROBENZENE			0.013	ND	0.013	0.003
1,4-DICHLOROBENZENE			0.013	ND	0.013	0.003
N,N-DIETHYLANILINE				ND	ND	-
N,N-DIMETHYLANILINE				ND	ND	0.001
N-ETHYLANILINE				ND	ND	-
BIS(2-ETHYLHEXYL)PHTHALATE	0.011			ND	0.011	0.005
FLUORENE				ND	ND	0.05 *
N-METHYLANILINE				ND	ND	0.005
NAPHTHALENE				ND	ND	0.01 *
1-NAPHTHYLAMINE				ND	ND	0.005 (4)
2-NAPHTHYLAMINE				ND	ND	0.005 (4)
NITROBENZENE				ND	ND	0.0004
N-NITROSODIPHENYLAMINE				ND	ND	0.05 *
PHENANTHRENE				ND	ND	0.05 *
O+P-TOLUIDINE				ND	ND	0.005 each isomer
1,2,4-TRICHLOROBENZENE	0.088		1.3	ND	1.3	0.005
TOTAL CONCENTRATION	**0.1042**	0	**1.356**			

TABLE 18
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 2 - AUGUST 1996)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)			Range		Groundwater
Analytes (1)	RFI20	RFI30	RFI31	MIN.	MAX.	Standards (mg/l)(3)
Metals	AREA C (Perimeter Well)	AREA C (Perimeter Well)	AREA C			
ALUMINUM	25.6	5.96	1.68	1.68	25.6	-
ARSENIC	0.0156			ND	0.0156	0.025
BARIUM	0.171	0.0762	0.0723	0.0723	0.171	1
CADMIUM				ND	ND	0.005
CHROMIUM	0.0546	0.175	0.338	0.0546	0.338	0.05
COPPER	0.133	0.0492	0.0312	0.0312	0.133	0.2
IRON	44.4	9.93	4.8	4.8	44.4	0.3
LEAD	0.0848			ND	0.0848	0.025
MANGANESE	2.86	0.936	1.78	0.936	2.86	0.3
MERCURY	0.000523			ND	0.000523	0.0007
NICKEL	0.126	0.0461	0.282	0.0461	0.282	0.1
SELENIUM	0.00581			ND	0.00581	0.01
VANADIUM	0.0501			ND	0.0501	0.25 (4)
ZINC	0.324	0.29	0.2	0.2	0.324	2
TOTAL CONCENTRATION	73.825433	17.4625	9.1835			
Inorganics						
CHLORIDE	82.8	634	5630	82.8	5630	250
TOTAL CYANIDE				ND	ND	0.2
TOTAL DISSOLVED SOLIDS	3450	NA	NA	NA	3450	-
TOTAL HARDNESS	2350	NA	NA	NA	2350	-
HEXAVALENT CHROMIUM				ND	ND	0.05
NITRATE NITROGEN				ND	ND	10
NITRATE NITRITE NITROGEN				ND	ND	10
NITRITE NITROGEN				ND	ND	1
PH	6.67	7.42	7.9	6.67	7.9	6.5 - 8.5 SU
TOTAL PHOSPHORUS	2.42	0.28	0.54	0.28	2.42	-
SULFATE	1330	605	1130	605	1330	250
TOTAL SULFIDE				ND	ND	0.05 *
PCBs				ND	ND	0.00009
Alcohols				ND	ND	-

TABLE 18
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 2 - AUGUST 1996)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)				Range		Groundwater
Analytes (1)	RFI17	RFI29	RFI32	RFI33	MIN.	MAX.	Standards (mg/l)(3)
Volatile Organic Compounds	AREA E (Perimeter Well)	AREA E	AREA E	AREA E (Perimeter Well)			
ACETONE					ND	ND	0.05 *
BENZENE					ND	ND	0.001
CHLOROBENZENE		0.036	10		ND	10	0.005
ETHYLBENZENE					ND	ND	0.005
TETRACHLOROETHENE					ND	ND	0.005
TOLUENE					ND	ND	0.005
M+P-XYLENE					ND	ND	0.005 each isomer
O-XYLENE					ND	ND	0.005
TOTAL CONCENTRATION	0	0.036	10	0			
Semi-Volatile Organic Compounds							
ACENAPHTHENE					ND	ND	0.02
ANILINE					ND	ND	0.005
BUTYL BENZYL PHTHALATE					ND	ND	0.05 *
DI-N-BUTYLPHTHALATE					ND	ND	0.05
CARBAZOLE					ND	ND	0.005 (4)
4-CHLOROANILINE					ND	ND	0.005 (4)
2-CHLOROPHENOL			0.02		ND	0.02	0.001
DIBENZOFURAN					ND	ND	0.05 (4)
1,2-DICHLOROBENZENE		0.0056	0.0067		ND	0.0067	0.003
1,3-DICHLOROBENZENE					ND	ND	0.003
1,4-DICHLOROBENZENE		0.012	0.017		ND	0.017	0.003
N,N-DIETHYLANILINE					ND	ND	-
N,N-DIMETHYLANILINE					ND	ND	0.001
N-ETHYLANILINE					ND	ND	-
BIS(2-ETHYLHEXYL)PHTHALATE			0.0051		ND	0.0051	0.005
FLUORENE					ND	ND	0.05 *
N-METHYLANILINE					ND	ND	0.005
NAPHTHALENE			0.01		ND	0.01	0.01 *
1-NAPHTHYLAMINE					ND	ND	0.005 (4)
2-NAPHTHYLAMINE					ND	ND	0.005 (4)
NITROBENZENE					ND	ND	0.0004
N-NITROSODIPHENYLAMINE					ND	ND	0.05 *
PHENANTHRENE					ND	ND	0.05 *
O+P-TOLUIDINE					ND	ND	0.005 each isomer
1,2,4-TRICHLOROBENZENE					ND	ND	0.005
TOTAL CONCENTRATION	0	0.0176	0.0588	0			

TABLE 18
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 2 - AUGUST 1996)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)				Range		Groundwater
Analytes (1)	RFI17	RFI29	RFI32	RFI33	MIN.	MAX.	Standards (mg/l)(3)
Metals	AREA E (Perimeter Well)	AREA E	AREA E	AREA E Perimeter Well)			
ALUMINUM	3.72	1.54	1.44	2.07	1.44	3.72	-
ARSENIC		0.0352			ND	0.0352	0.025
BARIUM	0.0769	0.18	0.0718	0.189	0.0718	0.189	1
CADMIUM					ND	ND	0.005
CHROMIUM	0.0213	0.031	0.019	0.383	0.019	0.383	0.05
COPPER				0.0372	ND	0.0372	0.2
IRON	5.6	9.35	2.13	4.73	2.13	9.35	0.3
LEAD					ND	ND	0.025
MANGANESE	0.326	1.42	0.183	1.18	0.183	1.42	0.3
MERCURY					ND	ND	0.0007
NICKEL	0.399		0.095	0.314	ND	0.399	0.1
SELENIUM					ND	ND	0.01
VANADIUM					ND	ND	0.25 (4)
ZINC	0.0523	0.0622	0.0631	0.0746	0.0523	0.0746	2
TOTAL CONCENTRATION	10.1955	12.6184	4.0019	8.9778			
Inorganics							
CHLORIDE	20.7	3090	93.9	1440	20.7	3090	250
TOTAL CYANIDE					ND	ND	0.2
TOTAL DISSOLVED SOLIDS	NA	NA	887	NA	NA	887	-
TOTAL HARDNESS	NA	NA	676	NA	NA	676	-
HEXAVALENT CHROMIUM			0.0181		ND	0.0181	0.05
NITRATE NITROGEN					ND	ND	10
NITRATE NITRITE NITROGEN					ND	ND	10
NITRITE NITROGEN		0.0161	0.0104		ND	0.0161	1
PH	7.86	7.47	7.8	7.13	7.13	7.86	6.5 - 8.5 SU
TOTAL PHOSPHORUS	0.734	0.0684	0.45	1.52	0.0684	1.52	-
SULFATE	168	83.2	101	189	83.2	189	250
TOTAL SULFIDE					ND	ND	0.05 *
PCBs					ND	ND	0.00009
Alcohols					ND	ND	-

<u>Notes</u>:
(1) Analysis performed in accordance with USEPA Methods identified in Quality Assurance Project Plan (Golder Associates, Inc. 1995).
(2) Detections only reported. Refer to labortory results for detection limits.
(3) Groundwater standards from the NYSDEC's Part 703 "Ambient Water Quality Standards and Guidance Values", for Class GA groundwaters as amended, June 1998.
(4) NYSDEC Contained-In Action Levels, Technical and Administrative Guidance Memorandum No. 3028 (8/26/97).
Perimeter wells located on perimeter of Area ABCE along Conrail Railroad and Elk Street.

* = Guidance Value
(-) = No standard
pH determined by field measurement

NA = Not Analyzed
ND = Not Detected

TABLE 19
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
AREA ABCE
SHALLOW AQUIFER
INTERIOR MONITORING WELLS
EXCEEDANCES

	Shallow Aquifer Interior Monitoring Wells			
Analytes	AREA A	AREA B	AREA C	AREA E
Volatile Organic Compounds	RFI-22, RFI-24, RFI-25, RFI-26	RFI-18, RFI-28	RFI-31	RFI-29, RFI-32, RFI-33
BENZENE	X			
CHLOROBENZENE	X		X	X
ETHYLBENZENE	X			
TOLUENE	X			
M+P-XYLENE	X			
O-XYLENE	X			
Semi-Volatile Organic Compounds				
ANILINE	X	X		
BIS(2-ETHYLHEXYL)PHTHALATE				X
CARBAZOLE	X			
4-CHLOROANILINE	X			
2-CHLOROPHENOL			X	X
1,2-DICHLOROBENZENE	X		X	X
1,3-DICHLOROBENZENE	X		X	
1,4-DICHLOROBENZENE	X		X	X
N,N-DIMETHYLANILINE	X			
N-METHYLANILINE	X			
1-NAPHTHYLAMINE	X	X		
2-NAPHTHYLAMINE	X			
NAPHTHALENE	X			
NITROBENZENE		X		
N-NITROSODIPHENYLAMINE	X			
O+P-TOLUIDINE	X	X		
1,2,4-TRICHLOROBENZENE			X	
Metals				
ARSENIC	X	X		
CADMIUM	X			
CHROMIUM	X	X	X	X
IRON	X	X	X	X
LEAD	X	X		
MANGANESE	X	X	X	X
MERCURY	X			
NICKEL		X	X	X
VANADIUM	X			
Inorganics				
CHLORIDE	X	X	X	X
TOTAL CYANIDE	X			
pH	X			
SULFATE	X	X	X	
TOTAL SULFIDE	X			
PCBs				
Alcohols				

X = Exceedance of groundwater standards from the NYSDEC's Part 703 "Ambient Water Quality Standards and Guidance Values", for Class GA groundwaters as amended, June 1998 or NYSDEC Contained-In Action Levels, Technical and Administrative Guidance Memorandum No. 3028 (8/26/97).

