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PHASE II
ENVIRONMENTAL SITE INVESTIGATION
WITMER ROAD DRIVE-IN
NIAGARA FALLS, NEW YORK

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SECTION I

INTRODUCTION

A. GENERAL

This report presents the results of a subsurface investigation and ground water monitoring program conducted at the former Witmer Road Drive-In, 4287 Witmer Road, Niagara Falls, New York. A site location map is shown as Drawing No. 1 in Appendix A. The report summarizes the results of the previous investigations, the information gathered during this investigation and Empire Soils Investigations recommendations for further investigation and/or remediation.

B. INVESTIGATION OBJECTIVES

The objectives of this investigation were established in the NYSDEC approved work plan entitled "Work Plan for Environmental Site Investigation, Witmer Road Drive-in, 4287 Witmer Road". These objectives were as follows:

1. Characterize the ground water within the fill materials;
2. Characterize the water quality that may be seeping into Gill Creek;
3. Develop a further understanding of site hydrogeology;
4. Determine if the fill materials have the characteristic of a hazardous waste (i.e. EP toxic for lead);
5. Determine if the phenolic-like resin material exhibits the characteristics of a hazardous waste (EP toxicity);
6. Prepare a report detailing the results of the sampling activity with recommendations for further investigations (if applicable) or remedial activities (if applicable).

C. SCOPE

The scope of the investigation was defined during discussions with the NYSDEC and has been summarized in a letter dated January 31, 1990 from the NYSDEC. The scope of the environmental services conducted at the site are as follows:

1. Installed five (5) monitoring wells in the fill and overburden materials on site to determine ground water flow directions and ground water quality.
2. Obtained and analyzed eight (8) soil samples for EP toxicity analysis (lead only).
3. Obtained a sample of the ground water seep along Gill Creek and analyzed the sample for priority pollutant metals (total and dissolved) and, oil and grease.
4. Developed, purged and sampled the five (5) monitoring wells. The ground water samples were analyzed for the presence of target compound list (TCL) volatile pollutants, target compound list semi-volatile pollutants and, lead. Selected samples were analyzed for dioxins and furans.
5. Measured organic vapor concentrations during the exploration phase of the project.
6. Prepared test boring logs and well installation diagrams.
7. Collected a sample of the phenolic resin like material for EP toxicity testing.
8. Conducted the sampling and analysis in general accordance with the provisions of the approved Work Plan.
9. Conducted the work in accordance with the provisions of the Health and Safety Plan.
10. Engaged the services of a New York State Department of Health (NYSDOH) certified environmental laboratory, Huntingdon Analytical Services (HAS) to analyze the soil and water samples collected from the subject site.
11. Instituted quality assurance/quality control (QA/QC) methodologies to assess data quality in accordance with the Work Plan.

12. Reviewed the previous environmental investigation report for the subject property and incorporated the findings into this report.

13. Prepared this report detailing all aspects of this investigation and the previous investigations into a comprehensive report. The report discusses the site history, the subsurface exploration results, the analytical results, and a discussion of potential human health and environmental impacts.

The opinions, findings and recommendations presented in this report are based solely on the above scope of services. Limitations to this environmental investigation are presented in Appendix B.

SECTION II

SITE CONDITIONS/SITE HISTORY

A. PHYSICAL SETTING

The subject site is located at 4287 Witmer Road in the Town of Niagara, Niagara County, New York. Based on the property map, the subject property covers approximately 74,900 square feet (approximately 1.72 acres). A copy of the property map is shown as Drawing No. 2 in Appendix A. The property is bounded by Witmer Road to the north, Gill Creek to the east, and vacant industrial park land to the south and west. A 20.0 foot easement to the Town of Niagara for a sanitary sewer exists parallel to Witmer Road along the northern boundary of the site. A 20.0-foot public utility easement exists along the western boundary of the site of which 10.0-feet is on the subject property. An easement along Gill Creek exists with the Town of Niagara for cleaning and maintaining the creek.

A single story 75-foot by 40-foot office/laboratory building exists on the site as shown in Drawing No. 2 presented in Appendix A. The building was built in 1987 and is occupied by Empire Soils Investigations, Industrial Hygiene Division. The property is zoned for business based on the Town of Niagara Zoning Map. The surrounding property is zoned for business with the exception of the property across Gill Creek which is zoned residential.

The site topography is relatively flat to gently sloping towards the northeast portion of the site. The eastern boundary of the site drops abruptly (approximately 10-12 feet) to the elevation of Gill Creek.

B. SITE HISTORY

Information on site history was obtained from the Title Abstract supplied by the current owner, a review of aerial photographs, the Town of Niagara Historian and an interview with the former Manager of the drive-in theater. The title search dates back to 1835 and the property was sold several times throughout the 1800's to various individuals. No indications of industrial activity or ownership by corporations or company's was found during the 1800's. According to Ms. Rolling, the Town of Niagara Historian there may have been a saw mill on the creek at this site in the early 1800's. In the early 1800's, the property was known as the Schwitzer (Switzer) farm and consisted of a 100-acre tract of land. In 1914 the property was sold to Jon (John) Rommeland and according Ms. Dorothy Rolling, Jon Rommel lived on the property which was farmland. Jon Rommel died in 1952 and his estate sold the property to Country Theatres Corporation on August 17, 1953. Ms. Rolling speculated that there is approximately six (6) feet of fill on the site, however the source of the fill material is unknown.

A drive-in theater was present on the site from approximately 1953 to 1986. The theater may have been there as early as late 1951. The October 14, 1951 aerial photograph of the site shows the outline of the future drive-in parking area but the screen and projection buildings are not present. The completed drive-in theater is easy to distinguish on the 1958 and 1966 aerial photographs. Copies of the available aerial photographs are presented in Appendix C. Several companies have owned the theater, since it was built and a list of the former owners is presented below:

COMPANY NAME	**PERIOD OWNED**
Country Theatres Corporation	08/17/53 to 07/01/54
Falls Drive-In, Inc.	07/01/54 to 08/31/73
Cataract Theater Corporation*	08/31/73 to 11/06/86

* Falls Drive-In, Inc. merged with Cataract Theatre Corporation in 1973.

On November 6, 1986, the property was sold to Patrick Flain, Gordon J. Smith, Donald H. Smith, James Miline and Flain Development Corporation, existing as Witmer Industrial Estate, a co-partnership. The property was transferred to its current owner, ASTECO, Inc., on June 22, 1987. It should be noted that ASTECO owns only a small portion of the former drive-in property (i.e. the northeast corner).

Mr. Clark Vernor, the former Manager of the drive-in theater, was contacted to determine if and what he knew about the fill materials found on-site. Mr. Vernor did not remember any filling activities on the site and thought that these activities probably occurred when Jon Rommel owned the property. The building observed east of the drive-in theater, on what is now the subject property, was a storage building for the equipment and lawn mowers used by the drive-in according to Mr. Vernor.

C. AERIAL PHOTOGRAPHS

ESI reviewed the available historical aerial photographs of the subject property. Photocopies of the aerial photographs reviewed are presented in Appendix C of this report. The aerial photographs reviewed were obtained from the U.S. Soil Conservation Service Office in Lockport, New York and the Niagara Country Highway Department, Lockport Office. The aerial photographs reviewed were as follows:

DATE OF PHOTOGRAPH	PHOTOGRAPH NO.	SCALE
September 25, 1938	ARE-18-34	1" = 660'
October 14, 1951	ARE-5H-151	1" = 660'
August 2, 1958	ARE-1V-24	1" = 660'
June 12, 1966	ARE-2GG-50	1" = 660'

The interpretation of the aerial photographs is as follows:

1938 - AERIAL PHOTOGRAPH

The subject property is part of a larger farm property with the farm house and barns located approximately 500-feet west of the site along Witmer Road. The subject property was not under active cultivation at the time of the photograph. An access road from Witmer Road to the subject property is visible. The purpose of the access road is not apparent.

There also appears to be two (2) small disturbed areas on the future drive-in site. One of these disturbed areas is on the subject property.

1951 - AERIAL PHOTOGRAPH

The outline of the drive-in parking area is clearly visible. However, there is no ticket building, screen or projection building. The access road to the subject site is visible and there is a small house or building adjacent to the access road, near the present day building location. A second access road from the farm buildings to the creek is visibly present south of the subject site. The subject property does not appear to be cultivated. An apparently wet area (darker area on photograph) is present between the structure on the site and the creek. This area roughly corresponds to the area investigated during the subsurface investigation. Disturbed land is present on the current subject site and the properties southward along the creek.

1958 - AERIAL PHOTOGRAPH

The drive-in theater is present with a ticket booth, screen and projection building. The access road and small shed or building present in the 1951 aerial photograph are still visible. There is a strip of disturbed land, from near Witmer Road and extending along the east side of the drive-in's parking area to the end of the drive-in parking area. This strip of disturbed land crosses the subject property and extends southward to the adjacent properties.

Construction activities associated with the Power Authority water supply conduits is underway to the north and west. A disturbed area is visible, further east on Witmer Road at the site of the present-day New York State Police Headquarters Building.

1966- AERIAL PHOTOGRAPH

In 1966, the drive-in theater, its access road and associated building are still present. The location of the disturbed area near the southern end of the drive-in theater, appears to have increased in size. No additional filling activities on the subject property are visible. It should be noted that disturbed area present in 1958 have not been revegetated.

The Power Authority tunnel work appears to be completed and the Niagara Expressway is present to the west of the site.

D. SITE GEOLOGY

GENERAL

The known site geological features are presented in this section. Information in this section was obtained from the soil borings, test pits, the U.S. Soil Conservation Service Soil Maps, Aerial Photographs, Historical Topographic Maps and Geologic Reference Materials as indicated in the text. Detailed references are presented in Appendix I.

Topographically, the site is located in the eastern lake section of the Central Lowland physiographic province. More specifically, the site lies in the Huron Plain which covers the southern portion of Niagara County and is marked on the north by the Niagara escarpment and the south by the Onondaga escarpment. The Huron Plain is an almost level area cut by shallow streams which drain southward into the Niagara River (located approximately 3.5 miles south of the subject site).

Differential erosion (rocks less resistant to weathering) caused plains to form between the more resistant rocks of the Niagara and Onondaga escarpments. The area bedrock consists of dolomites, sandstones and shale which dip in a generally southern direction.

SURFACE SOILS

Glaciers covered most of New York State during the Pleistocene Epoch, which spanned about 1.5 million years. During this period of extensive glaciation, the area was overridden many times by a thick continental ice sheet moving southward over the region from Quebec and Ontario, eroding the rock and changing drainage patterns. Bedrock control of glaciation and the drainage of glacial meltwaters were important factors in forming the present landscape.

The surficial deposits in the region are mainly the results of the last advance and subsequent retreat of the Pleistocene ice sheet. Retreat of the ice from the Niagara excarpment allowed glacial Lake Iroquois to form in the basin now occupied by Lake Ontario (American Falls International Board, 1971). As deglaciation progressed, the Niagara River developed as a channel for waters to flow between early Lake Erie and glacial Lake Iroquois. Further decrease in lake levels caused glacial Lake Tonawanda to form in the lowland between the Niagara and Onondaga escarpments (Huron Plain). The lake extended eastward from the Niagara River for a distance of about 50-miles. It is estimated that the lake was 8-miles wide (north to south) and had a maximum depth of approximately 35-feet (Buehler and Tesmer, 1963).

The project site is located on the lake bed of the former glacial Lake Tonawanda. The indigenous subsurface soils in the vicinity of the project site consist of lucustrine or lake deposited clays and silts. According to the soil survey for Niagara County (USDA-SCS), soils on the project site belong to the Odessa Silty Clay Loams. These soils are lake-laid clays and silts which are relatively deep, somewhat poorly drained to very poorly drained and are dominantly reddish in color. Currently on the subject site, approximately three (3) to twelve (12)-feet of fill materials exist over the indigenous soils.

The present surface conditions indicate that the site is relatively flat with a slight grade to the east towards Gill Creek. However, this grade has been built-up with man-made fill materials. Based on a review of the historical aerial photographs, historical topographic maps and the soil borings on the site, the original land surface was three (3) to twelve (12)-feet lower than present and a small tributary creek to Gill Creek cut across the property. This tributary stream was apparently filled in the 1940's or 1950's.

The apparent fill area corresponds almost identically with the area of detected volatile material contamination. The indications are, that an old tributary stream bed lies under the northeast corner of the existing building and extends southeast towards Gill Creek where the seep was found. Historical indications of this tributary creek can be seen on the 1969 USGS map showing the wells and springs in the immediate vicinity of Niagara Falls, the 1972 U.S. Soil Conservation Service Soil Map and the 1951 Aerial Photograph.

The native silts and clays vary across the site depending on the location of the boreholes relative to the buried stream channel. Above the bedrock there is a red-brown or brown-black silty clay layer. This layer of silty clay is probably between four and ten feet thick and likely overlies the entire area. It is believed that this silty clay layer acts as a low permeability confining layer between the fill materials above, and the Lockport Dolomite bedrock below.

BEDROCK

The bedrock beneath this property is the Lockport Dolomite formation which is a dark grey to brown, massive to thin-bedded dolomite (Johnston, 1964). Based on the boring logs (B-1 through B-4), bedrock (refusal) was 16.5 to 18-feet below the ground surface. The other borings on site were not advanced to refusal, in order to reduce the chance of penetrating the confining layer. The thickness of the Lockport-Dolomite unit varies from 20-feet to 140-feet and is believed to be approximately 100-feet thick beneath the site (Johnston, 1964). The rock dips towards the south, in the region, at approximately 30-feet per mile (Johnston, 1964).

The ground water characteristics of the Lockport Dolomite have been well defined and generally consist of a zone of broken and fractured rock at the soil/bedrock interface and several open bedding joints at various depths. The layers between the fracture zones are generally characterized as impermeable zones. An observation well installed into the Lockport Dolomite near the southern end of the Drive-In parking area by the Power Authority in 1958 is reportedly affected by the level of water in Gill Creek and by the PASNY water conduits (Johnston, 1964). The well was drilled 55-feet into the Lockport Dolomite and reportedly has a yield of 45 gallons per minute (Johnston, 1964).

SECTION III

PREVIOUS ENVIRONMENTAL INVESTIGATIONS

A. SITE RECONNAISSANCE

Several visits were made to the site by an ESI environmental engineer and an ESI environmental geologist between May 15 and June 21, 1989. The purpose of these site visits were to observe current conditions at the site with regards to potential environmental concerns, to conduct a soil gas survey, to monitor test pits and soil borings and to observe the uses of the adjacent properties.

The property consists of a small office/laboratory building (40' x 75'), an asphalt driveway and parking lot, a front lawn area and an undeveloped area east and south of the building. There are no visible indications of underground storage tanks on the site. In addition, there are no ponds, pits or lagoons or other physical evidence of recent disposal of hazardous or non-hazardous materials on this site.

The walkover focused primarily on the fill materials present. Fill materials were observed on the surface of the undeveloped portion of the site and along the creek bank. Fill materials were also observed on the adjacent site to the south and on the creek bank across Gill Creek. The nature and extent of the fill materials were investigated using a combination of test pits and subsurface borings.