TABLE 20
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE II GROUND WATER ANALYTICAL RESULTS
MULTIPLE DEPTH BORINGS
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)				Range		(3) Groundwater Standards (mg/l)
Analytes (1)	PRB1M	PRB2M	PRB3M	PRB4M	MIN.	MAX.	
Volatile Organic Compounds	AREA A	AREA A	AREA A	AREA E			
ACETONE				0.096	ND	0.096	0.05 *
BENZENE	1.5				ND	1.5	0.001
CHLOROBENZENE	1		6.2		ND	6.2	0.005
TOLUENE	0.13			0.029	ND	0.13	0.005
TOTAL CONCENTRATION	2.63	0	6.2	0.125			
Semi-Volatile Organic Compounds							
ANILINE	11		10		ND	11	0.005
1,2-DICHLOROBENZENE		0.51	0.34		ND	0.51	0.003
1,4-DICHLOROBENZENE		0.19	0.081		ND	0.19	0.003
N,N-DIETHYLANILINE			0.52	0.23	ND	0.52	-
2,4-DINITROTOLUENE	27				ND	27	0.005
2,6-DINITROTOLUENE	34				ND	34	0.005
N-ETHYLANILINE			0.38		ND	0.38	-
FLUORANTHENE			0.057		ND	0.057	0.05 *
3-NITROANILINE	0.94				ND	0.94	0.005
N-NITROSODIPHENYLAMINE		0.15			ND	0.15	0.05 *
O+P-TOLUIDINE	64				ND	64	0.005 each isomer
TOTAL CONCENTRATION	136.94	0.85	11.378	0.23			
Metals							
ALUMINUM	32.9	87.8	44.3	756	32.9	756	-
ARSENIC	0.938	3.61	1.63	0.816	0.816	3.61	0.025
BARIUM	1.6	1.91	2.5	4.99	1.6	4.99	1
CADMIUM	0.0146	0.0378	0.244		ND	0.244	0.005
CHROMIUM	0.37	1.66	0.565	1.93	0.37	1.93	0.05
COBALT		0.603		0.48	ND	0.603	-
COPPER	2.9	11	5.6	5.29	2.9	11	0.2
IRON	285	5290	209	1880	209	5290	0.3
LEAD	10.1	10.1	5.52	2.51	2.51	10.1	0.025
MANGANESE	5.87	63.5	0.922	81.1	0.922	81.1	0.3
MERCURY	0.00538	0.129	0.0784	0.00155	ND	0.129	0.0007
NICKEL	0.218	1.74	0.202	1.57	0.202	1.74	0.1
SELENIUM	0.167	2.73	0.117	1.02	0.117	2.73	0.01
SILVER	0.0117	0.0465	0.0141	0.016	0.0117	0.0465	0.05
VANADIUM	0.369	1.76	0.173	1.8	0.173	1.8	0.25 (4)
ZINC	15.9	36.9	50.4	26.8	15.9	50.4	2
TOTAL CONCENTRATION	356.36368	5513.5263	321.2655	2764.32355			

TABLE 20
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE II GROUND WATER ANALYTICAL RESULTS
MULTIPLE DEPTH BORINGS
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)				Range		(3) Groundwater Standards (mg/l)
Analytes (1)	PRB1M	PRB2M	PRB3M	PRB4M	MIN.	MAX.	
Inorganics	AREA A	AREA A	AREA A	AREA E			
CHLORIDE	274	218	115	44.1	44.1	274	250
TOTAL CYANIDE	0.0126		0.277		ND	0.277	0.2
NITRATE NITROGEN	0.619				ND	0.619	10
NITRATE/NITRITE NITROGEN	0.649				ND	0.649	10
NITRITE NITROGEN	0.0301	0.039	0.0536	0.119	0.0301	0.119	1
PH	5.7	8.01	11.7	10.8	5.7	11.7	6.5 to 8.5 SU
TOTAL PHOSPHORUS	5.03	0.66	6.53	1.93	0.66	6.53	-
SULFATE	1220	1410	37.3	43.7	37.3	1410	250
TOTAL SULFIDE	2.1	92.8	26.7	5.2	2.1	92.8	0.05 *
PCBs					ND	ND	0.00009
Alcohols					ND	ND	-

Notes: (1) Analysis performed in accordance with USEPA Methods identified in Quality Assurance Project Plan (Golder Associates, Inc. 1995).

(2) Detections only reported. Refer to labortory results for detection limits.

(3) Groundwater standards from the NYSDEC's Part 703 "Ambient Water Quality Standards and Guidance Values", for Class GA groundwaters as amended, June 1998.

(4) NYSDEC Contained-In Action Levels, Technical and Administrative Guidance Memorandum No. 3028 (8/26/97). Unfiltered groundwater samples collected directly from boreholes.

* = Guidance Value
(-) = No standard
pH determined by field measurement
ND = Not Detected

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BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
FORMER LAGOONS GROUNDWATER MONITORING WELLS
ANALYTICAL RESULTS
(DETECTIONS ONLY)

	Concentration Ranges (mg/l) (1)(2)								Groundwater Standards (mg/l)(3)
Analytes	Shallow Aquifer Downgradient Wells		Shallow Aquifer Upgradient Well R15		Confined Aquifer Downgradient Wells		Confined Aquifer Upgradient Well R07		
Volatile Organic Compounds	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
ACETONE	ND	0.083	ND	0.023	ND	0.046	ND	0.01	0.05 *
BENZENE	ND	0.003	ND	0.005	ND	0.007	ND	ND	0.001
CHLOROBENZENE	ND	0.33	ND	ND	ND	ND	ND	ND	0.005
CHLOROFORM	ND	1.1	NA	NA	NA	NA	NA	NA	0.007
ETHYLBENZENE	ND	0.01	ND	0.012	ND	0.018	ND	ND	0.005
METHYLENE CHLORIDE	ND	0.047	ND	ND	ND	0.0021	ND	ND	0.005
TOLUENE	ND	0.036	ND	0.05	ND	0.077	ND	ND	0.005
XYLENES	ND	0.059	ND	0.068	ND	0.13	0.001	0.005	0.005 each isomer
1,1-DICHLOROETHANE	ND	0.31	NA	NA	NA	NA	NA	NA	0.005
1,1-DICHLOROETHENE	ND	0.005	ND	ND	ND	ND	ND	ND	0.005
1,1,1-TRICHLOROETHANE	ND	0.111	NA	NA	NA	NA	NA	NA	0.005
Semi-Volatile Organic Compounds									
ANILINE	ND	3.2	ND	ND	ND	ND	ND	ND	0.005
4-CHLOROANILINE	ND	0.0083	ND	ND	ND	ND	ND	ND	0.005
1,2-DICHLOROBENZENE	ND	0.18	ND	ND	ND	ND	ND	ND	0.003
N-ETHYLANILINE	ND	0.38	ND	ND	ND	ND	ND	ND	-
N,N-DIETHYLANILINE	ND	0.83	ND	ND	ND	ND	ND	ND	-
N,N-DIMETHYLANILINE	ND	3.4	ND	ND	ND	ND	ND	ND	0.001
IS(2-ETHYLHEXYL)PHTHALATE	ND	0.55	ND	0.0034	ND	0.089	0.018	0.13	0.005
DI -N-OCTYLPHTHALATE	ND	0.0032	ND	ND	ND	ND	ND	ND	0.05 *
N-METHYLANILINE	ND	1.3	ND	ND	ND	ND	ND	ND	0.005
2-METHYLNAPHTHALENE	ND	0.0042	ND	ND	ND	ND	ND	ND	0.05 (4)
1-NAPHTHYLAMINE	ND	0.016	ND	ND	ND	ND	ND	ND	0.005 (4)
O+P-TOLUIDINE	ND	0.018	ND	ND	ND	ND	ND	ND	0.005 each isomer
PHENOLICS	ND	0.019	0.0078	0.011	0.0046	0.0162	0.0064	0.0064	0.001
Metals									
IRON	7	140	51	140	NA	NA	NA	NA	0.3
MANGANESE	0.43	4	1.2	4	NA	NA	NA	NA	0.3
SODIUM	48	320	170	190	NA	NA	NA	NA	20
Inorganics									
CHLORIDE	2.9	592	458	703	5.6	85.6	7.5	7.5	250
pH	7.34	8.98	7.13	7.16	8.52	8.9	10.12	10.12	6.5 - 8.5
SULFATE	21.8	327	25.1	39	6.1	286	9.5	9.5	250

(1) Downgradient Shallow Aquifer Wells (R08, R09,R11,R13,R14).
Downgradient Confined Aquifer Wells (R02, R03,R04, R06,R12)

(2) Data from Buffalo Color Corporation. Sampling events May 15-17, 1996, October 17, 1996 and May 13-14, 1997, except for R08. Data for R08 is from BCC monitoring May 21 and June 23, 1993. R08 is not required to be monitored for chemical constituents as per the Post Closure Permit. Upgradient and downgradient designation is relative to former lagoons area as reported by Buffalo Color Corporation.

(3) Groundwater standards 6NYCRR Part 703 as amended in NYSDEC's Memorandum "Ambient Water Quality Standards and Guidance Values", dated June 1998.

(4) NYSDEC Contained-In Action Levels, Technical and Administrative Guidance Memorandum No. 3028 (8/26/97).

* = Guidance Value
ND = Not detected.
NA = Not analyzed during these events.
\- = No standard or guidance value.

TABLE 22
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
SUPPLEMENTAL INVESTIGATION
GROUNDWATER ANALYTICAL RESULTS
(ROUND 1 - JUNE 1997)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)										Range		Groundwater Standards (mg/l)(3)
Analytes (1)	RFI-24	RFI24SOL	RFI-25	RFI25SOL	RFI-34	RFI-35	RFI-36	RFI-37	RFI-38	RFI38SOL	MIN.	MAX.	
Volatile Organic Compounds													
BENZENE	NA	NA	NA	NA					0.037	NA	ND	0.037	0.001
CHLOROBENZENE	NA	NA	NA	NA						NA	ND	ND	0.005
ETHYLBENZENE	NA	NA	NA	NA					0.015	NA	ND	0.015	0.005
TETRACHLOROETHENE	NA	NA	NA	NA						NA	ND	ND	0.005
TOLUENE	NA	NA	NA	NA					0.026	NA	ND	0.026	0.005
M+P-XYLENE	NA	NA	NA	NA					0.032	NA	ND	0.032	0.005 each isomer
O-XYLENE	NA	NA	NA	NA					0.015	NA	ND	0.015	0.005
ACETONE	NA	NA	NA	NA	0.027					NA	ND	0.027	0.005
BROMOMETHANE	NA	NA	NA	NA	0.0073					NA	ND	0.0073	0.005 *
CHLOROMETHANE	NA	NA	NA	NA	0.0077					NA	ND	0.0077	-
CHLOROFORM	NA	NA	NA	NA					0.099	NA	ND	0.099	0.007
TOTAL CONCENTRATION	0	0	0	0	0.042	0	0	0	0.224	0			
Semi-Volatile Organic Compounds													
ACENAPHTHENE	NA	NA	NA	NA						NA	ND	ND	0.02
ANILINE	NA	NA	NA	NA						NA	ND	ND	0.005
ANTHRACENE	NA	NA	NA	NA						NA	ND	ND	0.05 *
BUTYL BENZYL PHTHALATE	NA	NA	NA	NA						NA	ND	ND	0.05 *
CARBAZOLE	NA	NA	NA	NA						NA	ND	ND	0.005 (4)
4-CHLOROANILINE	NA	NA	NA	NA						NA	ND	ND	0.005 (4)
2-CHLOROPHENOL	NA	NA	NA	NA						NA	ND	ND	0.001
CHRYSENE	NA	NA	NA	NA						NA	ND	ND	0.000002 * / 0.0002 (4)
DIBENZOFURAN	NA	NA	NA	NA						NA	ND	ND	0.05 (4)
1,2-DICHLOROBENZENE	NA	NA	NA	NA						NA	ND	ND	0.003
1,3-DICHLOROBENZENE	NA	NA	NA	NA						NA	ND	ND	0.003
1,4-DICHLOROBENZENE	NA	NA	NA	NA						NA	ND	ND	0.003
N,N-DIETHYLANILINE	NA	NA	NA	NA						NA	ND	ND	-
DIETHYLPHTHALATE	NA	NA	NA	NA						NA	ND	ND	0.05 *
N,N-DIMETHYLANILINE	NA	NA	NA	NA						NA	ND	ND	0.001
BIS(2-ETHYLHEXYL)PHTHALATE	NA	NA	NA	NA	0.012	0.012	0.0054	0.0081		NA	ND	0.012	0.005
FLUORANTHENE	NA	NA	NA	NA						NA	ND	ND	0.05 *
N-METHYLANILINE	NA	NA	NA	NA						NA	ND	ND	0.005
NAPHTHALENE	NA	NA	NA	NA					1.1	NA	ND	1.1	0.01 *
1-NAPHTHYLAMINE	NA	NA	NA	NA						NA	ND	ND	0.005 (4)
2-NAPHTHYLAMINE	NA	NA	NA	NA						NA	ND	ND	0.005 (4)

TABLE 22
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
SUPPLEMENTAL INVESTIGATION
GROUNDWATER ANALYTICAL RESULTS
(ROUND 1 - JUNE 1997)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)										Range		Groundwater
Analytes (1)	RFI-24	RFI24SOL	RFI-25	RFI25SOL	RFI-34	RFI-35	RFI-36	RFI-37	RFI-38	RFI38SOL	MIN.	MAX.	Standards (mg/l)(3)
NITROBENZENE	NA	NA	NA	NA						NA	ND	ND	0.0004
N-NITROSODIMETHYLAMINE	NA	NA	NA	NA	0.0056					NA	ND	0.0056	0.05 (4)
N-NITROSODIPHENYLAMINE	NA	NA	NA	NA						NA	ND	ND	0.05 *
PHENANTHRENE	NA	NA	NA	NA						NA	ND	ND	0.05 *
PYRENE	NA	NA	NA	NA						NA	ND	ND	0.05 *
O+P-TOLUIDINE	NA	NA	NA	NA						NA	ND	ND	0.005 each isomer
1,2,4-TRICHLOROBENZENE	NA	NA	NA	NA						NA	ND	ND	0.005
HEXACHLOROETHANE	NA	NA	NA	NA					0.019	NA	ND	0.019	0.005
2-METHYLNAPHTHALENE	NA	NA	NA	NA					0.74	NA	ND	0.74	-
2-NITROPHENOL	NA	NA	NA	NA					0.016	NA	ND	0.016	0.001
TOTAL CONCENTRATION	0	0	0	0	0.0176	0.012	0.0054	0.0081	1.875	0			
Metals													
ALUMINUM	2.36	0.773	0.228		14.1	4.45	1.07	17.8	95.1	58.5	ND	95.1	-
ARSENIC	0.0388	0.0313	0.049	0.046	0.0257		0.0181	0.028	0.0408	0.0199	ND	0.049	0.025
BARIUM			0.114	0.116	0.19	0.0784	0.0304	0.236	0.477		ND	0.477	1
CADMIUM									0.0136	0.012	ND	0.0136	0.005
CHROMIUM	0.0225	0.0211			0.0208			0.0215	0.0557	0.012	ND	0.0557	0.05
COBALT									0.168	0.148	ND	0.168	-
COPPER	0.0442	0.0373			0.0946			0.0503	0.324	0.192	ND	0.324	0.2
IRON	5.92	1.66	7.64	2.3	32.3	5.14	26.9	28.2	90	56.4	1.66	90	0.3
LEAD									0.289		ND	0.289	0.025
MANGANESE	0.0522	0.0146	1.18	1.24	2.18	0.918	1.16	1.33	9.6	9.16	0.0146	9.6	0.3
MERCURY									0.00074		ND	0.000743	0.0007
NICKEL					0.0561				0.423	0.381	ND	0.423	0.1
VANADIUM											ND	ND	0.25 (4)
ZINC	0.203	0.157	0.0174		0.338		0.0531	0.0918	2.68	2.54	ND	2.68	2
SELENIUM											ND	ND	0.01
SILVER									0.0483	0.0138	ND	0.0483	0.05
TOTAL CONCENTRATION	8.6407	2.6943	9.2284	3.702	49.3052	10.5864	29.2316	47.7576	199.2201	127.3787			

TABLE 22
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
SUPPLEMENTAL INVESTIGATION
GROUNDWATER ANALYTICAL RESULTS
(ROUND 1 - JUNE 1997)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)										**Range**		**Groundwater**
Analytes (1)	RFI-24	RFI24SOL	RFI-25	RFI25SOL	RFI-34	RFI-35	RFI-36	RFI-37	RFI-38	RFI38SOL	MIN.	MAX.	**Standards (mg/l)(3)**
Inorganics													
CHLORIDE	NA	NA	NA	NA	112	231	9.46	149	259	NA	9.46	259	250
TOTAL CYANIDE	NA	NA	NA	NA					0.0346	NA	ND	0.0346	0.2
TOTAL DISSOLVED SOLIDS	NA	NA	NA	NA					4260	NA	ND	4260	-
TOTAL HARDNESS	NA	NA	NA	NA					2200	NA	ND	2200	-
HEXAVALENT CHROMIUM	NA	NA	NA	NA						NA	ND	ND	0.05
NITRATE NITROGEN	NA	NA	NA	NA		0.133			37.8	NA	0.133	37.8	10
NITRATE/NITRITE NITROGEN	NA	NA	NA	NA	91.7	0.133			37.8	NA	0.133	91.7	10
NITRITE NITROGEN	NA	NA	NA	NA	93.6					NA	ND	93.6	1
pH	NA	NA	NA	NA	7	6.8	6.8	7.4	3.8	NA	3.8	7.4	6.5 to 8.5 SU
TOTAL PHOSPHORUS	NA	NA	NA	NA	0.536	0.243	0.0778	2.32	1.52	NA	0.0778	2.32	-
SULFATE	NA	NA	NA	NA	610	2510	1690	1120	4260	NA	610	4260	250
TOTAL SULFIDE	NA	NA	NA	NA						NA	ND	ND	0.05 *
PCBs	NA	NA	NA	NA						NA	ND	ND	0.00009
Alcohols	NA	NA	NA	NA						NA	ND	ND	-