Fill materials observed on the surface included a lime-like material, broken glass, bricks, metal, concrete, one (1) crushed 55-gallon drum and porcelain pieces. The nature of the broken glass and recovered bottles from the test pits indicate that the fill is quite old. The glass is a mixture of types and colors. Indications of the age of the fill are the abundance of dark blue glass, white glass and uniquely shaped bottles not found in current wastes. An expert on glassware may be able to accurately date the age of the glass fill materials. Medicine type bottles, a milk bottle and a Pepsi (TM) bottle were some of the bottles found buried in the fill materials.

Vegetation is present on these fill materials near the creek. The focus of the majority of the subsurface exploration program is in the area of the fill materials between the building and the creek.

B. ADJACENT PROPERTIES

As part of the environmental site assessment, ESI completed a brief visual reconnaissance of the adjacent properties to determine their present use. The property across Witmer Road to the north is a park and is on land used by the Power Authority during the construction of the reservoir. North of the park is a large water reservoir used for hydroelectric power generation.

The property to the east of the site is separated from the site by Gill Creek. Immediately across the creek is an undeveloped area with visible indications of man-made fill. Further east is a residential subdivision and New York State Police facility.

The properties to the south and west of the subject site were once part of the subject property and have only recently been subdivided. This land south and east of the site is vacant. However, an industrial park is planned for this land. It is believed that varying amounts of fill materials are present on these adjacent sites.

C. GOVERNMENTAL AGENCY INFORMATION

ESI contacted Town of Niagara and Niagara County agencies to determine if there are any records of environmental concerns at the site. The following agencies or groups were contacted as part of this assessment: the Town of Niagara Tax Assessor, the Niagara Town Clerk, Niagara County Health Department, Town of Niagara Historian and the Niagara County Environmental Management Council. In addition, historical aerial photographs were obtained and reviewed from the United States Soil Conservation Service and Niagara County Highway Department. The U.S. Environmental Protection Agency (USEPA), National Priorities List and the New York State Department of Environmental Conservation (NYSDEC) Registry of

Inactive Hazardous Waste Sites were reviewed to determine if the subject property is a known hazardous waste disposal area.

The Town of Niagara Tax Assessor and the Town Clerk have no record of environmental concerns at the subject property. As stated previously, the Town Historian believes there is approximately six (6) feet of fill on the site.

Information obtained from the Niagara County Environmental Management Council land use maps on the subject property is as follows:

1. It is not on a NYSDEC designated wetland.
2. No known historical buildings or historical sites are on the property.
3. There is a small marsh present across Gill Creek.
4. The surface soils have been identified by the Environmental Council as being glacial ground moraine.
5. The vacant portions of the site have been identified as being covered by brush.
6. The soils of the subject property and the properties south and west generally consist of cut from an unknown borrow source. This includes all the land to the Niagara Expressway and Power Authority Tunnels.
7. The site has not been identified as a waste disposal site. The nearest known hazardous waste disposal site is approximately 3,750-feet (0.7 miles) south of the site.

The subject property is not adjacent to any of the inactive hazardous waste sites listed by the NYSDEC in their registry of inactive hazardous waste sites or on the USEPA National Priorities List (NPL).

The Niagara County Health Department Solid Waste division was contacted to determine if they have any information regarding environmental concerns on the subject property. According to Mr. Pat Dickey, the Department of Health is investigating the drainage from the lime-like materials on the property south of this site. The white, milky, lime-type, runoff is to be sampled and tested by the Department of Health during 1989. According to Mr. Dickey, the waste lime material is probably from SKW Alloys' predecessor company (Airco Alloys). There apparently is a large pile of this lime-like material just west of the I-190 near Witmer Road.

It should be noted that information available in the files of regulatory agencies only reflect those sites where inquiry and/or investigation by the NYSDEC, USEPA, local health/environmental departments or by input from the public at large have revealed the possibility of hazardous waste and/or associated activities involving hazardous materials that have taken place at or near the subject site. It should be further noted that answers to inquiries of this nature only reflect the information currently available to these agencies.

D. SUBSURFACE EXPLORATION

GENERAL

The reason for the initial Environmental Site Assessment was the detection of suspicious subsurface materials with relatively high organic vapor measurements in one of the four borings during a geotechnical investigation of the property for a proposed building expansion. The subsurface exploration program was conducted in several phases. The components of the subsurface investigation consisted of a soil gas survey, test pits and boreholes. Each series of testing was designed to better define the limits of the contaminated fill material. Soil samples for analytical testing were also recovered during the subsurface exploration program.

SOIL GAS SURVEY

ESI conducted a soil gas survey across the entire subject property. A 50-feet by 50-feet grid was established across the entire property and one-half inch soil gas sample pipes were installed at each of the nodes of the grid. The pipes were installed to a depth of three (3) feet below grade and the surface around the vent pipes were sealed with bentonite to reduce migration of soil gases around the outside of the pipes. Each of the pipes were capped and labelled. Prior to sampling, the pipe was purged to remove the air from within the pipe and to draw the soil gases into the pipe.

Organic vapor measurements were taken using a photoionization detector (PID), manufactured by Hnu Systems, Inc. of Newton Highlands, Massachusetts. The PID used was a Hnu Model PI-101 with a 10.2 eV ultraviolet light source. The meter was calibrated prior to use in accordance with the manufacturers instructions. This PID was used throughout the study to determine the relative concentrations of ionizable organic vapors in the soil samples.

The results of the soil gas survey are presented on Drawing No. 3 in Appendix A. ESI utilizes soil gas surveys as a preliminary tool for locating boreholes, test pits and wells where conditions warrant.

The soil gas survey did identify an area southeast of the building with elevated vapor readings. These conditions were further investigated with test pits and borings to better define the nature of the subsurface materials.

TEST PIT AND BOREHOLE EXPLORATION

A test pit and borehole exploration program was used to define the lateral extent of the organic vapor measurements. A particular concern, was the determination of the western boundary of fill materials which contained the elevated organic vapor readings. These were a concern in evaluating the feasibility of the proposed building expansion.

The test pit field logs and subsurface boring logs are presented in Appendix D. The test pit and borehole exploration program was conducted in several phases to provide time to interpret the data between each phase. The program consisted of the following phases:

PHASE: 1 (April 12 to 13, 1989)

DESCRIPTION: Geotechnical borings for proposed easterly and southerly expansion of the existing building.

FINDINGS: Elevated organic vapor readings (80-380 ppm) and chemical odors in the fill materials four to eight feet below grade in one of the boreholes.

SCOPE OF FIELD INVESTIGATION: 4 Boreholes (B-1, B-2, B-3 and B-4)

PHASE: 2 (May 15, 1989)

DESCRIPTION: Test pits were dug into the fill to determine the nature of the fill. The presence of glass in the fill suggested that a bottle may have been broken which contained paint thinner or a similar material.

FINDINGS: A resin-like sludge material with a dark red to black color was found in each of the test pits to be the source of the chemical odor and elevated organic vapor readings. The fill materials above the resin-like material contained broken glass and bottles. The type and colorings of the bottles indicate that the fill materials have been present for many years. Samples of the fill material were obtained for chemical analyses.

SCOPE OF FIELD INVESTIGATION: 3 Test Pits (TP-1, TP-2, and TP-3)

PHASE: 3 (May, 1989)

DESCRIPTION: A soil gas survey was conducted on 50-feet by 50-feet grid over the entire site to identify the areas of elevated organic vapor readings in the soil.

FINDINGS: Elevated organic vapor readings were found in the area surrounding Test Pits 1, 2 and 3. On the remaining portion of the site, the organic vapor readings were at or near background levels.

SCOPE OF FIELD INVESTIGATION: 39 soil gas pipes were installed and sampled.

PHASE: 4 (June 3, 1989)

DESCRIPTION: The results of the soil gas survey were used to locate borings to better define the lateral extent of the vapor producing resin-like fill material.

FINDINGS: The material was found in some of the boreholes and not in other areas and the preliminary boundaries of the resin-like fill material were established.

SCOPE OF FIELD INVESTIGATION: 7 Borings (B-5, B-6, B-7, B-8, B-9 B-10 and B-11)

PHASE: 5 (June 6, 1989)

DESCRIPTION: Additional holes were advanced using portable hand driven split-spoon sampling device due to the expected shallow depth of the resin-like material within the fill, and the difficult site access conditions.

FINDINGS: The perimeter of the area containing the resin-like fill area was better defined.

SCOPE OF FIELD INVESTIGATION: 8 boreholes (B-12, B-13, B-14, B-15 B-16, B-17, B-18 and B-19)

PHASE: 6 (June 5, 1989 and June 16, 1989)

DESCRIPTION: Based on the borings, soil gas survey and test pits in Phases 1 through 5, it appeared that the resin-like material was limited to an area southeast of the existing building. Additional test pits were excavated east of the new proposed foundation in order to accurately determine the western boundary of the resin-like material.

FINDINGS: The area was ringed with borings and test pits which defined the limits of the material to within approximately plus or minus 15-feet.

SCOPE OF FIELD INVESTIGATION: 8 boreholes (B-20, B-21, B-22, B-23, B-24, B-25, B-26, B-29)
6 test pits (TP-4, TP-5, TP-6, TP-7 TP-8 and TP-9)

PHASE: 8 (June 20 and 21, 1989)

DESCRIPTION: Additional borings were made in the area of concern to obtain samples for hazardous waste testing.

FINDINGS: The contaminated fill material was found near the northwest corner of the building and beneath the parking lot near the southeast corner of the building.

SCOPE OF FIELD INVESTIGATION: 10 boreholes (B-27, B-28, B-30 B-31, B-32, B-33, B-34, B-35, B-36 and B-37).

PHASE:	9 (July 13 and 21, 1989)
DESCRIPTION:	Additional borings were made in the area of concern to obtain samples for hazardous waste testing.
FINDINGS:	Analytical Results Presented in Section V.
SCOPE OF FIELD INVESTIGATION:	2 boreholes (B-38 and B-39)

A summary of the materials found in trace quantities in the miscellaneous fill above the resin-like material are listed below:

- Glass bottles (broken and intact)
- Brick
- Wire Cable
- Metal
- Paper
- Wood
- Cobbles, boulders and gravel
- Porcelain
- Concrete
- Clay Pipe
- Cloth
- Cardboard
- Slag
- Cinders
- Lime-Like Material
- Plastic
- Nail
- Tile
- Roots
- Black Charcoal-Like Wood

The overall findings of this extensive subsurface exploration program were as follows:

- In all cases, the elevated organic vapor measurements were associated with the dark red to black resin-like material. Therefore, the contamination was identified both visually and through the use of a photoionization organic vapor detector.

- Estimates of the thickness of the resin-like material vary from borehole to borehole. The thickness ranged from a trace to approximately six (6)-inches and average approximately two (2)-inches. Accurate thickness of the resin-like material was difficult to determine due to poor recovery (approximately 75%) in most of the split-spoons. This relatively poor recovery primarily was due to the stones and bricks in the fill.

SECTION IV

PHASE II SUBSURFACE EXPLORATION

A. GENERAL

ESI advanced five (5) test borings (GW-1 to GW-5) and installed ground water monitoring wells in each of the test borings. In addition, eight (8) subsurface soil samples and one (1) resin sample were taken from between zero (0) and four (4)-feet below the ground surface. Test borings, monitoring well installations and subsurface soil sampling were completed from May 21, 1990 to May 24, 1990. The ground water monitoring wells and subsurface soil sample locations are plotted on Drawing No. 4 presented in Appendix A.

The monitoring well and subsurface soil sample locations were determined by ESI and the NYSDEC as part of the subsurface investigation plan approved by the NYSDEC. A representative of the NYSDEC was on-site during the subsurface exploration and well installation phase of the investigation.

The five (5) monitoring wells are located both within the previously determined zone of organic contamination and on the perimeter of the zone. Two (2) wells (GW-1 and GW-2) are located within the zone of known contamination. Test boring logs, monitoring well installation details and subsurface soil sampling logs are presented in Appendix D.

Ground surface and well riser elevations at each of the monitoring well locations were measured in the field by ESI using optical survey methods. Ground surface elevations were referenced to a benchmark established as the finished floor surface at the east door on the south side of the existing building. ESI used an assumed elevation of 100.00 feet at this point. The benchmark location is plotted on Drawing No. 3 presented in Appendix A.

B. TEST BORING PROCEDURES

ESI advanced the five (5) test borings and installed five (5) ground water monitoring wells between May 21 and 24, 1990. Four (4) of the test borings were advanced with a track mounted Central Mine Equipment (CME) bombardier rotary drill rig, one (1) test boring was advanced with a truck mounted, Acker AD II rotary drill rig.

An ESI environmental geologist monitored drilling and well construction activities and prepared boring logs and well installation reports which are presented in Appendix D.

Generally, the test borings (GW-1 through GW-5) were advanced to depths of 10.0 to 12.0-feet below ground surface with 4-1/4-inch inside diameter (I.D.) hollow stem augers. The hollow stem augers were equipped with a bottom plug to prevent material from entering the bottom of the augers. The 4-1/4-inch augers allowed construction of a sand filter pack around the well screens.

Representative soil samples of the overburden were obtained by driving a standard 2-inch outside diameter (O.D.) split-spoon sampler into the undisturbed material below the auger casing with a 140-pound hammer falling freely a distance of 30-inches (American Society of Testing Materials [ASTM] Method D-1586). Split-spoon samples were taken continuously from ground surface to the bottom of the borehole at 10.0 to 12.0-feet. Soil samples were collected from each sampling interval and were stored in tightly sealed pint sized glass jars with screw-on lids denoting hole, sample number, sampling interval and blow counts. The recovered soils in the split spoons were photographed and screened with a photoionization detector. The photographs of the split spoons are presented in Appendix E.

ESI monitored the subsurface explorations and prepared boring logs based on visual observations of the recovered soil samples. The soil samples were generally described using ASTM D-2488 for identification of soils. Features such as relative density and consistency (obtained from the blow counts), color, grain size, moisture, etc. were recorded on the boring logs. Refer to Appendix D for the subsurface boring logs.

C. MONITORING WELL INSTALLATIONS

Ground water monitoring wells were installed in each of the five (5) test borings upon boring completion. The ground water monitoring wells were installed in the fill materials at the site and set at depths below ground surface of 9.2-feet (GW-1), 9.5-feet, (GW-2) 9.0-feet, (GW-3) 9.5-feet, (GW-4) and (GW-5) 9.6-feet. Each well consists of five (5)-feet of two (2)-inch I.D. polyvinyl chloride (PVC) slotted (0.010-inch) well screen. Each well consists of two (2)-inch I.D. PVC flush coupled threaded, PTFE (Teflon taped) joint riser pipe extending above the ground surface. Well GW-3 consists of riser pipe to ground surface. Quartzite sand (No. 2) was used as a sand pack to fill the annular space between the well screen and the borehole wall from the bottom of the borehole to a minimum of one (1)-foot above the top of the slotted well screen. A two (2)-feet minimum bentonite pellet seal was placed above the sand pack and the pellets were hydrated with approximately five (5)-gallons of potable water. A three (3) percent granular bentonite and Type I Portland Cement grout was installed from the top of the bentonite pellet seal to ground surface. Protective steel casings with locks were installed on wells GW-1, GW-2, GW-4 and GW-5 and a locking well cap and a protective curb box (installed flush with the ground surface) was installed at the top of well GW-3 to avoid outside contamination. The well construction diagrams are presented in Appendix D.