TABLE 22
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
SUPPLEMENTAL INVESTIGATION
GROUNDWATER ANALYTICAL RESULTS
(ROUND 1 - JUNE 1997)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)									Range		Groundwater
Analytes (1)	RFI-39	RFI39SOL	RFI-40	RFI40SOL	RFI-41	RFI-42	RFI-43	PZ-17	PZ-19	MIN.	MAX.	Standards (mg/l)(3)
Volatile Organic Compounds												
BENZENE		NA		NA						ND	ND	0.001
CHLOROBENZENE		NA	3.5	NA						ND	3.5	0.005
ETHYLBENZENE		NA		NA						ND	ND	0.005
TETRACHLOROETHENE		NA		NA						ND	ND	0.005
TOLUENE		NA		NA						ND	ND	0.005
M+P-XYLENE		NA		NA						ND	ND	0.005 each isomer
O-XYLENE		NA		NA						ND	ND	0.005
ACETONE		NA	0.29	NA						ND	0.29	0.005
BROMOMETHNE		NA		NA						ND	ND	0.005 *
CHLOROMETHANE		NA		NA						ND	ND	-
CHLOROFORM		NA		NA						ND	ND	0.007
TOTAL CONCENTRATION	0	0	3.79	0	0	0	0	0	0			
Semi-Volatile Organic Compounds												
ACENAPHTHENE		NA		NA						ND	ND	0.02
ANILINE		NA	0.02	NA						ND	0.02	0.005
ANTHRACENE		NA		NA						ND	ND	0.05 *
BUTYL BENZYL PHTHALATE		NA		NA		0.0058				ND	0.0058	0.05 *
CARBAZOLE		NA		NA						ND	ND	0.005 (4)
4-CHLOROANILINE		NA		NA						ND	ND	0.005 (4)
2-CHLOROPHENOL		NA		NA						ND	ND	0.001
CHRYSENE		NA		NA						ND	ND	0.000002 * / 0.0002 (4)
DIBENZOFURAN		NA		NA						ND	ND	0.05 (4)
1,2-DICHLOROBENZENE		NA	8	NA						ND	8	0.003
1,3-DICHLOROBENZENE		NA	0.063	NA						ND	0.063	0.003
1,4-DICHLOROBENZENE		NA	0.3	NA						ND	0.3	0.003
N,N-DIETHYLANILINE		NA	0.01	NA						ND	0.01	-
DIETHYLPHTHALATE		NA		NA						ND	ND	0.05 *
N,N-DIMETHYLANILINE		NA		NA						ND	ND	0.001
BIS(2-ETHYLHEXYL)PHTHALATE		NA		NA	0.0064	0.0059	0.079	0.0074		ND	0.079	0.005
FLUORANTHENE		NA		NA						ND	ND	0.05 *
N-METHYLANILINE		NA		NA						ND	ND	0.005
NAPHTHALENE		NA		NA						ND	ND	0.01 *
1-NAPHTHYLAMINE		NA		NA						ND	ND	0.005 (4)
2-NAPHTHYLAMINE		NA		NA						ND	ND	0.005 (4)

TABLE 22
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
SUPPLEMENTAL INVESTIGATION
GROUNDWATER ANALYTICAL RESULTS
(ROUND 1 - JUNE 1997)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)									Range		Groundwater Standards (mg/l)(3)
Analytes (1)	RFI-39	RFI39SOL	RFI-40	RFI40SOL	RFI-41	RFI-42	RFI-43	PZ-17	PZ-19	MIN.	MAX.	
NITROBENZENE		NA		NA						ND	ND	0.0004
N-NITROSODIMETHYLAMINE		NA		NA						ND	ND	0.05 (4)
N-NITROSODIPHENYLAMINE		NA		NA						ND	ND	0.05 *
PHENANTHRENE		NA		NA						ND	ND	0.05 *
PYRENE		NA		NA						ND	ND	0.05 *
O+P-TOLUIDINE		NA		NA						ND	ND	0.005 each isomer
1,2,4-TRICHLOROBENZENE		NA	**0.18**	NA						ND	0.18	0.005
HEXACHLOROETHANE		NA		NA						ND	ND	0.005
2-METHYLNAPHTHALENE		NA		NA						ND	ND	0.05 (4)
2-NITROPHENOL		NA		NA						ND	ND	0.001
TOTAL CONCENTRATION	0	0	8.573	0	0.0064	0.0117	0.079	0.0074	0			
Metals												
ALUMINUM	19.3	0.13	7.84		79.9	2.38	1.44	6.13	13.1	ND	79.9	-
ARSENIC	**0.0708**	0.0149	**0.0279**	0.0177	**0.0546**		0.0114	0.0171	0.0197	ND	0.0708	0.025
BARIUM	0.147		0.0887	0.0387	0.414	0.138	0.0307	0.272	0.181	ND	0.414	1
CADMIUM	**0.00562**				**0.0192**				**0.0491**	ND	0.0491	0.005
CHROMIUM	0.0344		0.0127		**0.0941**					ND	0.0941	0.05
COBALT					0.0753					ND	0.0753	-
COPPER	**0.269**		0.0328		0.0758					ND	0.269	0.2
IRON	**28.4**		**116**	**107**	**550**	**2.84**	**1.74**	**13**	**1060**	ND	1060	0.3
LEAD	**0.45**				**0.0829**					ND	0.45	0.025
MANGANESE	**2**	**0.394**	**3.2**	**3.14**	**14**	0.136	**2.98**	**0.43**	**21.9**	0.136	21.9	0.3
MERCURY	**0.00344**	0.000419								ND	0.00344	0.0007
NICKEL	0.0512				**0.182**					ND	0.182	0.1
VANADIUM					0.0807					ND	0.0807	0.25 (4)
ZINC	0.961		0.188	0.0426	0.496	0.0462	0.0227	0.0525	0.0226	ND	0.961	2
SELENIUM					0.0072					ND	0.0072	0.01
SILVER					0.0228				0.0306	ND	0.0306	0.05
TOTAL CONCENTRATION	51.69246	0.539319	127.3901	110.239	645.5046	5.5402	6.2248	19.9016	1095.303			

TABLE 22
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
SUPPLEMENTAL INVESTIGATION
GROUNDWATER ANALYTICAL RESULTS
(ROUND 1 - JUNE 1997)
SHALLOW AQUIFER
(DETECTIONS ONLY)

Analytes (1)	Sample Identification and Concentration (mg/l) (2)									Range		Groundwater Standards (mg/l)(3)
	RFI-39	RFI39SOL	RFI-40	RFI40SOL	RFI-41	RFI-42	RFI-43	PZ-17	PZ-19	MIN.	MAX.	
Inorganics												
CHLORIDE	238	NA	266	NA	322	328	12.1	11	22.8	11	328	250
TOTAL CYANIDE		NA		NA						ND	ND	0.2
TOTAL DISSOLVED SOLIDS	9060	NA	3380	NA						3380	9060	-
TOTAL HARDNESS	1340	NA	1660	NA						1340	1660	-
HEXAVALENT CHROMIUM		NA		NA						ND	ND	0.05
NITRATE NITROGEN	0.0528	NA		NA		3.13				ND	3.13	10
NITRATE/NITRITE NITROGEN	0.0528	NA		NA		3.13				ND	3.13	10
NITRITE NITROGEN		NA		NA					0.0776	ND	0.0776	1
pH	9	NA	6.5	NA	6	6.9	6.9	6.9	6.3	6	9	6.5 to 8.5 SU
TOTAL PHOSPHORUS	0.51	NA	0.281	NA	0.55	0.179	0.172	1.01	2.22	0.172	2.22	-
SULFATE	8220	NA	2090	NA	3490	62.3	1310	200	4550	62.3	8220	250
TOTAL SULFIDE	10.1	NA		NA						ND	10.1	0.05 *
PCBs		NA		NA						ND	ND	0.00009
Alcohols		NA		NA						ND	ND	-

Notes: (1) Analysis performed in accordance with USEPA Methods identified in Quality Assurance Project Plan (Golder Associates, Inc. 1995).

(2) Detections only reported. Refer to laboratory results for detection limits.

(3) Groundwater standards from the NYSDEC's 6NYCRR Part 703 "Ambient Water Quality Standards and Guidance Values", for Class GA groundwaters as amended, June 1998.
NYSDEC Action Levels, Table 1 Groundwater and Soils; Correspondence to Buffalo Color Corporation from NYSDEC, September 10, 1993.

(4) NYSDEC Contained-In Action Levels, Technical and Administrative Guidance Memorandum No. 3028 (8/26/97).

SOL = Filtered Sample
* = Guidance Value
(-) = No standard
pH determined by field measurement.
NA = Not Analyzed
ND = Not Detected

TABLE 23
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
SUPPLEMENTAL INVESTIGATION
GROUNDWATER ANALYTICAL RESULTS
(ROUND 2 - JULY 1997)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)										Range		Groundwater Standards (mg/l)(3)
Analytes(1)	RFI-24	RFI24SOL	RFI-25	RFI25SOL	RFI-34	RFI-35	RFI-36	RFI-37	RFI-38	RFI38SOL	MIN.	MAX.	
Volatile Organic Compounds													
BENZENE	NA	NA	NA	NA			0.019			NA	ND	0.019	0.001
CHLOROBENZENE	NA	NA	NA	NA						NA	ND	ND	0.005
ETHYLBENZENE	NA	NA	NA	NA						NA	ND	ND	0.005
TETRACHLOROETHENE	NA	NA	NA	NA						NA	ND	ND	0.005
TOLUENE	NA	NA	NA	NA						NA	ND	ND	0.005
M+P-XYLENE	NA	NA	NA	NA						NA	ND	ND	0.005 each isomer
O-XYLENE	NA	NA	NA	NA						NA	ND	ND	0.005
CHLOROFORM	NA	NA	NA	NA					0.1	NA	ND	0.1	0.007
ACETONE	NA	NA	NA	NA			0.02			NA	ND	0.02	0.050 *
TOTAL CONCENTRATION	0	0	0	0	0	0	0.039	0	0.1	0			
Semi-Volatile Organic Compounds													
ACENAPHTHENE	NA	NA	NA	NA						NA	ND	ND	0.02
ANILINE	NA	NA	NA	NA						NA	ND	ND	0.005
ANTHRACENE	NA	NA	NA	NA						NA	ND	ND	0.05 *
BUTYL BENZYL PHTHALATE	NA	NA	NA	NA						NA	ND	ND	0.05 *
CARBAZOLE	NA	NA	NA	NA						NA	ND	ND	0.005 (4)
4-CHLOROANILINE	NA	NA	NA	NA						NA	ND	ND	0.005 (4)
2-CHLOROPHENOL	NA	NA	NA	NA						NA	ND	ND	0.001
CHRYSENE	NA	NA	NA	NA						NA	ND	ND	0.000002 * / 0.0002 (4)
DIBENZOFURAN	NA	NA	NA	NA						NA	ND	ND	0.05 (4)
1,2-DICHLOROBENZENE	NA	NA	NA	NA						NA	ND	ND	0.003
1,3-DICHLOROBENZENE	NA	NA	NA	NA						NA	ND	ND	0.003
1,4-DICHLOROBENZENE	NA	NA	NA	NA						NA	ND	ND	0.003
N,N-DIETHYLANILINE	NA	NA	NA	NA						NA	ND	ND	-
DIETHYLPHTHALATE	NA	NA	NA	NA						NA	ND	ND	0.05 *
N,N-DIMETHYLANILINE	NA	NA	NA	NA						NA	ND	ND	0.001
BIS(2-ETHYLHEXYL)PHTHALATE	NA	NA	NA	NA						NA	ND	ND	0.005
FLUORANTHENE	NA	NA	NA	NA						NA	ND	ND	0.05 *
N-METHYLANILINE	NA	NA	NA	NA						NA	ND	ND	0.005
2-METHYLNAPHTHALENE	NA	NA	NA	NA					0.063	NA	ND	0.063	0.05 (4)
NAPHTHALENE	NA	NA	NA	NA					1.2	NA	ND	1.2	0.01 *
1-NAPHTHYLAMINE	NA	NA	NA	NA						NA	ND	ND	0.005 (4)
2-NAPHTHYLAMINE	NA	NA	NA	NA						NA	ND	ND	0.005 (4)
NITROBENZENE	NA	NA	NA	NA						NA	ND	ND	0.0004