D. SOIL SAMPLING

ESI obtained nine (9) subsurface soil samples for analytical testing. Four (4) samples were obtained from the perimeter of the plume of contamination, four (4) samples were obtained from within the plume of contamination and one sample was taken of the phenolic type red resin, as described in the approved work plan. The sample locations are plotted on Drawing No. 5 presented in Appendix A.

The four (4) samples within the area of known contamination and the resin sample were obtained from ground surface to the top of the resin. The remaining four (4) samples were obtained from 0.0 to 4.0-feet below ground surface. Seven (7) of the soil samples (SB-2, SB-3, SB-4, SB-5, SB-7, SB-8 and resin sample) were obtained by driving a three (3)-inch O.D. split spoon sampler with a 140 pound hammer falling freely a distance of 30-inches (American Society of Testing Materials [ASTM] Method D-1586). Samples SB-1 and SB-6 were obtained by driving a 3-inch O.D. split spoon sampler with an A.G. Penetrometer Hammer by manual methods. The recovered samples were classified by an on-site environmental geologist, measured for percent recovery and photographed. Resin thickness and depth (if encountered) was also measured. Refer to Appendix E for photographs of recovered soil samples.

Recovered samples, from each sampling location, were composited on site in a stainless steel mixing bowl and placed directly in precleaned glass jars with teflon lids. In accordance with the approved work plan any glass which may have been present in the samples was sorted and removed from the sample. Proper chain-of-custody forms were completed with required sample location and analysis. Samples were then packaged, cooled and sent to the laboratory for analysis.

All sampling equipment was decontaminated between each sample location with a steam cleaner to reduce potential cross contamination between sample locations.

E. SEEP SAMPLING

ESI obtained a sample from the seep, exiting the soil bank into Gill Creek for total and dissolved USEPA Target Analyte List (TAL) metals and oil and grease, as agreed on by ESI and the NYSDEC. A shallow pit was excavated in the creek bank above the level of the creek. The seep water was allowed to pool in the excavated pit and was then bailed three (3) times prior to sampling. The excavated pit was made with a precleaned hand shovel and bailed with a precleaned glass jar.

A sample for dissolved metals was collected from the seep and filtered through a 0.45 micron filter. The required samples were placed directly into precleaned bottles with teflon lids and appropriate preservatives were added.

A proper chain-of-custody form was completed. Samples were then packaged, cooled and shipped to the laboratory for analysis.

F. WELL DEVELOPMENT

The monitoring wells installed by ESI at the Witmer Road Drive-In site were developed after completion of the well installations. The purpose of well development is to increase the wells specific capacity, to restore the natural permeability of the formation adjacent to the borehole to remove clay and silt size particles or other fines from the formation and to obtain the maximum economic well life. The wells were developed between May 30 and 31, 1990. The equipment and methods used to develop these wells are described in this section.

The wells were developed by repeatedly purging water from the wells with precleaned, dedicated, stainless steel bailers. The purged water was regularly sampled during development and the samples were measured for pH, conductivity, temperature and turbidity. Generally, purging was continued until the values of these parameters stabilized or at least ten (10) well volumes of water were removed from the well.

A calibrated Beckman (phi-10) meter with a combination electrode was used to measure the pH and temperature of the purged water samples. The pH meter was calibrated at a pH of 7.0 and 10.0. The conductance of the water was measured with a YSI Water Quality Instrument Model 33, at a temperature of 25° C. The conductance meter was calibrated for temperature and to a known value on the meter. The instrument probes (pH, temperature and conductance) were rinsed with deionized water between measurements. Turbidity was measured in the field using a portable turbidimeter (Model 16800) manufactured by Hach Company, Inc. The Hach turbidity meter was calibrated a minimum of once a day using the manufacturers turbidity standards.

The water level measurements were made in the wells using a Slope Indicator Company (Sinco) electronic water level indicator calibrated in 1.0-foot increments. A six (6)-foot engineer's ruler was used to measure between 1.0-foot increments on the water level indicator cable.

The following procedure was used for developing the newly installed monitoring wells:

1. The water level in the well to be developed was measured and the volume of water in the well was determined. The bailer was then lowered to the bottom of the well and repeatedly raised and lowered to agitate any sediments around the well screen.

2. The well was bailed repeatedly and the evacuated water was emptied into a five (5) gallon pail to measure the volume evacuated. If the well was developed to dryness, it was allowed to recover, and then purging with the bailer continued.

3. Generally, a ground water sample was collected and measured for pH, temperature, conductance and turbidity after approximately two well volumes had been bailed. Bailing was continued for a minimum of ten (10) well volumes or until the measured parameters stabilized.

Ground water levels, pH, temperature and conductivity measurements are shown on the monitoring well development data sheets presented in Appendix F.

G. SURFACE WATER SAMPLING

In order to assess the potential environmental impact of the fill materials on the adjacent creek, ESI obtained surface water samples from three (3) locations. The water samples were analyzed for the USEPA target compound list (TCL) semi-volatiles, TCL volatiles, TAL metals, TCL pesticides, TCL PCB's, pH, conductivity, total cyanide, phenolics (4AAP) and oil and grease. Water samples were obtained from Gill Creek, upstream and downstream of the property, to determine the net impact on the stream, if any, from the property. The sampling at all locations was conducted on June 19, 1989. The upstream sample was obtained from near the center of the creek immediately downstream of the bridge across Witmer Road. The downstream sample was obtained from near the center of the creek at the southern edge of the property.

A third sample was obtained from a seep found in the stream bank wall. The location of the seep and the other sampling locations are shown on Drawing No. 3 in Appendix A. The seep was found under a piece of three (3)-inch diameter rubber hose. It is possible that this rubber hose was somehow, in the past, part of the drainage of the fill materials. No water was observed draining from the hose. The seep was sampled on June 19, 1989 and again on May 31, 1990.

The samples were taken using standard USEPA and NYSDEC protocols and procedures for obtaining water samples. Sample containers and preservation methods were in accordance with these protocols and procedures. Proper chain-of-custody records were maintained on all the samples and a copy of these records are presented in Appendix H. The samples were sent to Huntingdon Analytical Services (HAS) in Middleport, New York for analysis. HAS is a New York State Department of

Health certified environmental laboratory (Certificate No. 10833). It should be noted that the metal samples were not filtered and although this is not a concern for the stream samples, the seep sample contained a large amount of entrained soil and therefore, the metals concentration in the seep sample may overstate the actual concentrations present due to the increased particulate concentrations. The stream was flowing clear at the time of sampling and near its apparent normal level. The results of this previous sampling will be incorporated into the results of the current investigation.

SECTION V

FIELD AND LABORATORY TEST RESULTS

A. GENERAL

This section of the report presents the results of the field measurements and laboratory analytical testing. The Phase I results are included with the Phase II results in this section to intergrate all the information gathered, to date, at this site. This section of the report includes the results of the resin thickness determinations, organic vapor determinations, chemical analysis of the fill materials, hazardous waste characterization, ground water monitoring and stream and seep monitoring.

B. RESIN THICKNESS DETERMINATION

During the Phase II investigation the thickness of the resin layer was measured in the recovered soils in the split spoon samples. The approximate thickness and depth below grade are summarized on Table V-1. The thickness of the resin varied from a trace in borings SB-4 and GW-1 to approximately 7.2-inches in the sample obtained from boring SB-3. It should be noted that the resin is not actually a uniform thickness but exists as pockets and laminations over the given resin thickness. In other words, the resin is somewhat mixed with the soil or fill materials over the interval. The depth at which the material was encountered ranged from zero (0) to four (4) feet below grade.

TABLE V-1

SUMMARY OF RESIN THICKNESS
AND DEPTH DETERMINATIONS
4287 WITMER ROAD DRIVE-IN
TOWN OF NIAGARA, NEW YORK

Boring	Approximate Resin Thickness (Inches)	Depth Below Grade
AREA OF KNOWN RESIN CONTAMINATION		
SB-1	5.5"	0-2'
	Trace	2-4'
SB-2/GW-2	1.2"	0-2'
	Trace	4-6'
SB-3	7.2"	2-4'
SB-4	Trace	0-2'
Resin Sample	1.2"	2-4'
GW-1	Trace	2-4'
AREA OF NO KNOWN RESIN CONTAMINATION		
SB-5	0	NA
SB-6	0	NA
SB-7	0	NA
SB-8	0	NA
GW-3	0	NA
GW-4	0	NA

NA - Not applicable

C. ORGANIC VAPOR MONITORING

Organic vapor measurements were taken during the test boring program by ESI in order to evaluate air quality and the presence of ionizable contaminants in the soils at the site.

Organic vapor monitoring was completed during the test boring and soil sampling program. The results of the monitoring were compared to ambient background measurements to indicate the presence, or absence, of significant concentrations of ionizable organic vapors present below ground. Organic vapor measurements were taken at the top of the hollow stem augers with the augers set at various depths during drilling, on the samples as they were removed from the split-spoon, in the headspace of the sample jars after they were returned to the laboratory and at the top of the well risers prior to development of the wells.

Organic vapor measurements in the field were taken using a photoionization detector (PID). The PID used to measure total organic vapors was an Hnu model PI 101S manufactured by Hnu Systems, Inc. of Newton Highlands, Massachusetts and is equipped with an 10.2 eV ultraviolet light source.

Ambient "background" organic vapor measurements were taken upwind of each borehole and subsurface soil sample location, prior to drilling and/or sampling, to establish site conditions. The "background" measurements during the monitoring period from May 21, 1990 to May 24, 1990 generally ranged from 0.0 to 3.4 parts per million (ppm). PID measurements recorded in the field with the Hnu ranged from 0.0 ppm to 110 ppm. Four (4) subsurface sampling locations, SB-4, SB-5, SB-6 and SB-7, were not monitored in the field due to effect of adverse weather conditions on the meter at the time of sampling.

Organic vapor measurements taken in the headspace of the sample jars of the soil samples collected during field explorations generally ranged from 0.0 - 104 ppm. It should be noted that the headspace readings were taken on the monitoring well test borings only. The results of the sample jar headspace PID readings are summarized on the subsurface boring logs presented in Appendix D.

D. CHEMICAL CHARACTERIZATION OF FILL MATERIALS

During the initial investigation at this site, ESI obtained samples of the fill material for analytical testing. Soil samples from three test pits (TP-1, TP-2 and TP-3) were analyzed for the USEPA Target Compound List (TCL) volatiles, semi-volatiles, pesticide/PCB's and metals. A summary of the detectable organic compounds in one or more of the test pit samples is presented in Table V-2.

Ethylbenzene and xylene are the major organic compounds detected in fill materials and are the probable source of the elevated organic vapor measurements noted during the excavation of the test pits. These compounds are common commercial solvents (ethylbenzene 18th highest volume chemical produced and xylene 26th highest volume chemical produced in US [Source: Condensed Chemical Dictionary, 1987]).

Phenol and 2,4-dimethylphenol are the two other major compounds detected in the fill materials. 2,4-Dimethyphenol is also known as xylenol. The commercial uses of these four major compounds are summarized on Table V-3. The item that these four organic compounds have in common is their use in the manufacture of phenolic resins. The material that appears to be the source of the concern at this site has a dark-red, resin-like appearance.

TABLE V-2.

SUMMARY OF DETECTABLE ORGANIC COMPOUNDS IN THE FILL MATERIALS SAMPLED FROM TEST PITS 1,2, AND 3, WITMER ROAD DRIVE-IN 4287 WITMER ROAD, TOWN OF NIAGARA, NEW YORK

Parameter	CONCENTRATION (ppm) (mg/kg) TP-1	 TP-2	 TP-3
Volatiles			
Trichloroethene	<0.5	<0.5	0.950
Toluene	<0.5	<0.5	1.3
Ethylbenzene	<0.5	1,400	2.5
Total Xylene	120	7,200	8.9
Semi-Volatiles			
2,4 Dimethylphenol	2.4	8.7	0.33
Phenol	65	19.2	18.0
Di-n-Butylphthalate*	0.47	0.60	<0.33
1,2-Dichlorobenzene	0.43	0.43	<0.33
Fluoranthene	0.33	<0.33	<0.33
Naphthalene	1.2	2.0	<0.33
Pyrene	0.63	<0.33	<0.33
1,2,4 Trichlorobenzene	1.2	0.97	<0.33
Pesticides/PCB's			
Aldrin	<0.01	0.017	<0.01
A-BHC	0.023	0.018	0.087
B-BHC	<0.01	<0.01	0.047
D-BHC	<0.01	<0.01	0.022
G-BHC	<0.01	<0.01	0.013
PCB-1254	<0.20	<0.02	0.68

* = Present in the preparation blank

TP - Test Pit

TABLE V-3

COMMERCIAL USAGE OF PRIMARY ORGANIC COMPOUNDS DETECTED IN THE FILL

COMPOUND	USE
ETHYLBENZENE	Intermediate in production of styrene and resin solvent.
XYLENE	Aviation gasoline; protective coatings; solvent for alkyd resins, lacquers, enamels, rubber cement; synthesis of organic chemicals, production of benzoic acid, phthalic anhydride, isophthalic and terephthalic acids, dimethyl esters, and manufacturing dyes.
PHENOL	Phenolic resins; epoxy resins; nylon-6, 2,4, D, selective solvent for refining lubricating oils, adipic acid, salicylic acid, phenolphthalein, pentachlorophenol, acetophenetidine, picric acid, germical paints, pharmaceuticals, laboratory reagents, dyes and indicators, slimicide, biocide, and general disinfectants.
2,4 DIMETHTLPHENOL	Disinfectants, solvents, pharmaceuticals, insecticides and fungicides, plasticizers, rubber chemicals, additives to lubricants and gasoline manufacturer of polyphenylene oxide, wetting agents, dyestuff and manufac turer of artificial resins.

Based on the available information, the material of concern at the site is probably a waste material, phenolic resin compound and its associated solvents.

The other organic chemicals detected in the fill material are present in concentrations near the level of detection and probably represent typical levels in uncontrolled man-made fill. The major compounds and the other compounds detected will be further discussed in the ground water evaluation.

The results of the metals analysis on the fill materials are presented in Table V-4. Most of the TAL metals detected in the fill were present at or below those compounds in the earth or the published typical New York State background levels. However, arsenic, barium, copper, calcium, lead, thallium and zinc were slightly elevated above the average crustal abundance and/or the typical New York State background levels in one or more of the samples. It is likely that the man-made fill materials contain trace levels of these metals above the average concentrations. This may be due to paints, glassware, porcelain and metal objects buried in the fill. Lead is the only metal present which appears to be significantly elevated to a point of being a potential environmental concern. The hazardous waste testing, discussed in the next section, further addresses the potential environmental impact of the presence of lead.