TABLE 23
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
SUPPLEMENTAL INVESTIGATION
GROUNDWATER ANALYTICAL RESULTS
(ROUND 2 - JULY 1997)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)										Range		Groundwater Standards (mg/l)(3)
Analytes(1)	RFI-24	RFI24SOL	RFI-25	RFI25SOL	RFI-34	RFI-35	RFI-36	RFI-37	RFI-38	RFI38SOL	MIN.	MAX.	
2-NITROPHENOL	NA	NA	NA	NA					0.035	NA	ND	0.035	0.001
N-NITROSODIMETHYLAMINE	NA	NA	NA	NA					0.0057	NA	ND	0.0057	0.05 (4)
N-NITROSODIPHENYLAMINE	NA	NA	NA	NA						NA	ND	ND	0.05 *
PHENANTHRENE	NA	NA	NA	NA						NA	ND	ND	0.05 *
PYRENE	NA	NA	NA	NA						NA	ND	ND	0.05 *
O+P-TOLUIDINE	NA	NA	NA	NA						NA	ND	ND	0.005 each isomer
1,2,4-TRICHLOROBENZENE	NA	NA	NA	NA						NA	ND	ND	0.005
TOTAL CONCENTRATION	0	0	0	0	0	0	0	0	1.3037	0			
Metals													
ALUMINUM	22.1	0.499	13.9		18.9	1.02	0.94	41.6	218	100	ND	218	-
ARSENIC	0.106	0.0697	0.114	0.0543	0.044	0.0619	0.0522	0.0735	0.15	0.0369	0.0369	0.15	0.025
BARIUM	0.0875		0.194	0.0803	0.207	0.0324	0.0238	0.335	1.91		ND	1.91	1
CADMIUM	0.0102		0.0116		0.00908			0.0111	0.0474	0.0248	ND	0.0474	0.005
CHROMIUM	0.069	0.0359	0.245		0.0376			0.0664	0.219	0.044	ND	0.245	0.05
COBALT									0.24	0.178	ND	0.24	-
COPPER	0.114	0.0297	0.0698		0.14	0.0292		0.106	0.688	0.294	ND	0.688	0.2
IRON	62.3	1.8	89.9	1.09	47.2	2.01	19.9	81.3	194	66.8	1.09	194	0.3
LEAD	0.14		0.0516		0.0768				1.16		ND	1.16	0.025
MANGANESE	0.678	0.0206	1.62	0.943	2.65	0.887	1.11	2.46	10.9	9.38	0.0206	10.9	0.3
MERCURY	0.00114	0.000623	0.000402	0.000675	0.000314				0.00514		ND	0.00514	0.0007
NICKEL	0.0867		0.0726		0.0828			0.105	0.606	0.443	ND	0.606	0.1
SELENIUM											ND	ND	0.01
SILVER									0.161	0.0165	ND	0.161	0.05
VANADIUM		0.103							0.14		ND	0.14	0.25 (4)
ZINC	0.502	0.0752	0.379		0.489		0.0349	0.288	4.24	3.66	ND	4.24	2
TOTAL CONCENTRATION	86.19454	2.633723	106.558	2.168275	69.83659	4.0405	22.0609	126.345	432.4665	180.8772			

TABLE 23
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
SUPPLEMENTAL INVESTIGATION
GROUNDWATER ANALYTICAL RESULTS
(ROUND 2 - JULY 1997)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)										**Range**		**Groundwater Standards (mg/l)(3)**
Analytes(1)	RFI-24	RFI24SOL	RFI-25	RFI25SOL	RFI-34	RFI-35	RFI-36	RFI-37	RFI-38	RFI38SOL	MIN.	MAX.	
Inorganics													
CHLORIDE	NA	NA	NA	NA	134	241	11.1	89.7	299	NA	11.1	299	250
TOTAL CYANIDE	NA	NA	NA	NA					0.146	NA	ND	0.146	0.2
TOTAL DISSOLVED SOLIDS	NA	NA	NA	NA	NA	NA	NA	NA	4650	NA	NA	4650	-
TOTAL HARDNESS	NA	NA	NA	NA	NA	NA	NA	NA	2200	NA	NA	2200	-
HEXAVALENT CHROMIUM	NA	NA	NA	NA	0.0104					NA	ND	0.0104	0.05
NITRATE NITROGEN	NA	NA	NA	NA					103	NA	ND	103	10
NITRATE/NITRITE NITROGEN	NA	NA	NA	NA	124				103	NA	ND	124	10
NITRITE NITROGEN	NA	NA	NA	NA	110			0.0121	0.123	NA	ND	110	1
pH	NA	NA	NA	NA	7.1	6.8	7.2	6.9	4.2	NA	4.2	7.2	6.5 to 8.5 SU
TOTAL PHOSPHORUS	NA	NA	NA	NA	0.742	0.503	0.19	2.03	0.706	NA	0.19	2.03	-
SULFATE	NA	NA	NA	NA	798	2400	1750	521	4620	NA	521	4620	250
TOTAL SULFIDE	NA	NA	NA	NA						NA	ND	ND	0.05 *
PCBs	NA	NA	NA	NA						NA	ND	ND	0.00009
Alcohols	NA	NA	NA	NA						NA	ND	ND	-

TABLE 23
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
SUPPLEMENTAL INVESTIGATION
GROUNDWATER ANALYTICAL RESULTS
(ROUND 2 - JULY 1997)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)									Range		Groundwater
Analytes (1)	RFI-39	RFI139SOL	RFI-40	RFI40SOL	RFI-41	RFI-42	RFI-43	PZ-17	PZ-19	MIN.	MAX.	Standards (mg/l)(3)
Volatile Organic Compounds												
BENZENE		NA		NA						ND	ND	0.001
CHLOROBENZENE		NA	3.1	NA						ND	3.1	0.005
ETHYLBENZENE		NA		NA						ND	ND	0.005
TETRACHLOROETHENE		NA		NA						ND	ND	0.005
TOLUENE		NA		NA						ND	ND	0.005
M+P-XYLENE		NA		NA						ND	ND	0.005 each isomer
O-XYLENE		NA		NA						ND	ND	0.005
CHLOROFORM		NA		NA						ND	ND	0.007
ACETONE		NA		NA						ND	ND	0.050 *
TOTAL CONCENTRATION	0	0	3.1	0	0	0	0	0	0			
Semi-Volatile Organic Compounds												
ACENAPHTHENE		NA		NA						ND	ND	0.02
ANILINE		NA		NA						ND	ND	0.005
ANTHRCENE		NA		NA						ND	ND	0.05 *
BUTYL BENZYL PHTHALATE		NA		NA						ND	ND	0.05 *
CARBAZOLE		NA		NA						ND	ND	0.005 (4)
4-CHLOROANILINE		NA		NA						ND	ND	0.005 (4)
2-CHLOROPHENOL		NA		NA						ND	ND	0.001
CHRYSENE		NA		NA						ND	ND	0.000002 * / 0.0002 (4)
DIBENZOFURAN		NA		NA						ND	ND	0.05 (4)
1,2-DICHLOROBENZENE		NA	1.4	NA						ND	1.4	0.003
1,3-DICHLOROBENZENE		NA	0.068	NA						ND	0.068	0.003
1,4-DICHLOROBENZENE		NA	0.34	NA						ND	0.34	0.003
N,N-DIETHYLANILINE		NA	0.019	NA						ND	0.019	-
DIETHYLPHTHALATE		NA		NA						ND	ND	0.05 *
N,N-DIMETHYLANILINE		NA		NA						ND	ND	0.001
BIS(2-ETHYLHEXYL)PHTHALATE		NA		NA	0.0075	0.0076		0.0052	0.023	ND	0.023	0.005
FLUORANTHENE	0.0072	NA		NA						ND	0.0072	0.05 *
N-METHYLANILINE		NA		NA						ND	ND	0.005
2-METHYLNAPHTHALENE		NA		NA						ND	ND	0.05 (4)
NAPHTHALENE		NA		NA						ND	ND	0.01 *
1-NAPHTHYLAMINE		NA		NA						ND	ND	0.005 (4)
2-NAPHTHYLAMINE		NA		NA						ND	ND	0.005 (4)
NITROBENZENE		NA		NA						ND	ND	0.0004