TABLE V-4

COMPARISON OF FILL MATERIAL METALS CONCENTRATIONS WITH NATURALLY OCCURRING ELEMENTS FROM TEST PITS 1, 2 AND 3, WITMER ROAD DRIVE-IN, 4287 WITMER ROAD, TOWN OF NIAGARA, NEW YORK

	CONCENTRATION (mg/kg) (ppm)				
Parameter	TP-1	TP-2	TP-3	Average Abundance Crustal Rock*	Typical Background Levels in Surface Soils**
Aluminum	13,900	24,100	19,600	81,300	1,000-25,000
Antimony	<52.4	<50	<50.3	0.2	NA
Arsenic	76.3	79.4	65.2	2	0.1-45
Barium	754	963	490	400	15-600
Beryllium	<5.2	<5	<5	2	0.1-10
Cadmium	<5.2	<5	<5	0.2	0.01-2
Calcium	43,000	22,400	36,800	36,300	100-35,000
Chromium	65.7	45.7	31.9	200	1-100
Cobalt	<15.7	23.4	17.3	23	0.1-60
Copper	271	119	132	45	1-250
Iron	57,400	40,500	37,400	50,000	700-555,000
Lead	1,080	309	239	16	1-61
Magnesium	16,100	11,600	12,800	20,900	100-9000
Manganese	739	601	878	1,000	50-5,000
Nickel	42.5	65.1	46.4	80	0.5-60
Potassium	<5,240	<5,000	<5,030	25,900	100-43,000
Selenium	<52.4	<50	<50.3	0.9	0.01-12
Silver	<10.5	<10	<10.1	0.1	NA
Sodium	1,370	1,130	1,120	28,300	150-50,000
Thallium	142	149	<101	1	NA
Vandaium	34.3	45.7	37.4	110	1-300
Zinc	1,070	405	431	65	9-300

NA=Not Available

* Source: Berry, L.G. and Mason, Brain, "Mineralogy, Concepts, Descriptions, Determinations"

** Source: NYSDEC, "Background Concentrations of 20 Elements in Soils with a Special Regard for New York State.

E. HAZARDOUS WASTE CHARACTERIZATION

ESI obtained samples during both the Phase I and Phase II Investigations for hazardous waste characteristic testing. Drawing No. 5 in Appendix A shows the locations of the samples obtained for hazardous waste characterization testing. Drawing No. 5 and Table V-5 present the analytical results of the EP toxicity testing. Three samples collected during Phase I were analyzed for the organic fraction of the EP toxicity characteristics. The fill material was <u>not</u> found to be hazardous based on the EP toxicity organic fraction analysis.

The results of the EP toxicity test for the metals fraction indicated that the fill materials do <u>not</u> exhibit the characteristics of a hazardous waste based on the concentrations of arsenic, barium, cadmium, chromium, mercury, selenium, and silver.

Due to the elevated total lead levels, found in one sample during the Phase I Investigation, ESI conducted extensive EP toxicity testing for lead. This testing consisted of three samples obtained during the Phase I Investigation and nine samples obtained during the Phase II Investigation. Only one of the twelve (12) samples collected during the Investigation, exceeded the EP Toxicity criteria for lead. The criteria is set at 5.0 mg/l. All of the other samples from both the contaminated area and the area surrounding the

TABLE V-5

COMPARISON OF SOIL SAMPLES OBTAINED FROM THE WITMER ROAD DRIVE-IN SITE WITH THE USEPA HAZARDOUS WASTE CRITERIA

	Boring												
Parameter	B-38	B-39 (S-3)	B-39 (S-4)	Resin Sample	SB-1	SB-2	SB-3	SB-4	SB-5	SB-6	SB-7	SB-8	EPA Criteria*
Ignitability(°F)	145	>160	>160	NA	NA	NA	NA	NA	NA	NA	NA	NA	140
Corrosivity (as pH (SU))	7.4	7.8	8.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	<2 or >12.5
Reactivity													
Total Releasable Hydrogen Cyanide (mg/kg)	<50	<65	<53	NA	NA	NA	NA	NA	NA	NA	NA	NA	250
Total Releasable Hydrogen Sulfide (mg/kg)	<50	<65	<53	NA	NA	NA	NA	NA	NA	NA	NA	NA	500
EP Toxicity(mg/l)													
Arsenic	ND	0.038	0.048	ND	NA	NA	NA	NA	NA	NA	NA	NA	5.0
Barium	0.69	3.1	1.4	0.86	NA	NA	NA	NA	NA	NA	NA	NA	100
Cadmium	0.02	ND	ND	0.017	NA	NA	NA	NA	NA	NA	NA	NA	1.0
Chromium	0.02	ND	ND	0.019	NA	NA	NA	NA	NA	NA	NA	NA	5.0
Lead	8.1	0.38	0.08	0.179	0.657	0.417	1.27	0.634	1.72	0.294	ND	ND	5.0
Mercury	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	0.2
Selenium	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	1.0
Silver	0.03	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	5.0
Lindane	0.00005	0.00013	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4
Endrin	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
Methoxyclor	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	10.0
Toxaphene	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5
2,4,D	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	10.0
Silvex (2,4,5-TP)	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0

NA=Not Analyzed
ND=Not Detected
* 40 CFR 261

contaminated area were well below the criteria. The samples obtained during the Phase II portion of the investigation excluded the broken glass found on the site as required by the work plan. Based on the additional testing, it is likely that the slightly elevated lead detected in one of the twelve samples was due to a non representative sample which may have included paint chips, glassware or porcelain in higher than average concentrations.

Ignitability was tested during the Phase I Investigation and none of the three samples tested was found to exhibit the EPA hazardous waste criteria of ignitability. The results of the ignitability testing are presented on Table V-5. One sample has a flash point of 145°F which is very near the hazardous waste characteristic of 140°F and therefore if the wastes are excavated, it may be desirable for the soil to volatilize in order to raise the flash point and decrease any risk associated with ignitation. However, based on the sample results, the fill materials are not a hazardous waste based on the characteristic of ignitability.

Reactivity (releaseable hydrogen cyanide and releasable hydrogen sulfide) was tested during the Phase I Investigation and none of the three samples tested were found to exhibit the EPA hazardous waste criteria of reactivity.

F. GROUND WATER MONITORING

FLOW DIRECTION

The five wells were installed in the fill materials and overburden at the Witmer Road Drive-In site. Ground water elevations were obtained on May 30 and 31, 1990 and September 27, 1990. Table V-6 summarizes the ground water elevation data collected to date.

The ground water contours are plotted on Drawings No. 6 and No. 7 in Appendix A. The contours indicate that the direction of ground water flow is generally east towards Gill Creek. In May 1990, there was a gradient across the site of 0.18 ft/ft. This sharp gradient is probably due to the relatively steep creek bank. The flow pattern in September 1990 was similar however the gradient was lessened due to a change (drop) in ground water levels of approximately three feet. The presence of the suspected buried tributary channel is not apparent in the data collected and therefore, the representatives of the seep to the site with respect to the contamination, is suspect. The water in the seep, based on the flow patterns determined, would probably not be contaminated or only slightly contaminated.

The ground water elevations in spring may bring the ground water into direct contact with the dark red resin like material. For example, the ground water was approximately four feet below grade on May 30, and 31, 1990 in well GW-2 and the resin was found at approximately 0 to 6-feet below grade in this boring. However, in September 1990, the ground water elevation in well GW-2 had dropped to approximately seven (7)-feet below grade and would be below the phenolic resin layer. Therefore, a seasonal factor may be present that influences the ground water concentration of contaminants.

TABLE V-6

WITMER ROAD DRIVE-IN SITE
SUMMARY OF GROUND WATER ELEVATION DATA

Well No.	Ground Surface Elevation	Ground Water Surface May 30, 31, 1990	Ground Water Surface September 27,1990
GW-1	97.73	89.80	89.03
GW-2	98.01	94.05	91.07
GW-3	98.85	95.77	91.16
GW-4	97.67	91.14	88.50
GW-5	100.04	96.62	93.29
Gill Creek	NA	85.01	NA

* Arbitrary benchmark (100.00) established on finished floor of existing building.

NA -Not Available

GROUND WATER CHARACTERIZATION

ESI sampled the ground water from the five monitoring wells on May 30 and 31, 1990 as discussed in Section IV of this report. The ground water was analyzed in the field to determine pH, temperature, specific conductance and turbidity. The ground water samples were analyzed in the laboratory for TCL volatiles, TCL semi-volatiles (with tentatively identified compounds [tics]) and lead (total and dissolved). The laboratory data is reported in New York State CLP data format. The complete analytical data package is presented in Appendix G. A summary of the analytical data sheets is presented in Appendix H.

The field data (pH, temperature, specific conductance and turbidity) are summarized on Table V-7. Field data are presented on the Well Development Records and ESI Sampling Logs in Appendix F. Wells GW-1, GW-2, GW-3 and GW-4 all were purged to dryness during development, however, there was essentially no drawdown of water in well GW-5 during development. The two wells in the zone of contamination (GW-1 and GW-2) went dry at a very low flow rate. Based on the gallons removed and the elapsed time, the "pumping rate" from these wells would be less than the rates presented below:

GW-1	0.052 gpm
GW-2	0.047 gpm

The slow recoveries in these wells, and the fact that these measurements were made under relatively high water table conditions (Spring Conditions) are an important constraint in any design of a remediation system.

pH Analysis

The pH of the ground water varied widely across the site. Although the site is relatively small, the non-uniformity of the fill materials is reflected in the widely varying pH levels. The pH in the zone of known volatile and semi-volatile contamination (GW-1 and GW-2) is within the accepted NYSDEC Class GA ground water standards. The ground water from well GW-4 is also in the acceptable range (6.5 to 8.5) for Class GA waters, however, the pH of the water in wells GW-3 and GW-5 were elevated (basic) and above the Class GA ground water standards. An examination of the subsurface boring logs for these two wells indicates the following:

GW-3	Presence of trace quantities of cinders and slag
GW-5	White-gray sandy lime-like material from 0 to 10' below grade.

The presence of slag and cinders in well GW-3 probably accounts for the slightly elevated pH and similarly, the presence of lime-like material is the probable source of the significantly basic pH (7-14) in well GW-5. This lime-like material is visible on the surface of the site behind (south) of the building off the pavement and extending southward onto the adjacent properties. The source of this material is unknown, however it is probably unrelated to the organic

TABLE V-7.

SUMMARY OF FIELD ANALYSIS OF GROUND WATER SAMPLES
WITMER ROAD DRIVE-IN
4287 WITMER ROAD
TOWN OF NIAGARA, NEW YORK
(MAY, 1990)

Parameter	Well No.				
	GW-1	GW-2	GW-3	GW-4	GW-5
(SU)pH*	6.53	7.03	10.71	6.55	12.60
Temp(°C)*	18.3	18.2	16.0	16.0	17.0
Specific Conductance * (umho/cm @ 25° C)	1020	1110	1190	1700	5655
Turbidity(NTU)*	6	11	57+	178	47

* Average of four replicate measurements

** Turbidity measurement taken from first bailer of water removed from well.

SU Standard Units

NTU Nephelometric Turbidity Units

\+ Water brown and turbid at completion of sampling.

contamination noted in wells GW-1 and GW-2.

The lime-like waste, located on the south portion of the site, may be considered hazardous. A solid waste is considered hazardous if it exhibits the corrosivity characteristic. Corrosivity is defined as representing several properties including, an aqueous solution which has a pH less than or equal to 2 or greater than or equal to 12.5 as determined by a pH meter. The pH of the ground water from well GW-5 averaged 12.6, however the pH meter was not calibrated over this pH range and therefore the pH measurements should not be considered an absolute value but an indication only. It should be noted that the Niagara County Health Department and the NYSDEC have investigated this material at a location on Gill Creek south of the subject site. The results of the NYSDEC's investigation indicate that the leachable pH, of a sample collected from the surface, was 8.2. According to the NYSDEC, the site will probably not be investigated further or be listed as a hazardous waste site presently, however, it may eventually be listed as a candidacy or secondary site and require action at that time.

Currently the stipulations for listing a site include being associated with a process area or facility and/or the material failing the EP Toxicity test. According to the NYSDEC, this material did not fail the EP toxicity metals test and is not associated with a process facility on site.

It should be noted further that during the Phase I Investigation, three samples were tested to determine their corrosivity (pH). The three samples tested were not found to exhibit the characteristic of a hazardous waste based on corrosivity.

Volatile Compound Analysis

The results of the TCL volatile compound analysis of the ground water from the five wells is presented on Table V-8 and are summarized below:

Detectable TCL Volatile Compounds

	Well Concentration (mg/l)					
Compound	GW-1	GW-2	GW-3	GW-4	GW-4Dup	GW-5
Toluene	0.01	<1.0	<0.005	<0.005	<0.005	<0.014
Ethylbenzene	0.710	5.5	<0.005	<0.005	<0.011	<0.005
Xylene	5.50	40.0	0.012	<0.005	0.034	0.018

Toluene, ethylbenzene and xylene were the only TCL volatiles present above the analytical detection limits. The samples from wells GW-1 and GW-2 required dilution during analysis due to the presence of elevated concentrations of xylene and/or ethylbenzene, therefore, it is possible that other volatile compounds are present but are masked by the elevated detection levels. This potential masking is an inherent limitation of the analytical method.

The highest concentrations of toluene, ethylbenzene, and xylene were found in wells GW-1 and GW-2 which correspond to the previously identified zone of contamination. Toluene, ethylbenzene and xylene are common commercial solvents and exist as components of gasoline. The source of these volatile compounds is believed to be the carrier solvent for the phenolic resin like material found on the site. It is ESI's understanding that these solvents were historically used in the manufacture of phenolic resins.

TABLE V-8

SUMMARY OF VOLATILE COMPOUNDS
IN GROUND WATER FROM
WITMER ROAD DRIVE-IN
4287 WITMER ROAD
TOWN OF NIAGARA, NEW YORK

	Concentration (mg/l)					
Parameter	GW-1*	GW-2*	GW-3	GW-4	GW-4 Duplicate	GW-5
Chloromethane	<0.1	<2.0	<0.01	<0.01	<0.01	<0.01
Bromomethane	<0.1	<2.0	<0.01	<0.01	<0.01	<0.01
Vinyl Chloride	<0.01	<2.0	<0.01	<0.01	<0.01	<0.01
Chloroethane	<0.1	<2.0	<0.01	<0.01	<0.01	<0.01
Methylene Chloride	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
Acetone	<1.0	<20.0	<0.10	<0.10	<0.10	<0.10
Carbon Disulfide	<1.0	<20.0	<0.10	<0.10	<0.10	<0.10
1,1-Dichloroethene	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
1,1-Dichloroethane	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
1,2-Dichloroethene (total)	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
Chloroform	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
1,2-Dichloroethane	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
2-Butanone	<1.0	<20.0	<0.10	<0.10	<0.10	<0.10
1,1,1-Trichloroethane	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
Carbon Tetrachloride	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
Vinyl Acetate	<0.5	<10.0	<0.050	<0.050	<0.050	<0.050
Bromodichloromethane	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
1,2-Dichloropropane	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
cis-1,3-Dichloropropene	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
Trichloroethene	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
Dibromochloromethane	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
1,1,2-Trichloroethane	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
Benzene	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
trans-1,3-Dichloropropene	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
Bromoform	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
4-Methyl-2-Pentanone	<0.50	<10.0	<0.050	<0.050	<0.050	<0.050
2-Hexanone	<0.50	<10.0	<0.050	<0.050	<0.050	<0.050
Tetrachloroethene	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
1,1,2,2-Tetrachloroethane	<0.10	<1.0	<0.005	<0.005	<0.005	<0.005
Toluene	0.10	<1.0	<0.005	<0.005	<0.005	<0.014
Chlorobenzene	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
Ethylbenzene	0.710	5.50	<0.005	<0.005	0.011	<0.005
Styrene	<0.05	<1.0	<0.005	<0.005	<0.005	<0.005
Xylene (total)	5.50	40.0	0.012	<0.005	0.034	0.018

* = Elevated detection levels due to concentrations present.

SEMI-VOLATILE COMPOUND ANALYSIS

The results of the semi-volatile analyses are presented on Table V-9. Four (4) TCL semi-volatile compounds were detected in one or more of the wells. These analytical results are summarized below and on Drawing No. 8 in Appendix A.

DETECTABLE TCL SEMI-VOLATILE COMPOUNDS

	Well Concentration (mg/l)					
Parameter	GW-1	GW-2	GW-3	GW-4	GW-4Dup	GW-5
Phenol	9.4	86.0	0.022	<0.010	<0.010	<0.010
2-Methylphenol	2.1	21.0	<0.010	<0.010	<0.010	<0.010
4-Methylphenol	<0.5	2.2	<0.010	<0.010	<0.010	<0.010
2,4-Dimethyphenol	<0.5	6.0	<0.010	<0.010	<0.010	<0.010

The compounds listed above are all related to phenolics and are probably due to a single source of contamination. The phenolic contamination of the ground water appears to be essentially confined to the area of known contamination. No phenolics and only relatively low levels of ethylbenzene and xylene were detected in well GW-4. This indicates little or no migration of the contamination or potentially, a slightly different ground water flow pattern than that indicated by the information obtained from the five monitoring wells.

The gas chromatograph/mass spectrometer (GC/MS) semi-volatile testing was also used to determine if other compounds were present in the ground water that are not on the USEPA target compound list. The GC/MS was used to tentatively identify other organic compounds that may be present in the ground water and the results of these analyses are summarized on Table V-9. The nature of the unknown compounds listed is not defined, however these compounds may be associated with organic breakdown products, naturally occurring compounds or a waste material not currently determinable using the designated methods.

The TIC compounds (identifiable in wells GW-1 and GW-2) were all phenolic compounds such as 3-(1,1-Dimethylethyl) phenol; 2,3 dimethyl phenol; 2-ethylphenol; 2-ethyl 5- methyl phenol; and 2-ethyl phenol. It is likely that these TIC phenolic compounds are related to the phenolic compounds identified on the TCL list.

The potential environmental impact of the detected volatile and, semi-volatile compound including TIC's, will be discussed in the next section in conjunction with the field measurements, soil analysis and air monitoring data.

TABLE V-9
SUMMARY OF THE DETECTABLE TCL SEMI-VOLATILE COMPOUNDS AND TENTATIVELY IDENTIFIED SEMI-VOLATILE COMPOUNDS (TICS) IN THE GROUND WAATER - WITMER ROAD DRIVE-IN SITE
4287 WITMER ROAD
TOWN OF NIAGARA, NEW YORK

	Concentration (mg/l)					
Parameter	GW-1	GW-2	GW-3	GW-4	GW-4 (Dup)	GW-5
TCL SEMI-VOLATILE						
Phenol	9.4	86.0	0.022	<0.010	<0.010	<0.010
2-Methylphenol	2.1	21.0	<0.010	<0.010	<0.010	<0.010
4-Methylphenol	<0.5	2.2	<0.010	<0.010	<0.010	<0.010
2,4-Dimethylphenol	<0.5	6.0	<0.010	<0.010	<0.010	<0.010
TIC'S						
Ethylbenzene	0.4	3.0	ND	ND	ND	ND
Xylenes (Total)	3.37	7.3	ND	ND	ND	ND
Unknown A (1326)	4.0	3.8	ND	ND	ND	ND
3-(1,1-Dimethylethyl) phenol	2.0	1.8	ND	1.0	1.0	ND
Unknown B (1154)	ND	1.5	ND	ND	ND	ND
2,3 Dimethyl Phenol	ND	1.1	ND	0.016	0.020	ND
2-Ethylphenol	ND	4.0	ND	ND	ND	ND
Unknown D (1457)	ND	2.4	ND	ND	ND	ND
2-Ethyl-5-Methyl Phenol	ND	2.1	ND	ND	ND	ND
Unknown E (1708)	ND	1.0	ND	0.110	0.110	ND
Dimethyl Propanedoic Acid	ND	ND	0.012	ND	ND	ND
Unknown F (662)	ND	ND	0.018	ND	ND	ND
Unknown G (687)	ND	ND	0.045	ND	ND	ND
Unknown H (715)	ND	ND	0.026	ND	ND	ND
Hexanoic Acid (777)	ND	ND	0.015	ND	ND	ND
Unknown I (1472)	ND	ND	0.014	ND	ND	ND
Unknown J (2506)*	ND	ND	0.074	0.038	0.120	0.059
4,4-Dimethyl-1,3 Dioxane	ND	ND	ND	0.035	0.039	ND
Unknwon K (795)	ND	ND	ND	0.017	0.019	ND
Unknwon L (873)	ND	ND	ND	0.023	0.027	ND
Unknown M (1334)	ND	ND	ND	1.7	2.1	ND
3,4,5-Trimethyl Phenol	ND	ND	ND	0.019	0.024	ND
2-Ethyl-6-Methyl phenol	ND	ND	ND	0.007	ND	ND
Unkown N (1488)	ND	ND	ND	0.024	0.028	ND
2-(1,1-Dimethylethyl) phenol	ND	ND	ND	0.024	0.029	ND
Unknown O (1840)	ND	ND	ND	0.020	0.024	ND
1,3,5-Cycloheptatriene	ND	ND	ND	ND	ND	0.008
Unknown P (2963)	ND	ND	ND	ND	ND	0.009

* Present in rinsate blank and trip blank

ND-Not Detected

LEAD ANALYSIS

The five wells on the site were sampled and analyzed to determine the lead concentration in the ground water as specified in the approved Work Plan and the results of these analyses are presented on Table V-10. The conclusions from the data are that no lead was detected in the ground water samples from the two wells installed in the area of known organic contamination. The lead concentration in the designated upgradient well (GW-3) was elevated (0.239 mg/l), however, the samplers noted that this well went dry quickly and the water was brown and turbid during sampling, therefore, ESI attempted to redevelop and resample this well on September 28, 1990. The limited amount of water and slow recharge rate in the well precluded effective redevelopment and the total lead concentration including solids actually increased during the second round of sampling. In ESI's opinion this well (GW-3) is not adequately developed with respect to contaminants that may be present in particulate form (i.e. lead). ESI will address this issue in the recommendations section of this report.

The concentration of lead in well GW-4 exceeded the NYSDEC class GA standard of 0.025 mg/l but was within the allowable discharge concentration (Schedule I) for discharges to ground water of 0.05 mg/l.

The concentration of lead in well GW-5 was below the Class GA drinking water standards.

TABLE V-10

SUMMARY OF LEAD ANALYSIS
OF GROUND WATER FROM THE
WITMER ROAD DRIVE-IN SITE
4287 WITMER ROAD
TOWN OF NIAGARA, NEW YORK

	Concentration (mg/l)					
Parameter	GW-1	GW-2	GW-3	GW-4	GW-4(Dup)	GW-5
Lead (Total)	<0.005	<0.005	0.239 (3.19)	0.0437	0.0517	0.0097
Lead (Dissolved)	NA	NA	(0.006)	NA	NA	NA

( ) Results of additional sampling and analysis on September 28, 1990.

NA - Not Analyzed

POLYCHLORINATED DIBENZO-P-DIOXINS AND POLYCHLORINATED DIBENZOFURANS

Based on the recommendations of Huntingdon Analytical Services, (HAS) after review of the GC/MS semi-volatile data, ESI had a portion of the ground water samples from GW-1 and GW-2 analyzed to determine the concentrations of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans. This work was beyond the scope of the work plan for the site, however, ESI deemed it prudent to analyze for these compounds based on the recommendations from HAS. The samples were analyzed by Twin City Testing Corp., Saint Paul, Minnesota, a sister company of ESI using a modified version of USEPA Method 8290. A detailed discussion of the analytical method and the results are presented in Twin City Testing Corp. report presented in Appendix H.

The results of this additional testing are summarized on Table V-11. The ground water concentration in both wells was below the NYSDEC Class GA standard for 2, 3, 7, 8 tetrachloro-dibenzo dioxin in both wells. Although chlorinated dibenzo furans and dibenzo dioxins are present in both ground water samples, the concentrations present are below the established standards.

TABLE V-11

SUMMARY OF DETECTABLE POLYCHLORINATED DIBENZO-P-DIOXINS AND POLYCHLORINATED DIBENZOFURANS IN GROUND WATER SAMPLES FROM THE WITMER ROAD DRIVE-IN SITE 4287 WITMER ROAD, TOWN OF NIAGARA, NEW YORK

	Concentration (ug/l)		
Parameter	**GW-1**	**GW-2**	**NYSDEC Class GA Standard**
2,3,7,8-TCDF	0.0000043	0.0000078	NS
Total TCDF	0.0000043	0.00004	NS
2,3,7,8-TCDD	ND	0.000032	0.000035
Total TCDD	0.0000069	0.000046	NS
2,3,4,7,8 Pe CDF	ND	0.000005	NS
Total PeCDF	ND	0.000072	NS
Total PeCDD	ND	0.000029	NS
1,2,3,4,7,8 HxCDF	0.0000021	0.000014	NS
1,2,3,6,7,8 HxCDF	ND	0.0000089	NS
1,2,3,7,8,9 HxCDF	0.0000038	0.0000033	NS
2,3,4,6,7,8 HxCDF	ND	0.0000032	NS
Total HxCDF	0.0000079	0.0000790	NS
1,2,3,4,7,8 HxCDD	ND	0.0000077	NS
1,2,3,6,7,8 HxCDD	ND	0.000039	NS
1,2,3,7,8,9 HxCDD	ND	0.000024	NS
Total HxCDD	ND	0.00019	NS
1,2,3,4,6,7,8 HpCDF	ND	0.000023	NS
1,2,3,4,7,8,9 HpCDF	0.0000031	0.0000036	NS
Total HpCDF	0.0000031	0.000027	NS
1,2,3,4,6,7,8 HpCDD	0.0000017	0.00019	NS
Total HpCDD	0.000024	0.00032	NS
OCDF	0.0000069	0.000083	NS
OCDD	0.0000710	0.00055	NS
Total 1,2,3,7,8 TCDD Equivalence	0.0000006	0.0000371	NS

TCDF - Tetrachloro Dibenzo Furan
TCDD - Tetrachloro Dibenzo Dioxin
PeCDF - Pentachloro Dibenzo Furan
PeCDD - Pentachloro Dibenzo Dioxin
HxCDF - Hexa-chloro Dibenzo Furan
HxCDD - Hexa-chloro Dibenzo Dioxin
HpCDF - Hepta-chloro Dibenzo Furan
HpCDD - Hepta-chloro Dibenzo Dioxin
OCDF - Octa-chloro Dibenzo Furan
OCDD - Octa-chloro Dibenzo Dioxin

ND - Not Detected
NS - No Current Standard

G. STREAM AND SEEP SAMPLING RESULTS

The laboratory results of the stream and seep sampling are presented in Appendix H and are summarized on Table V-12 and V-13. There were no detectable organic compounds in the seep, the upstream sample or the downstream sample collected from Gill Creek. This indicates that no detectable organic compounds have been determined to be migrating from the fill and entering the water in Gill Creek. The absence of organic compounds in the surface water samples combined with the probable age of the fill (approximately 40 years), indicates that there is some other inhibiter present which is reducing or preventing migration of the organic compounds. This ihibiter may be a combination of the soil matrix, the resin matrix, limited available ground water or the presence of low permeable materials around the fill.

The pH, specific conductance, cyanide and oil and grease measurements on the stream and seep samples were all within the range of expected values. A slight increase (~0.002 mg/l) in the total phenolics (4AAP) was noted in the downstream sample, however this is within the range of expected variation in the laboratory method and not considered significant.

The results of the metals analyses on the surface water are presented on Table V-13. To date, only lead has been identified as a potentially significant metal related to the site. The total lead in the seep was measured at 0.084 mg/l in 1989 and 0.0141 mg/l in 1990 (dissolved <0.005 mg/l) and does not appear to be a significant concern in the seepage from the site. The concentrations reported for the metals present in the seep samples may overstate the actual concentrations present due to the sediment present in the sample matrix.

TABLE V-12
ORGANICS AND CONVENTIONAL SUMMARY OF DETECTABLE PARAMETERS IN WATER SAMPLES FROM THE WITMER ROAD DRIVE-IN SITE
4287 WITMER ROAD, TOWN OF NIAGARA, NEW YORK

	Concentration (mg/l)				
Parameter	(1989)	(1990)	Upstream	Downstream	Water Quality Standard
Organics					
Pesticides/PCB's	ND	NA	ND	ND	-----
TCL Semi-Volatiles	ND	NA	ND	ND	-----
TCL Volatiles	ND	NA	ND	ND	-----
Conventional					
pH (SU)	7.28	NA	7.92	7.71	6.0-9.5
Total Cyanide	ND	NA	ND	ND	0.020
Phenolics (4AAP)	ND	NA	ND	0.007	0.005
Oil and Grease	ND	8.3	1.1	1.1	NS
Specific Conductance (umho/cm at 25°C)	1,750	NA	1,560	1,570	NS

NS-No Standard
ND-Not Detected
NA-Not Analyzed

TABLE V-13
SUMMARY OF DETECTABLE METALS IN WATER SAMPLES FROM THE WITMER ROAD DRIVE-IN SITE 4287 WITMER ROAD, TOWN OF NIAGARA, NEW YORK

	Total Concentration (mg/l)			
Parameter	Seep (1989)	Seep (1990)	Upstream	Downstream
Aluminum	10.9	5.99 (0.289)	0.29	0.39
Barium	0.47	0.122 (0.0896)	0.05	0.06
Cadmium	0.006	<0.024 (<0.024)	<0.005	<0.01
Calcium	409	112 (11.4)	74.8	79.8
Chromium	0.02	<0.019 (<0.019)	<0.01	<0.02
Cobalt	0.02	<0.05 (<0.05)	<0.015	<0.03
Copper	0.05	0.0432 (0.0241)	<0.01	<0.02
Iron	6.78	4.94 (0.240)	0.45	0.84
Lead	0.084	0.0141 (<0.005)	<0.005	0.015
Magnesium	59.7	16.7 (15.7)	26.1	27.4
Manganese	2.98	0.253 (0.113)	0.05	0.05
Mercury	0.0003	<0.0002 (<0.0002)	0.0003	0.0003
Potassium	7.3	6.28 (<5.0)	5.7	11
Selenium	<0.005	<0.005 (<0.005)	0.006	<0.005
Sodium	41.6	64.2 (66.4)	26.7	25.7
Zinc	0.35	<0.02 (<0.02)	0.06	0.01

(   ) Dissolved fraction ($\leq$0.45 um)

SECTION VI

POSSIBLE REMEDIAL ALTERNATIVES

A. GENERAL

In this section of the report, several possible remedial alternatives will be briefly discussed, in order to begin the evaluation and selection process and to identify any additional data that should be collected to aid in the selection and implementation of the remedial actions. This discussion is not intended to replace a Remedial Investigation/Feasibility Study (RI/FS) or remedial design, but to provide a framework for implementing the remedial activities.