TABLE 23
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
SUPPLEMENTAL INVESTIGATION
GROUNDWATER ANALYTICAL RESULTS
(ROUND 2 - JULY 1997)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)									Range		Groundwater
Analytes (1)	RFI-39	RFI39SOL	RFI-40	RFI40SOL	RFI-41	RFI-42	RFI-43	PZ-17	PZ-19	MIN.	MAX.	Standards (mg/l)(3)
2-NITROPHENOL		NA		NA						ND	ND	0.001
N-NITROSODIMETHYLAMINE		NA		NA						ND	ND	0.05 (4)
N-NITROSODIPHENYLAMINE		NA		NA						ND	ND	0.05 *
PHENANTHRENE	0.008	NA		NA						ND	0.008	0.05 *
PYRENE	0.0063	NA		NA						ND	0.0063	0.05 *
O+P-TOLUIDINE		NA		NA						ND	ND	0.005 each isomer
1,2,4-TRICHLOROBENZENE		NA	0.27	NA						ND	0.27	0.005
TOTAL CONCENTRATION	0.0215	0	2.097	0	0.0075	0.0076	0	0.0052	0.023			
Metals												
ALUMINUM	16.5	0.109	43.2		17.7	0.596	0.339	3.79	9.85	ND	43.2	-
ARSENIC	0.0701	0.0186	0.108	0.0332	0.0599		0.0362	0.0344	0.095	ND	0.108	0.025
BARIUM	0.103		0.289	0.0278	0.087	0.0855		0.225	0.195	ND	0.289	1
CADMIUM	0.00747		0.0259	0.0177	0.0484				0.104	ND	0.104	0.005
CHROMIUM	0.036		0.0763		0.0307					ND	0.0763	0.05
COBALT										ND	ND	-
COPPER	0.217		0.248							ND	0.248	0.2
IRON	26.4		182	128	387	0.993	0.425	9.75	748	ND	748	0.3
LEAD	0.417		0.374							ND	0.417	0.025
MANGANESE	1.91	0.488	4.13	3.08	12.5	0.0681	3.05	0.441	14.4	0.0681	14.4	0.3
MERCURY	0.00397		0.00257							ND	0.00397	0.0007
NICKEL	0.0472		0.118		0.0534					ND	0.118	0.1
SELENIUM		0.152							0.00548	ND	0.152	0.01
SILVER					0.0174				0.0237	ND	0.0237	0.05
VANADIUM			0.0694							ND	0.0694	0.25 (4)
ZINC	0.73		0.988	0.0116	0.0997	0.0499	0.0112	0.0452	0.0894	ND	0.988	2
TOTAL CONCENTRATION	46.44174	0.7676	231.6292	131.1703	417.5965	1.7925	3.8614	14.2856	772.7626			

TABLE 23
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
SUPPLEMENTAL INVESTIGATION
GROUNDWATER ANALYTICAL RESULTS
(ROUND 2 - JULY 1997)
SHALLOW AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)									Range		Groundwater Standards (mg/l)(3)
Analytes (1)	RFI-39	RFI39SOL	RFI-40	RFI40SOL	RFI-41	RFI-42	RFI-43	PZ-17	PZ-19	MIN.	MAX.	
Inorganics												
CHLORIDE	237	NA	239	NA	334	245	12.6	11.5	32.3	11.5	334	250
TOTAL CYANIDE		NA		NA						ND	ND	0.2
TOTAL DISSOLVED SOLIDS	10700	NA	3350	NA						ND	10700	-
TOTAL HARDNESS	1300	NA	1800	NA						ND	1800	-
HEXAVALENT CHROMIUM	0.0128	NA		NA						ND	0.0128	0.05
NITRATE NITROGEN		NA		NA		2.86				ND	2.86	10
NITRATE/NITRITE NITROGEN		NA		NA		2.93				ND	2.93	10
NITRITE NITROGEN		NA	0.0481	NA	0.0983	0.0732			0.0794	ND	0.0983	1
pH	9.1	NA	6.5	NA	6	7	7	6.9	6.1	6	9.1	6.5 to 8.5 SU
TOTAL PHOSPHORUS	0.471	NA	0.432	NA	0.662	0.0631	0.173	0.687	2.78	0.0631	2.78	-
SULFATE	6850	NA	2060	NA	3800	70.8	1300	288	3800	70.8	6850	250
TOTAL SULFIDE	2.3	NA		NA						ND	2.3	0.05 *
PCBs		NA		NA						ND	ND	0.00009
Alcohols		NA		NA						ND	ND	-

Notes: (1) Analysis performed in accordance with USEPA Methods identified in Quality Assurance Project Plan (Golder Associates, Inc. 1995).
(2) Detections only reported. Refer to laboratory results for detection limits.
(3) Groundwater standards from the NYSDEC's 6NYCRR Part 703 "Ambient Water Quality Standards and Guidance Values", for Class GA groundwaters as amended, June 1998.
(4) NYSDEC Contained-In Action Levels, Technical and Administrative Guidance Memorandum No. 3028 (8/26/97).

SOL = Filtered Sample
* = Guidance Value
(-) = No standard
pH determined by field measurement.
NA = Not Analyzed
ND = Not Detected

TABLE 24
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
SHALLOW AQUIFER
OFF SITE EXCEEDANCES

	Shallow Aquifer Off Site Wells and Piezometers											
Analytes (1)	RFI-34	RFI-35	RFI-36	RFI-37	RFI-38	RFI-39	RFI-40	RFI-41	RFI-42	RFI-43	PZ-17	PZ-19
Volatile Organic Compounds												
CHLOROBENZENE							X					
CHLOROFORM					X							
Semi-Volatile Organic Compounds												
BIS(2-ETHYLHEXYL)PHTHALATE								X	X		X	
1,2-DICHLOROBENZENE							X					
1,3-DICHLOROBENZENE							X					
1,4-DICHLOROBENZENE							X					
NAPHTHALENE					X							
NITROPHENOL					X							
1,2,4-TRICHLOROBENZENE							X					
Metals												
ARSENIC	X			X	X	X	X	X				
CADMIUM					X	X		X				X
CHROMIUM					X							
COPPER					X	X						
IRON	X	X	X	X	X	X	X	X	X	X	X	X
LEAD					X	X						
MANGANESE	X	X	X	X	X	X	X	X		X	X	X
MERCURY					X	X						
NICKEL					X							
ZINC	X				X							
Inorganics												
CHLORIDE					X			X				
NITRATE/NITRITE NITROGEN	X				X							
pH					X	X		X				X
SULFATE	X	X	X	X	X	X	X	X		X		X
TOTAL SULFIDE						X						

X = Exceedance of groundwater standards from the NYSDEC's part 703 "Ambient Water Quality Standards and Guidance Values", for Class GA groundwaters as amended, June 1998 or NYSDEC Contained-In- Action Levels, Technical and Administrative Guidance Memorandum No. 3028 (8/26/97).

TABLE 25
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 1 - JUNE 1996)
CONFINED AQUIFER
(DETECTIONS ONLY)

Analytes (1)	Sample Identification and Concentration (mg/l) (2)				Range		Groundwater Standards (mg/l)(3)
	RFI16 AREA A	RFI19D AREA B	RFI21D AREA C	RFI23D AREA A	MIN.	MAX.	
Volatile Organic Compounds							
BENZENE	0.013				ND	0.013	0.001
CHLOROBENZENE	0.011		0.01		ND	0.011	0.005
ETHYLBENZENE					ND	ND	0.005
TETRACHLOROETHENE					ND	ND	0.005
TOLUENE					ND	ND	0.005
M+P-XYLENE					ND	ND	0.005 each isomer
O-XYLENE					ND	ND	0.005
TOTAL CONCENTRATION	0.024	0	0.01	0			
Semi-Volatile Organic Compounds							
ACENAPHTHENE					ND	ND	0.02
ANILINE		0.029			ND	0.029	0.005
ANTHRACENE					ND	ND	0.05*
BUTYL BENZYL PHTHALATE					ND	ND	0.05*
CARBAZOLE					ND	ND	0.005 (4)
4-CHLOROANILINE					ND	ND	0.005 (4)
2-CHLOROPHENOL					ND	ND	0.001
CHRYSENE					ND	ND	0.000002* / 0.0002 (4)
DIBENZOFURAN					ND	ND	0.05 (4)
1,2-DICHLOROBENZENE					ND	ND	0.003
1,3-DICHLOROBENZENE					ND	ND	0.003
1,4-DICHLOROBENZENE					ND	ND	0.003
N,N-DIETHYLANILINE					ND	ND	-
DIETHYLPHTHALATE					ND	ND	0.05*
N,N-DIMETHYLANILINE					ND	ND	0.001
BIS(2-ETHYLHEXYL)PHTHALATE				0.079	ND	0.079	0.005
FLUORANTHENE					ND	ND	0.05 *
N-METHYLANILINE					ND	ND	0.005
NAPHTHALENE					ND	ND	0.01 *
1-NAPHTHYLAMINE					ND	ND	0.005 (4)
2-NAPHTHYLAMINE					ND	ND	0.005 (4)
NITROBENZENE					ND	ND	0.0004
N-NITROSODIPHENYLAMINE					ND	ND	0.05 *
PHENANTHRENE					ND	ND	0.05 *
PYRENE					ND	ND	0.05 * / 0.0002 (4)
O+P-TOLUIDINE					ND	ND	0.005 each isomer
1,2,4-TRICHLOROBENZENE					ND	ND	0.005
TOTAL CONCENTRATION	0	0.029	0	0.079			