The USEPA and NYSDEC have developed procedures and guidance documents to aid in the collection of the data and selection of the remedial alternatives. These documents will be used by ESI, to the extent practicable, in selecting the remedial approach. Risk assessment data, health effects information and published criteria will also be used in the selection and implementation of the remedial alternatives.

B. SUMMARY OF EXISTING SITE CONDITIONS

A phenol resin waste material ranging in thickness from a trace amount to approximately 7.2-inches is present approximately 1 to 4 feet below grade. This waste material exhibits a distinct magic marker like odor when disturbed. The major constituents of the waste material are ethylbenzene;

xylene; 2,4, dimethylphenol; and phenol. Relatively low concentrations of several other volatile, semi-volatile and pesticide/PCB compounds are present but should not constrain the remedial selection. The waste material is visually a dark red, resin like material that can be easily identified. The waste has probably been present on the site for approximately forty years.

Organic contamination of the ground water appears to be limited to the originally defined area of volatile contamination. This area covers approximately 7,500 square feet in roughly an oblong shape starting at the southwest corner of the building and extending south/southeast towards Gill Creek. The ground water contamination may result when seasonally high ground water comes into contact with the buried phenolic resin. Ground water recharge appears to be slow and the ground water levels vary by several feet, probably on a seasonal basis.

C. CONSTRAINTS AND DESIGN CONSIDERATIONS

SITE FEATURES

Site Access:	Good - Vegetation limited to brush and small trees
Available Land:	Sufficient amount of vacant land is available on the site for most remedial options.

Topography:	Land is relatively flat.
Building:	Building is unoccupied and sufficient space is probably available for a small project office.
Surrounding Land:	Commercial industrial (generally undeveloped). Residential areas across Gill Creek and downwind of the prevailing winds. Recreational across Witmer Road.
Utilities:	Power, water and sanitary sewer hookups are available.

CONTAMINATED AREA = ~7,500 Square Feet (0.17 acres).

WASTE MATERIAL:

1) Resin like with limited exposed surface area.
2) Material has not naturally biodegraded in the unsaturated soil zone in 40 years.
3) Resin material not easily separated, physically, from surrounding soils.
4) Resin releases a strong distinct odor when disturbed.
5) Waste material is not a hazardous waste based on reactivity, corrosivity, ignitability and EP Toxicity.
6) Flash point of one sample was sufficiently low (145°F) to include this as a design constraint.
7) Material and ground water from well GW-5 outside the zone of contamination may be a hazardous waste based on corrosivity ($pH>12.5$)
8) Excavation may cause the uncontrolled release of volatiles (ethylbenzene, toluene, and xylene).

GROUND WATER:

1) Well recharge rates are slow and wells can easily be pumped dry.
2) No information regarding contamination at the top-of-rock zone is known.

3) Organic contamination of ground water is essentially limited to the known zone of contamination.

4) Ground water appears to flow generally east, towards Gill Creek.

5) Ground water elevations, vary by in the wells at least four feet.

6) There is probably insufficient water for a nonaugmented pump and treat type system.

SITE GEOLOGY:

1. Waste material is believed to overlie a clay layer several feet thick.

D. CHEMICAL AND PHYSICAL PROPERTIES OF THE WASTE CONSTITUENTS ON SITE

In order to effectively implement remediation of the site, the chemical and physical properties of the waste constituents need to be known and understood. These properties include water solubility, vapor pressure, Henry's Law constant, octanol-water partition coefficient (Kow), organic carbon partition coefficient (Koc), density, molecular weight, melting point, dissociation constant (pka), flash point and odor threshold. Table V1-1 presents the available chemical and physical properties of the primary waste constituents. One of the goals of the next phase of work on the site would be to obtain information on the waste material where insufficient information is present.

TABLE VI-1
CHEMICAL, AND PHYSICAL PROPERTIES OF WASTE CONSTITUENTS
FOUND AT THE WITMER ROAD DRIVE-IN SITE
4287 WITMER ROAD, TOWN OF NIAGARA, NEW YORK

Chemical Name	Cas No.	Water Solubility (mg/l)	Vapor Pressure (mmHg)	Henry's Law Constant atm-m^3/mol	Koc	Kow	Density (g/cm^3)
Toluene	108-88-3	535	28.1	6.37×10^{-3}	300	537	0.8623
Ethylbenzene	100-41-4	152	7.0	6.43×10^{-3}	11.0	1410	0.8670
Xylene	1330-20-7	170.5	5-10	7.04×10^{-3}	48-68 240	Unknown	App. 0.86-0.88
Phenol	108-95-2	93,000	0.341 0.41	4.54×10^{-7} 3.97×10^{-7}	16.2-91 1.21-1.96	1.46 28.8	1.0533 to 1.072
2-Methylphenol (o-cresol)	95-48-7	25,000	0.243	1.5×10^{-6}	Unknown	89.1	1.047
2,4-Dimethylphenol (xylenol)	1300-71-6	4,200	0.0621	2.38×10^{-6}	222	263	0.965 to 1.03

Source: (1) USEPA, "Basics of Pump and Treat Ground Water Remediation Technology," EPA/600/8-90-003, March, 1990.
(2) USEPA, "Health Effects Assessment For Phenol," July 1989, PB90-142472
(3) Agency For Toxic Substances And Disease Registry, "Toxicological Profile For Phenol," PB90-181249.
(4) USEPA, "Health Effects Assessment For Xylenes," PB90-142506, August, 1989.
(5) Hawley, Condensed Chemical Dictionary
(6) CRC, Handbook of Chemistry and Physics, 65th Edition.

TABLE VI-1 (CONTINUED)
CHEMICAL AND PHYSICAL PROPERTIES OF WASTE CONSTITUENTS
FOUND AT THE WITMER ROAD DRIVE-IN SITE
4287 WITMER ROAD, TOWN OF NIAGARA, NEW YORK

Chemical Name	Molecular Weight	Chemical Formula	Melting Point(°C)	Boiling Point(°C)	Dissoication Constant (p Ka) at 20°C	Flash Point Open Cup (°C)
Toluene	92.15	$C_6H_5CH_3$	Unknown	110.7	Unknown	40
Ethylbenzene	106.17	$C_6H_5C_2H_5$	-95	136.2	Unknown	59
Xylene	106.17	$C_6H_4(CH_3)_2$	Unknown	138.5-144.4	Unknown	81-115
Phenol	94.11	C_6H_5OH	40.85	181.84	9.686	85
2-Methylphenol (o-cresol)	108.0	$CH_3C_6H_4OH$	30.95	191	Unknown	178
2,4-Dimethylphenol (xylenol)	122.17	$(CH_3)_2C_6H_3OH$	20-76	203-255		

TABLE VI-1 (CONTINUED)
CHEMICAL AND PHYSICAL PROPERTIES OF WASTE CONSTITUENTS
FOUND AT THE WITMER ROAD DRIVE-IN SITE
4287 WITMER ROAD, TOWN OF NIAGARA, NEW YORK

Chemical Name	Odor	Solvents
Toluene	Benzene Like Odor	Alcohol, Benzene, Ether.
Ethylbenzene	Aromatic Odor	Alcohol, Benzene, Carbon Tetra chloride, Ether
Xylene	Unknown	Alcohol, Ether
Phenol	Distinct Aromatic Somewhat sickening sweet and acid odor.	Very soluble in Ether, Methyl and Ethyl Alcohol, Carbon Tetra Chloride, Acetic Acid Glycerol, Benzene.
2-Methylphenol (o-cresol)	Phenolic Odor	Alcohol, Ether Chloroform, Hot Water
2,4-Dimethylphenol	Unknown	Organic Solvents, Caustic Soda, Alcohol Ether

E. REGULATORY LIMITATIONS

The federal and state government have developed rules, regulations and guidelines concerning the chemicals present. Any treatment, handling and/or disposal of this waste must be in compliance with the applicable rules or a site specific variance must be obtained. In general, these rules, regulations and guidelines were formulated to protect the public, on-site workers and the environment from the effects of exposure to these chemicals. These rules, regulations and guidelines are generally subdivided into allowable air and water concentration values.

The impact of the site, and the risks (if any) posed by the site will be addressed in the recommended risk assessment. This section of the report provides some of the basic framework for the risk assessment. A summary of the applicable air and water regulations, rules and guidelines are presented on Table V1-2 and V1-3.

TABLE VI-2
SUMMARY OF AIR RELATED RULES, REGULATIONS AND GUIDELINES FOR THE CHEMICALS PRESENT AT THE WITMER ROAD DRIVE-IN SITE

	CONCENTRATION (ppm)			
	ACGIH *		NIOSH	OHSA
Parameter	TWA-TLV	STEL	10 Min. Ceiling	PEL
Toluene	100	150	200	200
Ethylbenzene	100	125	Unknown	100
Xylene	100	150	200	100
Phenol	5	10	Unknown	5
2-Methylphenol (o-cresol)	5	Unknown	Unknown	Unknown
2,4-Dimethylphenol (xylenol)	Unknown	Unknown	Unknown	Unknown

ppm - parts per million

TABLE VI-3
SUMMARY OF WATER RELATED RULES, REGULATIONS AND GUIDELINES FOR THE CHEMICALS PRESENT AT THE WITMER ROAD DRIVE-IN SITE

	Concentration (mg/l)			
			Water Quality Criteria	
Parameter	NYSDEC Class D Ambient Water Criteria	NYSDEC Class GA Ground Water Criteria	Human Health	Chronic Aquatic Life
Toluene	NS	NS	14.3 to 15	1.65
Ethylbenzene	NS	NS	1.4 to 2.4	0.58
Xylene	NS	NS	0.30 to 0.44	0.211
Phenol	0.005(1)	0.001(1)	0.2 to 3.5 (2)	2.56
2-Methylphenol (o-cresol)	NS	NS	2.0	0.159
2,4-Dimethylphenol (xylenol)	NS	NS	0.400	0.132

NS-No Standard
(1) Standard based on misapplication of limited stuides.
(2) Organoleptic Standard

F. CURRENT ACTION OPTIONS

ESI has identified several potential remedial methods for the treatment of the organic contamination on the site. The purpose of identifying these methods is to begin to define the design constraints, the treatability information needed and the probable cost factors of these methods. These remedial technologies were selected based on the chemicals present, their chemical and physical properties, the depth of placement in the fill, the quality of the ground water and the probable regulatory constraints. These technologies have been tested in other applications but would be considered experimental at this site due to the resin-like nature of the waste. The identified remedial technologies fall into the following broad categories:

1) Pump and Treat
2) In-situ Treatment
    a. In-Situ Biological Treatment
    b. Solvent Extraction
    c. Chemical Oxidation
    d. Resin Immobilization
    e. Vapor Extraction
3) Excavation and Removal
    a. Off-Site Treatment
    b. On-Site Treatment
4) Isolation and Containment Methods
5) No Remedial Action

The advantages and disadvantages of each type of remedial technology will be discussed in this section. Some of the additional information needed to aid in the design and selection of the appropriate remedial action is also identified in this section.

PUMP AND TREAT

Ground water pumping and treatment would be used to withdraw contaminated ground water at a controlled rate and reduce the potential seepage of ground water into Gill Creek. The technology consists of installing one or more extractions wells and pumps into the zone of the contaminated ground water. The ground water is then pumped into a treatment system and then subsequently discharged. A schematic of possible treatment alternatives for this site is shown on Figure V1-1.

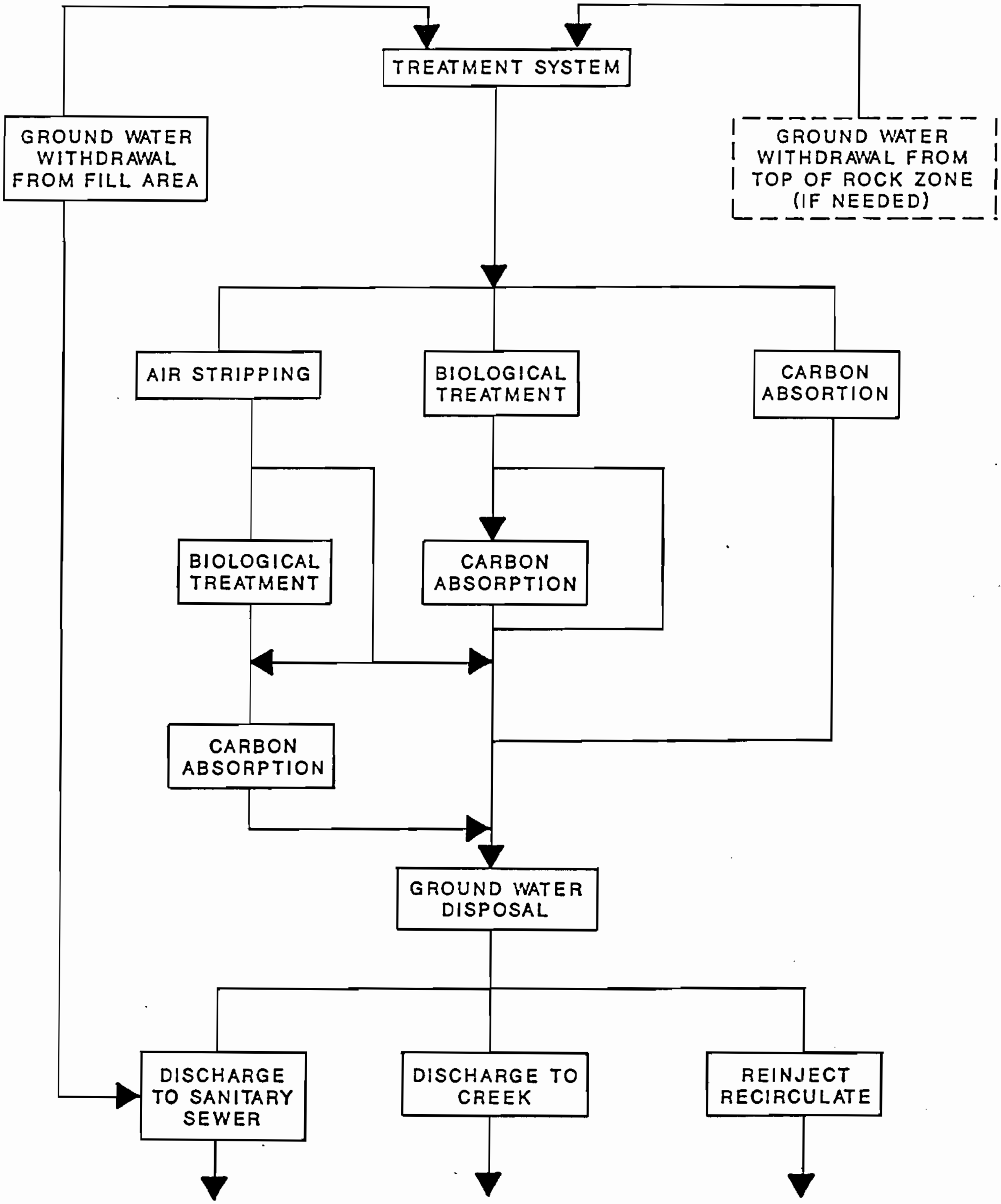
Advantages of a Pump and Treat System

1. Relatively inexpensive (upfront costs)
2. Controllable
3. Major environmental risk factor (i.e. discharge to creek) minimized.
4. Treats both volatile and semi-volatile compounds.
5. Direct discharge to sanitary sewer may be possible.
6. Natural biological activity may be enhanced.
7. Can treat contamination (if any) at the top of rock zone.

Disadvantages of Pump and Treat System

1. Treatment of the phenol resin in the unsaturated (vadose) zone, would be minimal.
2. Source of contamination (resin) would remain.
3. Treatment period may be long (>30 years).
4. Limited ground water available in contaminated fill zone would reduce pumping rate.
5. Ground water quality may fluctuate as ground water levels rise and fall.
6. Significant long term cost associated with operation of the treatment system.

FIGURE VI-I
GROUND WATER TREATMENT SCHEMATIC FOR WITMER ROAD DRIVE-IN SITE



Additional information necessary to evaluate and design a system.

1. Is the top of rock zone contaminated?
2. Transmissibility, permeability and yield of ground water for each zone to be treated.
3. Discharge constraints for:
   a) sewage treatment plant
   b) recycle/reinject
   c) creek
4. Ground water flow patterns.
5. Ground water quality and variation.
6. Will withdraw system be augmented to reduce treatment period (i.e. water addition, solvent extraction of resin biological enhancement, etc).
7. Air emissions constraints and monitoring requirements.
8. Treatability information
   a) Text Book, (Isotherm's, Henry's law constant, solubility, etc.)
   b) Site specific (system pilot-scale treatment).

IN-SITU TREATMENT

ESI has identified several in-situ treatment techniques that would destroy the contamination and/or reduce the risks associated with the contamination. These in-situ treatment techniques fall into the following categories.

a) Biological Treatment
b) Solvent Extraction
c) Chemical Oxidation
d) Resin Immobilization
e) Vapor Extraction

The biological, solvent extraction, chemical oxidation and vapor extraction processes should be used in conjunction with a pump and treatment system. These in-situ treatment technologies would be designed to enhance the ground water treatment system and reduce the treatment period. The biological treatment, solvent extraction and chemical oxidation treatment would reduce the quantity of waste present.

The vapor extraction system would reduce long term volatile emissions.

Resin immobilization involves either completing the original reaction to form a phenolic resin plastic (heat treatment or chemical) or immobilization of waste in a low surface area, low permeability matrix to reduce potential harmful effects. To a large degree, the resin is already relatively immobile in its present state and only appears to release odors when disturbed (broken up). A schematic of the in-situ techniques is presented on Figure V1-2.

a. In-Situ Bilogical Treatment

The use of in-situ biological treatment would consist of the addition of bacteria and nutrients to the waste using water as the transfer medium. A distribution and recovery system would be used to control the rate of application, and moisture levels.

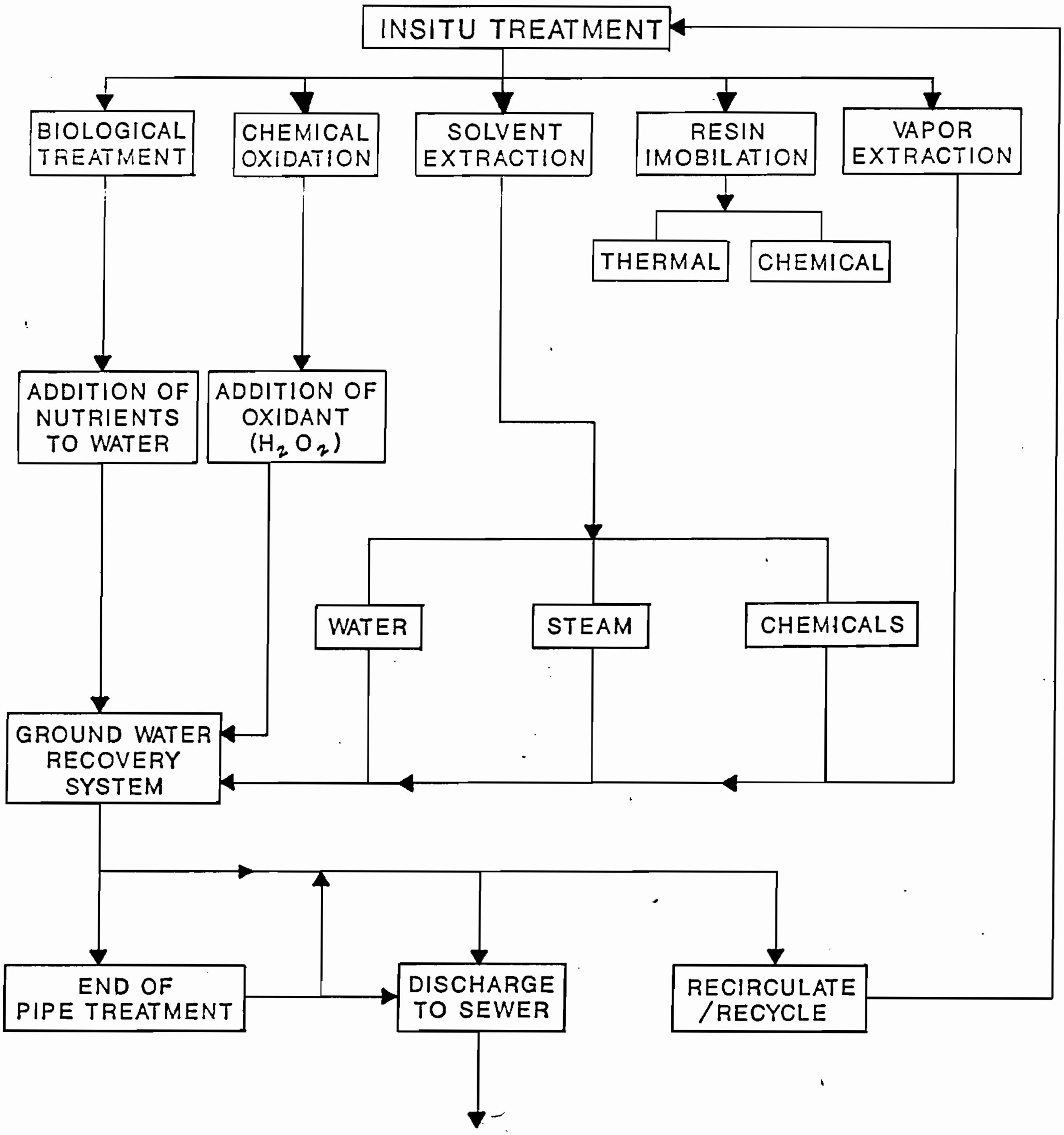
Advantages of In-situ Biological Treatment

1. Relatively inexpensive.
2. Destruction of waste.
3. Treats both volatile and semi-volatile compounds.
4. Compatible with ground water treatment systems.

Disadvantages of In-situ Biological Treatment

1. Material has not naturally biodegraded in the last 40 years.
2. Resin material may resist biological attack due to high, localized concentration and limited surface area.
3. A ground water recovery system is also required.
4. Unproven technology with a resin like waste.

FIGURE VI-2
INSITU TREATMENT SCHEMATIC FOR THE WITMER ROAD DRIVE-IN SITE



Additional Information Necessary to Evaluate & Design System

1. Can waste biodegrade (bench scale test)?
2. Is rate of biodegradation acceptable?
3. Optimum requirements of oxygen, water, nutrients and other factors.

b. Solvent Extraction

In-situ solvent extraction of the contaminated resin material may be possible. The extracted solvent would then require collection and treatment. Possible solvents include water, steam and chemicals (methyl alcohol, ethyl alcohol, acetic acid). The solvent would dissolve the resin layer and cause the phenol and other contaminants to migrate towards the ground water. The ground water would be captured and treated.

Advantage of Solvent Extraction

1. Would result in the removal of the resin layer by dissolution.
2. Controllable based on application rate.
3. Generally compatible with pump and treatment systems.

Disadvantages of Solvent Extraction

1. A chemical solvent may lead to additional contamination.
2. Migration of phenol into uncontaminated ground water.
3. Relatively slow process.
4. Unproven technology in this application.
5. May destroy natural biological activity on the site.
6. Areas of contamination may be missed due to the formation of preferential pathways.

Additional Information Necessary to Evaluate & Design System

1. Extraction capability of various solvents (bench-scale testing).
2. Environmental and human health risks of various solvents.

c. Chemical Oxidation

This remedial technology involves injection of hydrogen peroxide or an other strong oxidant into the fill materials to oxidize the contamination. The compounds present would be broken down through a series of reactions into harmless compounds, typically carbon dioxide and water. The hydrogen peroxide would also oxidize the organic material in the soil including roots, wood, etc. and therefore the quantity of hydrogen peroxide needed would be many times in excess of the stoichiometric ratio.

Advantages of In-Situ Chemical Oxidation

1. No excavation is necessary.
2. Material is oxidized to harmless compounds

Disadvantage of In-Situ Chemical Oxidation

1. High cost and large quantities of hydrogen peroxide are required.
2. Safety concerns in storage and handling of hydrogen peroxide.
3. Bringing the hydrogen peroxide in contact with the waste will be difficult.
4. System will probably require an operator on-site.
5. A ground water collection system would also be required to maintain the water balance.

Additional Information Necessary to Evaluate & Design System

1. Can hydrogen peroxide destroy the waste and at what dosage?
2. Can a permit to store hydrogen peroxide be obtained (fire codes and separation distances)?
3. Can oxidant be handled safely?

d. Resin Immobilization

This remedial method would involve either completing the original resin reaction or, immobilization of the resin in an insoluble matrix. The completion of original resin reaction may involve driving off the solvents or other processes such as heating to produce a hardened phenolic resin. Hardened phenolic resins are not generally considered a problem and are used in many hard plastics. Since phenolic resins are a thermoset type plastic, once the reaction is complete, it is not generally reversible.

Advantages of Resin Immobilization

1. Excavation is not necessary.
2. Waste becomes inert.
3. Potential releases to the surface water and ground water are substantially reduced.

Disadvantages of Resin Immobilization

1. The right set of conditions both chemically and physically may not be able to be achieved.
2. Preliminary testing will be required.
3. Volatiles may be released during immobilization

Additional Information Necessary to Evaluate & Design System

1. Bench-scale testing of immobilization methods to define method and its limitations.
2. Constraints on the stripping of volatiles

e. Vapor Extraction

Vapor extraction of volatiles from the in-situ soils consists of placing a negative pressure (vacuum) on the sub-surface soils and drawing out the volatiles from the pore spaces. Fans or vacuum pumps connected to a system of piping are used to remove the volatiles. The volatiles can then be either captured (carbon absorption/vapor condensation) or discharged to the atmosphere. The phenolic compounds present are not expected to be removed in the process, however xylene and ethylbenzene are likely to be removed. It is possible that by removing the volatiles from the phenolic resin matrix, the resin may harden and become relatively immobile.

Advantages of Vapor Extraction

1. Relatively non-intrusive.
2. Relatively inexpensive.
3. Well established technology and readily available equipment.

Disadvantages of Vapor Extraction

1. Resin matrix may be too impermeable to allow release of volatiles.
2. Shallow nature of the contamination will likely cause short-circuiting of collection system.
3. Phenolics present are not removed or destroyed.

Additional Information Necessary to Evaluate & Design System

1. Bench-scale testing of extraction method to determine feasibility and vacuum requirements.
2 Methods to reduce or eliminate atmospheric short -circuiting (i.e. plastic cover, asphalt pavement, etc.)

EXCAVATION AND REMOVAL TREATMENT

a. Off-Site Treatment

Non-contaminated surface soils would be stripped and stockpiled on-site for use as backfill material. Contaminated soils would be removed using conventional excavating equipment (backhoe). The excavated material would be contained in drums, tanks, bins, or trucks and transported off-site for treatment and disposal. Removal of the source of the contamination from the site is generally known as "clean closure", this typically results in minimal regulatory oversight. On this site, once the concentrated source material is removed natural, biological processes can probably remove any residual contamination.

On this site there are several technical problems with the excavation and removal approach. The problems are primarily associated with vapor and odor control, the associated protection of workers and the community, and the ultimate disposal of the contaminated soil. Vapor and odor suppression may be accomplished through the use of foams, surfactants or by temperature controls (i.e. excavating the contaminated soil from frozen ground).

The solvents (xylene and ethylbenzene) present in the fill materials may preclude disposal in a landfill for technical and regulatory reasons. The determination of whether these materials are prohibited from hazardous waste landfills is dependent on how they are classified, the concentrations present and whether or not a landfill will accept these wastes.

It may be possible to excavate the soil and send it to a facility for treatment. This treatment may consist of incineration, biological or chemical treatment. However, off-site treatment is likely to be expensive, and difficult to obtain and a cost for disposal of the residual will also be incurred.

Advantages of Excavation and Off-Site Treatment or Disposal

1. Contamination is removed and future use of the site is obtained.
2. Long term monitoring costs are not likely to be incurred.
3. Cleanup period is brief.

Disadvantages of Excavation and Off-site Treatment

1. Material is likely prohibited from reburial.
2. Responsibility, if buried, does not end when material is landfilled. The company could be held partially responsible for future cleanup at the landfill.
3. Technical problems associated with vapor and odor control during excavation and transportation may not be solvable.
4. Off-site treatment and/or disposal is likely to be very costly.