TABLE 25
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 1 - JUNE 1996)
CONFINED AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)				Range		Groundwater
Analytes (1)	RFI16	RFI19D	RFI21D	RFI23D	**MIN.**	**MAX.**	**Standards (mg/l)(3)**
Metals	AREA A	AREA B	AREA C	AREA A			
ALUMINUM	1.02	18.1	0.344	4	0.344	18.1	-
ARSENIC					ND	ND	0.025
BARIUM	0.0997	0.192	0.109	0.11	0.0997	0.192	1
CADMIUM					ND	ND	0.005
CHROMIUM		0.0254			ND	0.0254	0.05
COBALT					ND	ND	-
COPPER		0.0243			ND	0.0243	0.2
IRON	0.202	21.1	0.508	4.71	0.2	21.1	0.3
LEAD					ND	ND	0.025
MANGANESE		0.4	0.016	0.0945	ND	0.4	0.3
MERCURY					ND	ND	0.0007
NICKEL					ND	ND	0.1
VANADIUM					ND	ND	0.25 (4)
ZINC		0.0798		0.0253	ND	0.0798	2
TOTAL CONCENTRATION	1.3217	39.9215	0.977	8.9398			
Inorganics							
TOTAL ALKALINITY	443	207	312	339	207	443	-
CHLORIDE	59.1	7.88	350	74.6	7.88	350	250
TOTAL CYANIDE			0.0204		ND	0.0204	0.2
HEXAVALENT CHROMIUM					ND	ND	0.05
NITRATE NITROGEN		0.0574			ND	0.0574	10
NITRATE/NITRITE NITROGEN		0.0752			ND	0.0752	10
NITRITE NITROGEN	0.212	0.0178		0.0273	ND	0.212	1
pH	12.3	10.7	8.9	11.5	8.9	12.3	6.5 to 8.5 SU
TOTAL PHOSPHORUS	0.446	0.504	0.0796	0.277	0.0796	0.504	-
SULFATE	27.8	16.5	226	17.9	16.5	226	250
TOTAL SULFIDE		1.8			ND	1.8	0.05 *
PCBs					ND	ND	0.00009
Alcohols					ND	ND	-

Notes:
(1) Analysis performed in accordance with USEPA Methods identified in Quality Assurance Project Plan (Golder Associates, Inc. 1995).
(2) Detections only reported. Refer to labortory results for detection limits.
(3) Groundwater standards from the NYSDEC's Part 703 "Ambient Water Quality Standards and Guidance Values", for Class GA groundwaters as amended, June 1998.
(4) NYSDEC Contained-In Action Levels, Technical and Administrative Guidance Memorandum No. 3028 (8/26/97).

pH determined by field measurement
* = Guidance Value
(-) = No standard
ND = Not Detected

TABLE 26
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 2 - AUGUST 1996)
CONFINED AQUIFER
(DETECTIONS ONLY)

	Sample Identification and Concentration (mg/l) (2)				Range		Groundwater
Analytes (1)	RFI16	RFI19D	RFI21D	RFI23D	MIN.	MAX.	Standards (mg/l)(3)
Volatile Organic Compounds	AREA A	AREA B	AREA C	AREA A			
ACETONE					ND	ND	0.05 *
BENZENE	0.027				ND	0.027	0.001
CHLOROBENZENE	0.0094		0.0064		ND	0.0094	0.005
ETHYLBENZENE					ND	ND	0.005
TETRACHLOROETHENE					ND	ND	0.005
TOLUENE					ND	ND	0.005
M+P-XYLENE					ND	ND	0.005 each isomer
O-XYLENE					ND	ND	0.005
TOTAL CONCENTRATION	0.0364	0	0.0064	0			
Semi-Volatile Organic Compounds							
ACENAPHTHENE					ND	ND	0.02
ANILINE		0.031			ND	0.031	0.005
BUTYL BENZYL PHTHALATE					ND	ND	0.05 *
DI-N-BUTYLPHTHALATE					ND	ND	0.05
CARBAZOLE					ND	ND	0.005 (4)
4-CHLOROANILINE					ND	ND	0.005 (4)
2-CHLOROPHENOL					ND	ND	0.001
DIBENZOFURAN					ND	ND	0.05 (4)
1,2-DICHLOROBENZENE					ND	ND	0.003
1,3-DICHLOROBENZENE					ND	ND	0.003
1,4-DICHLOROBENZENE					ND	ND	0.003
N,N-DIETHYLANILINE					ND	ND	-
N,N-DIMETHYLANILINE					ND	ND	0.001
N-ETHYLANILINE					ND	ND	-
BIS(2-ETHYLHEXYL)PHTHALATE				0.0093	ND	0.0093	0.005
FLUORENE					ND	ND	0.05 *
N-METHYLANILINE					ND	ND	0.005
NAPHTHALENE					ND	ND	0.01 *
1-NAPHTHYLAMINE					ND	ND	0.005 (4)
2-NAPHTHYLAMINE					ND	ND	0.005 (4)
NITROBENZENE					ND	ND	0.0004
N-NITROSODIPHENYLAMINE					ND	ND	0.05 *
PHENANTHRENE					ND	ND	0.05 *
O+P-TOLUIDINE					ND	ND	0.005 each isomer
1,2,4-TRICHLOROBENZENE					ND	ND	0.005
TOTAL CONCENTRATION	0	0.031	0	0.0093			

TABLE 26
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
PHASE I GROUND WATER ANALYTICAL RESULTS
(ROUND 2 - AUGUST 1996)
CONFINED AQUIFER
(DETECTIONS ONLY)

Analytes (1)	Sample Identification and Concentration (mg/l) (2)				Range		Groundwater Standards (mg/l)(3)
	RFI16	RFI19D	RFI21D	RFI23D	MIN.	MAX.	
Metals	AREA A	AREA B	AREA C	AREA A			
ALUMINUM	0.902	3.66		1.68	ND	3.66	-
ARSENIC					ND	ND	0.025
BARIUM	0.0917	0.102	0.135	0.0993	0.0917	0.135	1
CADMIUM					ND	ND	0.005
CHROMIUM				0.0128	ND	0.0128	0.05
COPPER					ND	ND	0.2
IRON	0.196	3.55	0.186	1.81	0.186	3.55	0.3
LEAD					ND	ND	0.025
MANGANESE		0.0674	0.0102	0.0357	ND	0.0674	0.3
MERCURY					ND	ND	0.0007
NICKEL					ND	ND	0.1
SELENIUM					ND	ND	0.01
VANADIUM					ND	ND	0.25 (4)
ZINC	0.0334	0.0184	0.0111	0.0289	0.0111	0.0334	2
TOTAL CONCENTRATION	1.2231	7.3978	0.3423	3.6667			
Inorganics							
TOTAL ALKALINITY	326	176	274	115	115	326	-
CHLORIDE	59.4	9.45	304	65.6	9.45	304	250
TOTAL CYANIDE					ND	ND	0.2
TOTAL DISSOLVED SOLIDS	546	290			ND	546	-
TOTAL HARDNESS	193	115			ND	193	-
HEXAVALENT CHROMIUM					ND	ND	0.05
NITRATE NITROGEN					ND	ND	10
NITRATE NITRITE NITROGEN					ND	ND	10
NITRITE NITROGEN	0.0496	0.0117			ND	0.0496	1
pH	11.4	10.1	8.72	9.67	8.72	11.4	6.5 - 8.5 SU
TOTAL PHOSPHORUS	0.616	0.135		0.32	ND	0.616	-
SULFATE	11.5	30.3	690	27.4	11.5	690	250
TOTAL SULFIDE	1.4	2.2	17.2		ND	17.2	0.05 *
PCBs					ND	ND	0.00009
Alcohols					ND	ND	-

Notes: (1) Analysis performed in accordance with USEPA Methods identified in Quality Assurance Project Plan (Golder Associates, Inc. 1995).

(2) Detections only reported. Refer to labortory results for detection limits.

(3) Groundwater standards from the NYSDEC's Part 703 "Ambient Water Quality Standards and Guidance Values", for Class GA groundwaters as amended, June 1998.

(4) NYSDEC Contained-In Action Levels, Technical and Administrative Guidance Memorandum No. 3028 (8/26/97).

* = Guidance Value	NA = Not Analyzed
(-) = No standard	ND = Not Detected

pH determined by field measurement

TABLE 27
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
AREA ABCE
SUMMARY OF CONSTITUENTS EXCEEDING ACTION LEVELS

	Media				
Analytes	Area ABCE	Area ABCE	Area ABCE (1)	Off-Site	Area ABCE (1)
Volatile Organic Compounds	Soil	Shallow Aquifer Perimeter Wells	Shallow Aquifer Interior Monitoring Wells	Shallow Aquifer	Confined Aquifer
ACETONE			X		
BENZENE			X		X
CHLOROBENZENE	X	X	X	X	X
CHLOROFORM			X	X	
1,1-DICHLOROETHANE			X		
1,1-DICHLOROETHENE			X		
ETHYLBENZENE			X		X
METHYLENE CHLORIDE			X		
TETRACHLOROETHENE		X			
1,1,1-TRICHLOROETHANE			X		
TOLUENE			X		X
M+P-XYLENE			X		X
O-XYLENE			X		X
Semi-Volatile Organic Compounds					
ANILINE	X		X		X
BENZO(A)ANTHRACENE	X				
BENZO(A)PYRENE	X				
BENZO(B)FLUORANTHENE	X				
BENZO(K)FLUORANTHENE	X				
CARBAZOLE	X		X		
4-CHLOROANILINE			X		
2-CHLOROPHENOL			X		
CHRYSENE	X				
DIBENZOFURAN	X				
1,2-DICHLOROBENZENE			X	X	
1,3-DICHLOROBENZENE			X	X	
1,4-DICHLOROBENZENE			X	X	
N,N-DIMETHYLANILINE			X		
2,4-DINITROTOLUENE			X		
2,6-DINITROTOLUENE			X		
3-NITROANILINE			X		
BIS(2-ETHYLHEXYL)PHTHALATE			X	X	
INDENO(1,2,3-CD)PYRENE	X				
N-METHYLANILINE			X		
1-NAPHTHYLAMINE			X		
2-NAPHTHYLAMINE			X		
NAPHTHALENE	X		X	X	
NITROBENZENE	X		X		
NITROPHENOL				X	
N-NITROSODIPHENYLAMINE			X		
O+P-TOLUIDINE			X		
1,2,4-TRICHLOROBENZENE	X	X	X	X	
Metals					
ARSENIC	X		X	X	
BARIUM			X		
CADMIUM	X		X	X	
CHROMIUM	X	X	X	X	
COPPER	X		X	X	
IRON	X	X	X	X	X
LEAD		X	X	X	