Additional Information Necessary to Evaluate & Design System

1. Proper classification of waste (i.e. hazardous or non-hazardous, source code).
2. Treatment requirements for waste as classified.
3. Treatment and disposal costs.
4. Vapor pressures as a function of temperature for primary constituents.
5. Odor suppression techniques.

b. On-Site Treatment

The excavation methods and procedures used would be the same as for excavation and off-site treatment and disposal, however the material would be placed in a vacant area for on-site treatment. This on-site treatment would consist of a controlled biological treatment process. The waste would be placed in large plastic bags for the odor and process control. Adapted bacteria would be distributed over the soil and allowed to consume the waste material. The soil can be evenly blended to reduce localized toxicity; distribution of water, nutrients and bacteria can be controlled; treatment temperatures can be optimized; odors can be controlled; and alternative treatment methods such as vapor extraction, chemical oxidation or stream stripping could be easily adapted to the treatment system.

Advantages of Excavation and On-Site Treatment

1. The treatment process is controllable.
2. Once the waste is contained, the rate of treatment can be controlled to minimize costs.
3. Costs are relatively low.
4. Sufficient vacant land is available on-site.

Disadvantages of Excavation and On-site Treatment

1. Odor control problems during excavation.
2. No established cleanup standards.
3. Resin material may be difficult to break-up to increase its surface area.

Additional Information Necessary to Evaluate & Design System

1. Type, temperature, moisture and nutrient requirements for bacteria.
2. Soil blending and size reduction methods.
3. Odor control (Carbon Canisters) requirements.

ISOLATION AND CONTAINMENT METHODS

This method would be used to reduce the rate of waste constituent migration into the ground water, surface or atmosphere and thereby reduce the risks (if any) associated with the site. This method would be focussed on identifiable releases (if any). Currently, to date, no releases to surface water and the atmosphere have been detected, however, very localized ground water contamination has been identified. Possible isolation methods include reducing ground water recharge, containing ground water and sealing the surface to reduce vapor emissions. Reducing ground water recharge and reducing vapor emissions could be accomplished using a cap material. Possible cap materials include asphaltic concrete, clay, and synthetic liner material or a combination of these materials.

Ground water containment could be accomplished using a slurry wall, sheet piling or other barriers. Due to the limited available ground water in the contaminated fill materials it is likely that ground water withdrawal would be more cost effective than a barrier system.

Advantages of Isolation and Containment

1. Risks to human health and the environment (if any) are reduced.
2. Compatible with in-situ treatment processes
3. Health risk (if any) to workers and community are reduced.

Disadvantages of Isolation and Containment

1. Waste material is not treated or destroyed.
2. Long term monitoring costs.
3. Full use of the property is limited.
4. Site will remain under regulatory oversight.

Additional Information Necessary to Evaluate & Design System

1. Risk assessment with release pathways.
2. Area drainage system information.
3. Acceptable cap materials and design.

NO REMEDIAL ACTION

The no remedial action option appears to be a viable option at this site given the known information. Additional information, gathered during the recommended additional work will help determine if this remains a viable option. This option is considered as a viable option, based on one or more of the following conditions:

1. No unacceptable exposures to human health.
2. No unacceptable exposures to the environment.
3. Cleanup may increase risks rather than decrease risk.
4. The waste is not classified as a hazardous waste.

SECTION VII

SUMMARY AND CONCLUSIONS

An environmental site investigation was completed at the Witmer Road Drive-In, 4287 Witmer Road, Town of Niagara, New York. This environmental site investigation was completed in general accordance with the provisions of the NYSDEC approved work plan for the site. This environmental site investigation includes the results and findings of an initial environmental site assessment (August 1989, BTA-89-039A) and information collected during this phase of the investigation. These environmental investigations were limited to data obtained by site visits, a limited review of site history, a review of the available governmental agency data, a soil gas survey, a subsurface exploration program, a ground water monitoring program, and surface water sampling and analysis. The conclusions and findings presented in this report are subject to the limitations presented in Appendix B. Based on the limitations of this investigation and the information made available to ESI, the relevant findings and conclusions are presented below:

- The subject site is located at 4287 Witmer Road, Town of Niagara, New York. A single story office building with a parking area currently occupies a portion of the 1.72 acre site;
- The property was part of a farm until 1953. From 1953 to 1986, a drive-in theater occupied the site and adjacent sites south and west.

- In 1986, the land was sold to a developer and in 1987, Asteco Inc. bought the land and erected the existing structure;

- An access road from Witmer Road to the subject site was visible in the 1938 aerial photograph.

- Two disturbed areas of land, on or adjacent to the subject property were visible on the 1938 aerial photograph.

- Filling and other land disturbance activities were visible on the site on the 1951 aerial photograph. A small building, identified as the drive-in maintenance shed, was present on the property approximately where the current structure is located;

- Filling activities are clearly present in the 1958 and 1966 aerial photographs of the site. The fill was placed from near Witmer Road in a narrow strip to the southern end of the drive-in. Based on a comparison of the aerial photographs, and the site visit, this fill is probably the lime-like material currently found on portions of the site.

- The investigation has not identified the presence of existing ponds, pits, lagoons or buried underground storage tanks that might indicate the presence of hazardous materials.

- Fill materials were evident over essentially the entire undeveloped portion of the site. The surface evidence of these fill materials consisted of broken glass, metal, bricks and a lime-like material coupled with the apparent man-made grades adjacent to Gill Creek.

- The fill materials appear to be quite old based on the color and shapes of the broken glass and bottles found.

- The adjacent property is used for commercial business, a recreational park (across Witmer Road) and residential (across the creek). The land immediately south and east is vacant industrial park land.

- The site is not a NYSDEC designated wetland and there are no known historical sites on the property.

- The nearest known hazardous waste site is approximately 0.7 miles to the south.

- The Niagara County Department of Health conducted a limited investigation of the adjacent property to the south with respect to the runoff from the lime-like materials present south of the site.

- The soil gas survey was found to be a useful tool in locating the extent of the organic contamination.

- Fifty-two (52) boreholes were advanced and nine (9) test pits were excavated to determine the nature and extent of the fill materials with the elevated organic vapor measurements.

- A dark red, to black, resin-like material was identified in the fill materials as the source of the organic vapors.

- The organic vapor has a distinct "magic marker" type odor and is detectable with a photoionization meter with a 10.2 eV lamp.

- The resin-like material appears to be scattered and exists in thin laminations. Measured thickness of the existing resin ranges from trace amounts to to 7.2-inch interval with the average interval being 2.5 inches.

- There is no evidence that this resin-like material is in drums or other containers but appears to have been dumped or spread on a portion of the property in the 1940's or 1950's and covered with soil and other fill materials.

- Beneath the fill materials on this site, there is a red to brown silty clay layer approximately 4 to 12' thick. The silty clay may act as a barrier to downward migration of contamination.

- The bedrock beneath the site is the Lockport Dolomite. The general hydraulic characteristics of this formation are that the first water bearing zone is probably in the fractured and weathered rock near the soil/bedrock interface.

- The man-made materials found in trace quantities or greater in the fill above the resin-like material are as follows: glass bottles (broken and intact), brick, wire, cable, metal, paper, wood, porcelain, concrete, vitrified clay pipe, cloth, cardboard, slag, cinders, lime-like material, plastic, nails, tile and black charcoal-like wood.

- The aerial extent of the resin-like contamination is approximately 7,500 square feet.

- Five ground water monitoring wells were installed in the fill materials and overburden on the site.

- Ethylbenzene and xylene are the primary organic compounds detected in the fill materials. These volatile compounds are the probable source of the elevated organic vapor measurements noted in the resin-like material.

- Phenol and 2,4-dimethylphenol (xylenol), are the other major semi-volatile compounds detected in the fill materials.

- The common use of the four primary compounds is in the resin manufacture.

- Other, lesser, TCL organic constituents detected in the fill materials were trichloroethene, toluene, di-n-butylphthalate, 1,2-dichlorobenzene, fluoranthene, naphthalene, pyrene, 1,2,4 trichlorobenzene, aldrin, a-BHC, b-BHC, d-BHC, g-BHC and PCB (1254). The concentrations of these compounds were relatively low and probably represent typical levels in uncontrolled manmade fill.

- The concentrations of target analyte list metals, above typical background levels in one or more of the samples, were arsenic, barium, copper, calcium, lead, thallium and zinc. It is likely that the manmade fill materials contain concentrations of these metals above typical background levels as the result of use in paints, glassware, porcelain, and metal objects present in the fill.

- The fill materials tested did not exhibit the hazardous waste characteristics of ignitability, reactivity or corrosivity. The lime-like material was not tested for corrosivity, however it may exhibit the corrosivity characteristic (pH > 12.5) since the average pH of the ground water in this area was 12.6.

- The pH of the ground water from well GW-5 was measured in the fill at 12.60. This well was installed into the lime-like fill materials. No phenolic like resin was present in this boring.

- One of twelve (12) samples failed the EP Toxicity test for lead. The EP toxicity test result for the single lead concentration above the 5.0 mg/l standard was 8.1 mg/l. All other metal and organic parameters were below the established EP toxicity criteria.

- Ground water monitoring in the overburden wells indicate that the ground water is flowing east towards Gill Creek.

- Ground water elevations varied during the monitoring period up to 4.51 feet, however, the flow pattern remained generally consistent.

- Withdrawal rates observed during development and purging of the two wells in the zone of contamination indicate very slow recharge rates (~0.05 gpm). This implies low permeability and/or limited available water.

- Toluene, ethylbenzene and xylene were detected in one or more of the monitoring wells with the most significant concentrations detected in wells GW-1 and GW-2. These are the two wells installed directly in the area of known resin contamination.

- Toluene, ethylbenzene, and xylene were identified in the fill materials and in the ground water.

- Trichloroethene was identified in one of the three test pit samples but not in any of the ground water samples.

- Phenol, 2-methylphenol, 4-methylphenol and 2,4-dimethyl phenol were present in well GW-2 in relatively significant concentrations, however, in nearby wells outside the zone (GW-4 and GW-5) these compounds were not detected.

- The lateral extent of the phenolic contamination appears to be limited to the originally defined area of contamination.

- Many of the tentatively identified compounds (TICs) were phenolic compounds with attached methyl and/or ethyl groups.

- Lead concentrations in the zone of contamination (i.e. wells GW-1 and GW-2) were below the analytical detection levels. Lead concentrations in the ground water sample from GW-4 and GW-5 are below the allowable standard for discharge to ground water and/or below the Class GA ground water standards.

- The lead concentration in the upgradient well (GW-3) was elevated, however, due to excessive turbidity in the samples, the lead concentration is not considered representative and this well will be redeveloped and resampled during the next phase of the project.

- Relatively low concentrations (i.e. below the state Class GA standard) of 2,3,7,8,-TCDD were detected in the two wells in the zone of known contamination. Other dibenzo dioxins and dibenzo furans were detected at relatively low concentrations in the ground water tested.

- There were no detectable concentrations of pesticides, PCB's, semi-volatiles, or volatile compounds in the surface water samples and seep sample in Gill Creek. Therefore, no release to surface waters have been documented from the site.

In summary, there is an area of fill materials at the Witmer Road Drive-In location that contain a layer of phenolic resin materials. The resin material covers an area of approximately 7,500 square feet and is covered by several feet of fill material. In addition to phenolics, three volatile compounds (ethylbenzene, xylene and toluene) are also present. Ground water contamination of the overburden and fill areas appears to be limited essentially to the originally defined resin layer zone (~7,500 square feet).

The lime-like waste, located on the south portion of the site, may be considered hazardous if the corrosivity characteristic is determined to exist (pH equal to or greater than 12.5). After an investigation by the Niagara County Health Department, into the lime-like material, they determined that the pH was very basic and reported their results to the NYSDEC. The NYSDEC is estimating that the material is calcium hydroxide, a by-product from processes at the SKW Alloy Facility located near the site. The NYSDEC stated that the material, currently, is not being considered hazardous. In order for a material or site to be listed as hazardous by the NYSDEC, it must be associated with a processing facility or fail the EP toxicity test for metals. Eventually, the site may be listed as a secondary or candiate site, pending the results of further testing.

Based on the test results and our knowledge of the site, the resin-like material present on-site should not be considered a hazardous waste under current regulatory definitions. However, hazardous substances have been identified and the potential release of these substances in harmful concentrations should be investigated. The recommendations for further site investigation will be as discussed in the next section.

The results of this investigation indicate several areas where additional information is needed prior to taking actions on the site. The recommendations for the next phase of the investigation are presented in the next section of this report.

SECTION VIII

RECOMMENDATIONS

A. GENERAL

Empire Soils Investigations, Inc. (ESI) recommends that additional information relative to the nature and extent of the contamination be obtained at this site. It is ESI's opinion that this additional information is needed to aid in the selection of a cost effective remedial approach and to better determine the risks to human health and the environment.

This section of the report outlines ESI's recommendations and ESI will submit (after NYSDEC comment on this report is received) a detailed work plan to implement these recommendations. The work plan would include a sampling and analysis plan, a quality assurance project plan (QAPP), an updated health and safety plan, a risk assessment plan and a community relations plan.

ESI's recommendations for additional work at the site are presented below and are grouped by type of work recommended.

B. GROUND WATER MONITORING

- Redevelop and resample well GW-3 to better evaluate possible lead contamination.
- Estimate in-situ permeability and withdrawal rates of the five overburden wells.
- Install three top of rock (i.e. fractured zone of Lockport Dolomite) wells to determine if contamination is present in the next water bearing zone.

- Develop, purge and sample the new top of rock wells for volatiles, semi-volatiles (with tics) and pH.

- Resample the five existing wells for volatiles, semi-volatiles and pH.

- Obtain ground water elevation data monthly for the duration of this phase of the work.

- Use EPA Method 602 (8020) for volatile analysis in place of the more expensive (8240) 624 method.

C. SITE SECURITY AND SAFETY

- Fence off and post warning signs around the area of known contamination as a precautionary measure.

- Inform employees at the site of the general information known about the site.

D. RISK ASSESSMENT

- Develop a risk assessment plan to assess potential risks to human health and the environment if the waste is not removed from the site. This risk assessment determination would be completed using EPA guidelines and would be expected to include the following:

  1. Limited additional stream sampling
  2. Ambient air monitoring for volatiles
  3. Inside air monitoring for volatiles
  4. Collection of health effects information for chemicals present.
  5. Exposure assessment and modeling

E. HAZARDOUS WASTE DETERMINATIONS

- Determine the TCLP leachate characteristics of the resin.

- Test the lime-like material for corrosivity.

F. REMEDIAL INVESTIGATION AND DESIGN

- Identify data requirements and obtain available information relative to possible remedial activities.
- Identify users of ground water in accordance with established EPA procedures with respect to distance and direction.
- Obtain information relative to the physical and chemical properties of the identified compounds on-site and phenolic resins.

ESI recommends that in addition to the specific recommendations above, that the next phase of work on this site be conducted to meet the general requirements of an EPA defined Remedial Investigation and Feasibility Study (RI/FS). Many of the components of an RI/FS have been completed in the work conducted to date and are implicit in the recommendations for additional work. In addition to the work completed and work recommended, a RI/FS would include identification of the applicable or relevant and appropriate requirements for cleanup, an expanded description of the sites physical characteristics, a further screening and selection of remedial alternatives, treatability investigations and analysis of the alternatives.

ESI recommends that the RI/FS be conducted using the guidance procedures as specified by the USEPA.

Respectfully Submitted,
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