TABLE 27
BUFFALO COLOR CORPORATION
RCRA FACILITY INVESTIGATION
AREA ABCE
SUMMARY OF CONSTITUENTS EXCEEDING ACTION LEVELS

	Media				
Analytes	Area ABCE	Area ABCE	Area ABCE (1)	Off-Site	Area ABCE (1)
Metals (Cont'd)					
MANGANESE	X	X	X	X	
MERCURY	X		X	X	
NICKEL	X		X	X	
SELENIUM	X		X		
VANADIUM			X		
ZINC		X	X	X	
Inorganics	Soil	Shallow Aquifer Perimeter Wells	Shallow Aquifer Interior Monitoring Wells	Shallow Aquifer	Confined Aquifer
CHLORIDE	NA	X	X	X	X
TOTAL CYANIDE	X		X		
NITRATE/NITRITE NITROGEN	NA			X	
pH	NA	X	X	X	X
SULFATE	NA	X	X	X	X
TOTAL SULFIDE	NA		X	X	X
PCBs				NA	
Alcohols	NA			NA	

X = Exceedance of groundwater standards from the NYSDEC's Part 703 "Ambient Water Quality Standards and Guidance Values", for Class GA groundwaters as amended, June 1998 or NYSDEC Contained-In Action Levels, Technical and Administrative Guidance Memorandum No. 3028 (8/26/97). Soil sample exceedances were also compared to reported typical background soil concentrations (NYSDOH Seneca-Babcock Neighborhood Soil Sampling Program, Draft Technical Report, October 1996) and NYSDEC Soil Clean-up Objectives (NYSDEC TAGM HWR-94-4046, 1/24/94) adjusted for 5.3% soil organic carbon content.

(1) Includes data from Table 21 from Buffalo Color Corporation monitoring of former Lagoons 1, 2, and 3 wells, interior Area ABCE RFI wells and groundwater multiple-depth borings.

Note: NA = Not analyzed.
Soil samples were not analyzed for alcohols. Off site shallow aquifer samples were not analyzed for PCBs or alcohols.

Perimeter wells are wells on perimeter of Area ABCE along Conrail Railroad and Elk Street.

INSERT ATTACHED
ANALYTICAL RESULTS
AT THE END OF APPENDIX H

Columbia Analytical Services inc.

Date: 3/23

Number of pages including cover sheet: 4

To: Brian Emekelden

Phone:

Fax phone: 731 1652

CC:

From: MARK WILSON

Columbia Analytical Services
1 Mustard Street, Suite 250
Rochester, NY 14609

Phone: (716) 288-5380

Fax phone: (716) 288-8475

1) Method Blank "hit" summary
2) Chromatogram of RFIP217C9F
3) Method Blank run at 125x dilution is actually a "medium level" method blank, and is analyzed to show same preparation as other medium level samples.

If questions please call

Mark W.

IMPORTANT NOTE:

DATE	COMPOUND		METHOD	MATRIX	CONC	
5/6/96	Di-n-butyl phthalate		8270	soil	4500 ug/Kg	
5/22/96	Di-n-butyl phthalate		8270	soil	1400 ug/Kg	
8/9/98	Butyl Benzyl phthalate		8270	water	5.1 ug/L	

Golden

Buffalo Color

Method Blank analysis

Summary

```
                              Quantitation Report

Data File : J:\ACQUDATA\MSVOA5\DATA\Q9337.D                 Vial: 1
Acq On    : 21 May 96   7:31 pm                         Operator: RODH
Sample    : 78454 125                                   Inst    : 5971 - In
Misc      : GOLDER 8260.TCLH MED SOIL                   Multiplr: 1.00
Quant Time: May 28 13:42 1996

Method        : C:\HPCHEM\1\METHODS\8260VOA.M
Title         : 8260voa
Last Update   : Tue May 21 15:32:37 1996
Response via  : Single Level Calibration

Internal Standards                  R.T.  QIon  Response  Conc Units Dev(Min)
-----------------------------------------------------------------------------
 1) Pentafluorobenzene             12.00    99    108744   50.00 ppb      0.08
22) 1,4-Difluorobenzene            14.23   114    188608   50.00 ppb      0.07
40) d5-Chlorobenze                 21.38   117    163699   50.00 ppb      0.02
52) d4-1,4-Dichlorobenzene         27.31   152     92574   50.00 ppb     -0.04

System Monitoring Compounds                                          %Recovery
23) surr4,Dibrflmethane            12.29   113    108540   48.32 ppb    96.64%
37) surr3,Toluene-d8               17.75    98    201984   50.70 ppb   101.39%
39) surr2,bfb                      24.34    95    126689   54.29 ppb   108.57%

Target Compounds                                                        Qvalue
14) 1,1-Diclethane                 10.14    63      5444    2.21 ppb  #     50
16) 2-Butanone                     10.92    43      6488    6.61 ppb  #     61
20) Vinyl Acetate                  10.42    43     47225   17.99 ppb  #     96
21) 1,1,1-Trichloroethane          12.68    97      3399    1.52 ppb        88
32) 4-Methyl-2-Pentanone           16.65    43     20020    5.03 ppb  #     65
36) 1,1,2-Trichloroethane          18.78    83      1757    1.32 ppb  #      6
45) Chlorobenzene                  21.57   112      8262    2.59 ppb  #     69
```

npw 5/28

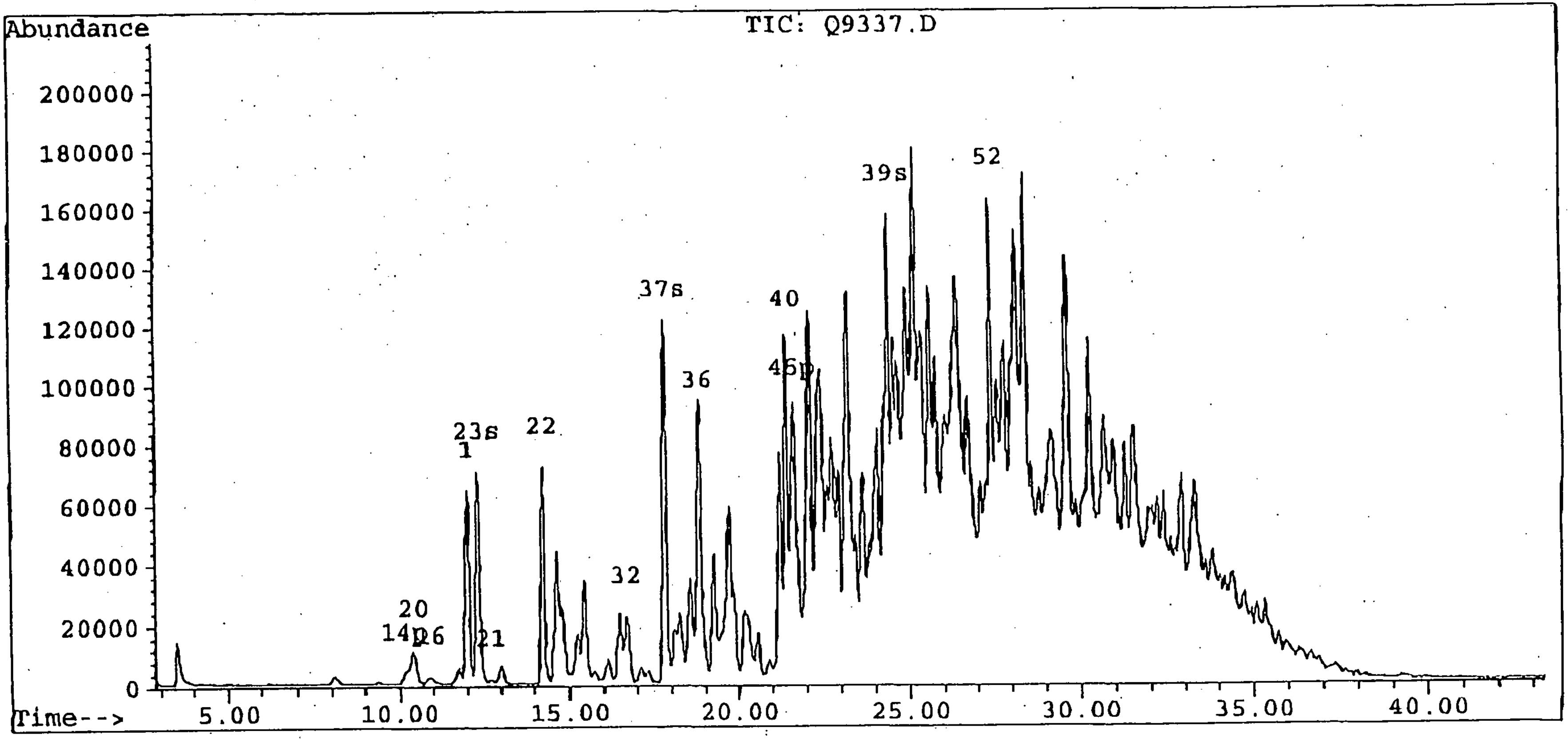
```
-----------------------------------------------------------------------------
(#) = qualifier out of range (m) = manual integration
```

Quantitation Report

Data File : J:\ACQUDATA\MSVOA5\DATA\Q9337.D
Acq On : 21 May 96 7:31 pm
Sample : 78454 125
Misc : GOLDER 8260.TCLH MED SOIL
Quant Time: May 28 13:42 1996

Vial: 1
Operator: RODH
Inst : 5971 - In
Multiplr: 1.00

Method : C:\HPCHEM\1\METHODS\8260VOA.M
Title : 8260voa
Last Update : Tue May 21 15:32:37 1996
Response via : Single Level Calibration



ATTACHMENT A

STUDY AREA SUBSURFACE WATER AND SEWER LINES

Golder Associates Inc.

2221 Niagara Falls Boulevard, Suite 9
Niagara Falls, NY USA 14304
Telephone (716) 731-1560
Fax (716) 731-1652

Golder Associates

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FINAL REPORT
ON
RCRA FACILITY INVESTIGATION
BUFFALO COLOR CORPORATION
BUFFALO, NEW YORK
(Revision 1)

Submitted to:

Buffalo Color Corporation
100 Lee Street
Buffalo, New York 14240

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December 1998

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